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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 2,880,057 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 focused on only one of these two diseases.

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
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)). ACS and T2DM are often associated with high-risk factors such as low levels of physical exercise, obesity, smoking and unhealthy diet. Some of these and other risk factors, specifically glycaemia, high blood pressure (BP), lipidaemia and obesity, are frequently addressed by health education interventions.

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. 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. Most diabetes education is provided through programmes within outpatient services or physicians’ practices. Many recent education programmes have been designed to meet national or international education standards with diabetes education being individualised to consider patients’ existing needs and health conditions. Patients with T2DM have reported feelings of hopelessness and fatigue with low levels of self-efficacy, after experiencing an acute coronary episode.

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. 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, National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand, WHO 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 X7 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). 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). 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. 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. 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). 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%. 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. 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. 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. Some evidence, is a less conclusive finding about the effects of the health education-related interventions 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. 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.

**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 were removed due to low scores ≤3 on the AMSTAR scale. Fifty-one systematic reviews or meta-analyses 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 review 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 277,493 patients, including 225,034 patients with coronary heart disease or ACS (one article did not report the total sample) and 52,459 patients with T2DM (16 papers did not report the total sample). The average sample size of included articles was 8161 (range, 536–68,556) participants, however, 63 studies related to ACS and 177 studies related to T2DM were included in more than one systematic review or meta-analysis (see online supplementary appendices 2 and 3 and CCA statistics). The sample of these studies would therefore be included more than once. Of the included systematic reviews or meta-analyses, 11 were published in The Cochrane Library. Nine of the articles described meta-analyses, 29 articles described systematic reviews and the remaining 13 articles were described as systematic reviews or 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
| 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 |
|-------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| **Systematic reviews and meta-analysis involved patients with ACS** |        |        |        |        |        |        |        |        |        |        |         |
| 1 Barth et al<sup>49</sup>   | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 11 |
| 2 Devi et al<sup>44</sup>    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | NA     | Yes     | 10 |
| 3 Ghisi et al<sup>50</sup>   | CA     | Yes    | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | No     | No      | 7 |
| 4 Kotb et al<sup>69</sup>    | CA     | Yes    | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 8 |
| 5 Brown et al<sup>37</sup>   | Yes    | No     | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | NA     | Yes     | 7 |
| 6 Dickens et al<sup>45</sup> | CA     | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 8 |
| 7 Aldcroft et al<sup>31</sup> | CA     | No     | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 6 |
| 8 Brown et al<sup>70</sup>   | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | NA     | Yes     | 10 |
| 9 Huttunen-Lenz et al<sup>66</sup> | CA     | No     | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 5 |
| 10 Goulding et al<sup>51</sup> | Yes    | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 8 |
| 11 Auer et al<sup>34</sup>   | CA     | Yes    | Yes    | CA     | No     | No     | Yes    | No     | Yes    | Yes    | No      | 5 |
| 12 Barth et al<sup>36</sup>  | Yes    | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 10 |
| 13 Fernandez et al<sup>48</sup> | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 8 |
| 14 Barth et al<sup>35</sup>  | CA     | Yes    | Yes    | CA     | No     | Yes    | CA     | Yes    | Yes    | Yes    | Yes     | 7 |
| 15 Clark et al<sup>33</sup>  | 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<sup>40</sup>   | CA     | Yes    | Yes    | No     | No     | No     | Yes    | Yes    | Yes    | Yes    | Yes     | 8 |
| 17 Creamer et al<sup>52</sup> | Yes    | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 8 |
| 18 Huang et al<sup>55</sup>  | CA     | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 7 |
| 19 Chen et al<sup>50</sup>   | CA     | CA     | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 7 |
| 20 Pillay et al<sup>71</sup> | Yes    | No     | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 9 |
| 21 Terranova et al<sup>72</sup> | CA     | Yes    | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 8 |
| 22 Attridge et al<sup>33</sup> | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 10 |
| 23 Odnoletkova et al<sup>66</sup> | Yes    | CA     | Yes    | CA     | No     | No     | Yes    | Yes    | Yes    | Yes    | No      | 6 |
| 24 Pal et al<sup>87</sup>    | CA     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 8 |
| 25 Ricci-Cabello et al<sup>73</sup> | Yes    | CA     | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 9 |
| 26 Saffari et al<sup>74</sup> | CA     | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | Yes    | Yes     | 8 |
| 27 Gucciardi et al<sup>62</sup> | CA     | Yes    | Yes    | No     | No     | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 7 |
| 28 Pal et al<sup>88</sup>    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | Yes    | No     | Yes     | 10 |
| 29 van Vugt et al<sup>75</sup> | CA     | Yes    | Yes    | CA     | No     | Yes    | Yes    | Yes    | Yes    | NA     | No      | 6 |

Continued
| Item | Authors | 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 | CA     | CA     | Yes    | No     | No     | Yes    | Yes    | Yes    | NA     | No       | No       | 4          |
| 31   | Nam et al | CA     | CA     | Yes    | Yes    | No     | Yes    | Yes    | Yes    | Yes    | NA       | Yes      | 8          |
| 32   | Steinsbekk et al | CA | Yes | Yes | CA | No | Yes | Yes | Yes | Yes | No | Yes | 7          |
| 33   | Burke et al | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | NA | Yes | 10         |
| 34   | Lun Gan et al | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | 8          |
| 35   | Ramadas et al | CA | CA | Yes | No | No | Yes | Yes | Yes | NA | No | Yes | 5          |
| 36   | Hawthorne et al | Yes | Yes | Yes | CA | No | Yes | Yes | Yes | Yes | CA | Yes | 8          |
| 37   | Minet et al | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes | 9          |
| 38   | Alam et al | Yes | Yes | No | CA | No | Yes | Yes | Yes | Yes | Yes | Yes | 8          |
| 39   | Duke et al | Yes | CA | No | No | Yes | Yes | Yes | Yes | No | Yes | 8          |
| 40   | Fan and Sidani | Yes | No | Yes | No | No | Yes | No | Yes | Yes | 5          |
| 41   | Hawthorne et al | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 11         |
| 42   | Khunti et al | CA | Yes | Yes | Yes | No | Yes | No | No | No | Yes | Yes | 5          |
| 43   | Loveman et al | Yes | CA | Yes | No | Yes | Yes | Yes | Yes | Yes | No | Yes | 8          |
| 44   | Wens et al | CA | Yes | Yes | CA | No | Yes | Yes | Yes | Yes | NA | Yes | 7          |
| 45   | Niel et al | Yes | Yes | Yes | CA | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 9          |
| 46   | Zabaleta and Forbes | CA | CA | Yes | CA | Yes | Yes | Yes | Yes | NA | No | No | 5          |
| 47   | Deakin et al | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 11         |
| 48   | Vermeire et al | Yes | Yes | Yes | CA | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | 9          |
| 49   | Gary et al | Yes | No | Yes | No | Yes | Yes | No | Yes | No | Yes | Yes | 6          |
| 50   | Norris et al | CA | No | Yes | No | No | Yes | Yes | Yes | CA | No | No | 4          |
| 51   | Norris et al | CA | Yes | Yes | CA | No | Yes | Yes | Yes | NA | No | No | 5          |

Item 1: ‘Was an “a priori” design provided?’; 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...)
|-----------------------------|---------------------------------------------------------------|
| Devi, 2015<sup>33</sup>; The Cochrane Library | Lifestyle changes and medicines management
| Studies details | Intervention |
| Number of studies: 11 completed trials (12 publications); Types of studies: RCTs; Total sample: 1392 participants | Educational content |
| All internet-based interventions | Provider |
| Dietitians; exercise specialists; nurse practitioners; physiotherapist rehabilitation specialists; or did not describe. | Number of session(s), delivery mode, time, setting |
| Weekly or monthly or unclear; Total contact hours: unclear. Duration: from 6 weeks to 1 year | Inpatient settings, postdischarge, other |
| Strategies: internet-based and mobile phone-based intervention, such as email access, private-messaging function on the website, one-to-one chat facility, a synchronised group chat, an online discussion forum, or telephone consultations; or video files; Format: one-on-one chat sessions; ‘ask an expert’ group chat sessions; Theoretical approach: unclear | Synthesis methods |
| Meta-analysis used Review Manager software |

| Barth, 2015<sup>39</sup>, The Cochrane Library | Smoking cessation |
| Studies details | Intervention |
| Number of studies: 40 RCTs; Types of studies: RCTs; Total sample: 7928 participants | Educational content |
| Psychosocial smoking cessation interventions | Provider |
| Cardiologist; general practitioner physician or study nurse | Number of session(s), delivery mode, time, setting |
| Weekly or 2–3 times per week; Total contact hours: unclear. Duration: from 8 weeks to 1 year | Inpatient settings, postdischarge, other |
| Strategies: face-to-face, telephone contact, written educational materials, videotape, booklets or unclear; Format: one by one counselling; telephone call; group meetings or unclear; Theoretical approach: unclear | Theoretical approach: TTM, SCT |
| Meta-analysis used Review Manager software |

| Kotb, 2014<sup>40</sup>, PLoS One | Patients' outcomes |
| Studies details | Intervention |
| Number of studies: 26 studies; Types of studies: RCTs; Total sample: 4081 participants | Educational content |
| Telephone-delivered postdischarge interventions | Provider |
| Dietitians; exercise specialists; health educators; nurses and pharmacists | Number of session(s), delivery mode, time, setting |
| 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 | Unclear, did not describe the setting |
| Strategies: telephone calls; Format: unclear, did not describe the format; Theoretical approach: unclear | Synthesis methods |
| Meta-analysis used Review Manager software |

| Outcomes (primary outcomes were in bold) | ↓ No change | ↑ Increase | ↓ Decrease |
|-----------------------------------------|-------------|-----------|-----------|
| Clinical outcomes; Cardiovascular risk factors; Lifestyle changes; Compliance with medication; Healthcare utilisation and costs; Adverse intervention effects | | | |

Continued
| First author, year; journal | Primary objectives (to assess effect of interventions on...) | Studies details | Intervention | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes (primary outcomes were in bold) | Synthesis methods |
|-----------------------------|-------------------------------------------------------------|-----------------|-------------|---------------------|---------|-----------------------------------------------|------------------------------------------|------------------|
| Liu X, et al. BMJ Open 2017;7:e016857. doi:10.1136/bmjopen-2017-016857 | 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. | Any educational interventions | 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 | Strategies: did not describe the strategies; Format: group (88.1%) education was delivered by lectures (40.5%), group discussions (40.5%) and question and answer periods (7.1%). Individual education (88.1%), including individual counselling (80%), follow-up telephone contacts (31%) and home visits (7.1%); Theoretical approach: unclear | Inpatient settings |
| Ghisi, 2014 | Patient Education and Counseling | 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. | Number of session: 1–24 or unclear; Total contact hours: 5–10 min to 3 hours as well as a full day of education | 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 | Strategies: did not describe the strategies; Format: group (88.1%) education was delivered by lectures (40.5%), group discussions (40.5%) and question and answer periods (7.1%). Individual education (88.1%), including individual counselling (80%), follow-up telephone contacts (31%) and home visits (7.1%); Theoretical approach: unclear | Inpatient settings |
| Brown, 2013 | European Journal of Preventive Cardiology | 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 | Nurses or other healthcare professionals. | Number of session and duration: from a total of 2 visits to a 4-week residential stay reinforced with 11 months of nurse-led follow-up; Total contact hours: unclear | Strategies: face-to-face education sessions, telephone contact and interactive use of the internet; Format: group-based sessions, individualised education and four used a mixture of both sessions; Theoretical approach: unclear | Inpatient settings, other |
| Dickens, 2013 | Psychosomatic Medicine | Depression and depressive symptoms | Number of studies: 62 independent studies; Types of studies: RCTs; Total sample: 17 397 | Psychological interventions | A single health professional or by a unidisciplinary team | Number of session and duration: from 14.4 (range, 1–156); Total contact hours: varying from 10 to 240 min; Duration: unclear | Strategies: face-to-face education sessions, telephone contact or unclear; Format: group or unclear; Theoretical approach: unclear | Unclear, did not describe |
| Dickens, 2013 | Psychosomatic Medicine | Depression and depressive symptoms | Number of studies: 62 independent studies; Types of studies: RCTs; Total sample: 17 397 | Psychological interventions | A single health professional or by a unidisciplinary team | Number of session and duration: from 14.4 (range, 1–156); Total contact hours: varying from 10 to 240 min; Duration: unclear | Strategies: face-to-face education sessions, telephone contact or unclear; Format: group or unclear; Theoretical approach: unclear | Unclear, did not describe |

Narrative synthesis

Meta-analysis used Review Manager software

Univariate analyses using comprehensive meta-analysis, multivariate meta-regression using SPSS V15.0

Univariate analyses using comprehensive meta-analysis, multivariate meta-regression using SPSS V15.0

Univariate analyses using comprehensive meta-analysis, multivariate meta-regression using SPSS V15.0
| First author, year; journal | Health behaviour change / Mortality, morbidity, HRQoL and healthcare costs | Change maladaptive illness | Smoking cessation | Studies details | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes | Intervention | Synthesis methods |
|-----------------------------|-----------------------------|------------------------|----------------------|----------------|----------------|--------|------------------------------------------------|---------|-------------|----------------|
| Aldcroft, 2011, Journal of Cardiopulmonary Rehabilitation & Prevention | 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 | Unclear, did not describe | Smoking rates; medication use; Supplemental oxygen use; Physical activity; Nutritional habits | Meta-analysis and narrative presentation |
| Brown, 2011, The Cochrane Library | Number of studies: 24 papers reporting on 13 studies | Types of studies: RCTs; Total sample: 68,556 participants | Total contact hours: unclear; Number of session: unclear; Duration: 4–29 weeks or unclear | Patient education | Nurse or did not describe | Number of session and duration: two visits to 4 weeks residential; 11 months of nurse led follow-up; Total contact hours: unclear | Strategies: face-to-face sessions, telephone contact and interactive use of the internet; 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, Journal of Advanced Nursing | Number of studies: 13 studies; Types of studies: RCTs; Total sample: 1792 participants | Interventions to change maladaptive illness beliefs | Cardiologist, nurse, psychologist or did not describe | Number of session: unclear; Total contact hours: unclear; Duration: 4–29 weeks or unclear | Strategies: face-to-face counselling, self-help materials, home visit, booklet, video and telephone contact; Format: individual or unclear; Theoretical approach: social learning theory; ASE model; TTM; behavioural multicomponent approach | Inpatient settings, postdischarge, other | Beliefs (or other illness cognition); QoL; Behaviour; Anxiety or depression; Psychological wellbeing; Modifiable risk factors; protective factors | A descriptive data synthesis analysis | Smoking rates; medication use; Supplemental oxygen use; Physical activity; Nutritional habits | Meta-analysis used Review Manager software |
| Huttunen-Lenz, 2010, British Journal of Health Psychology | Number of studies: a total of 14 studies were included | Types of studies: RCTs; Total sample: 1792 participants | 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 | Strategies: face-to-face counselling, self-help materials, home visit, booklet, video and telephone contact; Format: individual or unclear; Theoretical approach: social learning theory; ASE model; TTM; behavioural multicomponent approach | Inpatient settings, postdischarge, other | Prevalent smoking cessation; Continuous smoking cessation; Mortality | Subgroup meta-analysis was used software | Smoking rates; medication use; Supplemental oxygen use; Physical activity; Nutritional habits | Meta-analysis and narrative presentation |
| First author, year; journal | Primary objectives (to assess effect of interventions on....) | Studies details | Intervention | Provider | Number of session(s), delivery mode, time, setting | Outcomes (primary outcomes were in bold) | Synthesis methods |
|----------------------------|-------------------------------------------------------------|----------------|-------------|---------|-----------------------------------------------|------------------------------------------|--------------------|
| Auer, 2008; Circulation    | Multiple cardiovascular risk factors and all-cause mortality | No change: 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 | Inpatient settings | Stata V.9.1 |
| Barth, 2008; The Cochrane Library | Smoking cessation | No change: 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 | Inpatient settings | Meta-analysis used Review Manager software |
| Fernandez, 2007; International Journal of Evidence-Based Healthcare | Risk factor modification | No change: Brief structured intervention | Case manager; dieticians; health educator; nurses; psychologist; and research assistants | Number of session: uncertain; 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 | Unclear, did not describe | Cochrane statistical package Review Manager |
| Barth, 2006; Annals of Behavioural Medicine | Smoking cessation | No change: Psychosocial interventions | Unclear, did not describe | Number of session: uncertain; Total contact hours: uncertain; Duration: unclear | Strategies: face-to-face, telephone contact or unclear; Format: unclear; Theoretical approach: unclear | Unclear, did not describe | Data analyses were carried out in Review Manager V.4.2 |
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.24 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.

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**Table 2. Continued**

| First author, year journal | Characteristics of health educational interventions |
|---------------------------|--------------------------------------------------|
| Liu X, et al. BMJ Open 2017;7:e016857. doi:10.1136/bmjopen-2017-016857 | The description of the health educational interventions followed the Workgroup for Intervention Development and Evaluation Research reporting guidelines for behaviour change interventions.24 The characteristics of the recipients, setting, delivery methods, intensity, duration and educational content of health educational interventions for patients with ACS or T2DM are summarised in tables 2 and 3. The delivery strategies for health education included face-to-face, internet-based, phone-based, videotape, written educational materials or mixed. The format included one-on-one (individualised), group or both. Face-to-face sessions were the most common delivery formats, and many education sessions were also delivered by telephone/web contact or individualised counselling. The number of sessions, total contact hours and durations varied, and there was limited information about the intensity of health education for patients provided. The frequency of educational sessions was weekly or monthly, and an average of 3.7 topics was covered per education session. Nurses and multidisciplinary teams were the most frequent educators, and most education programmes were delivered postdischarge. |
### Table 3 Characteristics and interventions of included systematic reviews and meta-analysis involved patients with T2DM

| First author, year; journal | Interventions | Educational content | Number of session(s) | Delivery mode, time, setting | Outcomes (primary outcomes were in bold) | Provider | Study design | Synthesis methods |
|-----------------------------|---------------|---------------------|----------------------|-----------------------------|------------------------------------------|---------|--------------|------------------|
| Choe, 2016; Diabetes Research and Clinical Practice | Glycemic effect | Diabetes education intervention | Number of studies: 83 studies 6 in English, 77 in Chinese; Types of studies: RCTs; Total sample: unclear | Undear, did not describe | Number of session: unclear; Total contact hours: unclear; Duration: face-to-face, written materials, telephone contact and home visit | | | Meta-analysis using the Review Manager statistical programme |
| | | | | | | | | |
| Creamer, 2016; Diabetic Medicine | Successful outcomes and to suggest directions for future research | Culturally appropriate health education | Number of studies: 53; Types of studies: RCTs; Total sample: unclear | Nurse, pharmacist or unclear | Number of session: 5–10 or unclear; Total contact hours: unclear; Duration: from a single session to 24 months | | | |
| | | | | | | | | |
| Huang, 2019; European Journal of Internal Medicine | Clinical markers of cardiovascular disease | Lifestyle interventions | Number of studies: 17; Types of studies: RCTs; Total sample: unclear | Nurse, pharmacist or unclear | Number of session: unclear; Total contact hours: unclear; Duration: 6–12 months | | | |
| | | | | | | | | |
| Chen, 2019; Metabolism - Clinical and Experimental | Clinical markers | Lifestyle intervention | Number of studies: 16; Types of studies: RCTs; Total sample: per study ranged from 23 to 275 | Undear, did not describe | Number of session: unclear; Total contact hours: unclear; Duration: 4 or more weeks | | | |
| | | | | | | | | |
| Terranova, 2015; Diabetes, Obesity and Metabolism | Weight loss | Lifestyle-based-only intervention | Number of studies: 10; Individual studies (from 13 papers); Types of studies: RCTs; Total sample: ranging from 27 to 5145 participants | Undear, did not describe | Number of session: 1–42; Total contact hours: unclear; Duration: ranged from 16 weeks to 6 years | | | |
| | | | | | | | | |
| Pillay, 2015; Annals of Internal Medicine | HbA1c level | Behavioural programmes | Number of studies: 12; Types of studies: RCTs; Total sample: unclear | Trained individuals | Number of session: unclear; Total contact hours: range, 7–40 hours; Duration: 4 or more weeks | | | |

**Notes:**
- SELF refers to Self-efficacy and satisfaction.
- BEHA refers to Behavioral programme.
- DR refers to Diet.
- EXERCISE refers to Exercise.
- GC refers to General care.
- MED refers to Medicine.
- PSY refers to Psychological care.
- SMOKING refers to Smoking.
- BP refers to Blood pressure.
- BMI refers to Body mass index.
- HbA1c refers to Hemoglobin A1C.
- HRQoL refers to Health-related quality of life.
- Diabetes complications refers to Theoretical approach of diabetes complications.
- Economic analyses, mortality and diabetes knowledge refers to Theoretical approach of economic analyses, mortality and diabetes knowledge.
- Empowerment refers to Theoretical approach of empowerment.
- Self-efficacy and satisfaction refers to Theoretical approach of self-efficacy and satisfaction.
### Table 3 Continued

| First author, year; journal | Primary objectives (to assess effect of interventions on…) | Studies details | Intervention | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes | Synthesis methods |
|-----------------------------|----------------------------------------------------------|----------------|--------------|---------------------|----------|---------------------------------------------------|----------|------------------|
| Pal, 2014<sup>12</sup>; Diabetes Care | Health status, cardiovascular risk factors and QoL | Number of studies: 30 papers describing 16 studies | Computer-based self-management interventions | □ BEHA | Undecid did not describe | Number of session: 1–8; Total contact hours: 10 min–6 hours; Duration: 3–12 weeks | Unclear did not describe | Meta-analysis using Review Manager software or narrative presentation |
| Ricci-Cabello, 2014 | Knowledge, behaviours and clinical outcomes | Number of studies: 10; Types of studies: RCTs; Total sample: 960 patients | An educational intervention using SMS | □ BEHA | Undecid did not describe | Number of session: weekly or two messages daily or undecid; Total contact hours: unclear; Duration: 3 months–1 year | Strategies: SMS sending and receiving data; Receipt data through text messaging by patients only; Used a website along with SMS; Theoretical approach: Unclear | Meta-analyses and bivariate meta-regression were conducted with Stata V.12.0 |
| Vugt, 2013<sup>32</sup>; BMC Endocrine Disorders | Glycemic control | Number of studies: 17; Types of studies: RCTs; Total sample: 7463 patients | Therapeutic education | □ BEHA | General physician or health educator or unclear | Number of session: 3 or 4; Total contact hours: unclear; Duration: 12 weeks | Strategies: Face-to-face; Theoretical approach: Unclear | Comprehensive Meta-analysis Software V.2.0 |
| Vugt, 2013<sup>33</sup>; The Cochrane Library | HbA1c level, knowledge and clinical outcomes | Number of studies: 33 trials; Types of studies: RCTs and quasi-RCTs; Total sample: 7463 patients | "Culturally appropriate" health education | □ BEHA | OHPs, dietitians, exercise physiologists, lay workers, nurses, podiatrists and psychologists | Number of session: one session to 34 months; Total contact hours: unclear; Duration: median duration of interventions was 6 months | Strategies: Format: group intervention method; one-to-one sessions and a mixture of the two methods; Theoretical approach: empowerment theories; behavioural change theories; TTM of behaviour change and SCT | Meta-analyses used Review Manager software for meta-analysis |
| Vugt, 2013<sup>34</sup>; Journal of Medical Internet Research | Health outcomes | Number of studies: 13; Types of studies: RCTs; Total sample: 3813 patients | Online self-management interventions | □ BEHA | Healthcare professional | Number of session: 6 weekly sessions or unclear; Total contact hours: unclear; Duration: unclear | Strategies: Online web-based; Theoretical approach: self-efficacy theory, social support theory, TTM, SCT, social-ecological model and cognitiv behaviour therapy | Incremental cost-effectiveness ratio |

Note: □ represents baseline, √ represents improvement, and − represents no change.
### Table 3 Continued

| First author, year; journal | Primary objectives (to assess effect of interventions on….) | Number of studies | Types of studies: RCTs and comparative studies | Total sample | Educational content | Provider | Number of session(s), delivery mode, time, setting | Intervention | Outcomes (primary outcomes were in bold) | Synthesis methods |
|----------------------------|-------------------------------------------------------------|------------------|-----------------------------------------------|--------------|-------------------|--------|------------------------------------------------|--------------|------------------------------------------|------------------|
| Grabardi, 2013; Patient Education and Counseling | HbA1c level, psychological activity and diet outcomes | Number of studies: 13 studies | DSME interventions. | Ottolans (n=7/13); Multidisciplinary team (n=7/13); 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: weeks (n=7/13); months (n=6/13) | Strategies: face-to-face (n=13/13); written literature (eg, handbook) (n=4/13); telephone (n=13/13); auditory (n=7/13); | Inpatient settings, postdischarge | - HbA1c levels; - Anthropometrics; - Physical activity; - Diet outcomes | A recently described method |
| Liu X, et al. BMJ Open 2017;7:e016857. doi:10.1136/bmjopen-2017-016857 | | | | | | | | | | |
| Pal, 2013; The Cochrane Library | Health status and HRQoL | Number of studies: 16 studies | Computer-based diabetes self-management intervention | Nurse or other healthcare professionals | Number of session: unclear; Total contact hours: unclear; Duration: 1 session–18 months | Strategies: online/web-based; phone contact | Inpatient settings, postdischarge, other | - HRQoL; - Death from any cause; - HbA1c; - Cognition; - Behaviour; - Social support; - Biological markers; - Complications | Formal meta-analyses and narrative synthesis |
| Nam, 2012; Journal of Cardiovascular Nursing | Glycemic control | Number of studies: 12 RCTs; Types of studies: RCTs | Diabetes educational interventions (no duration indicated) | Nurses (63%), dieticians (36%), diabetes educators (5%), other professionals (9%) and non-professional staff (14%) | Number of session: 1/month or less; 1–3 months; 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 | Strategies: teaching or counselling; home-based support and visual aids | Inpatient settings, postdischarge, other | HbA1c level | Meta-analysis |
| Steindelk, 2012; Health Services Research | Clinical, lifestyle and psychosocial outcomes | Number of studies: 21 studies (20 publications) | Group-based education | Community workers; dietitian; lay health advisors; nurse and nutritionist | Number of session and total contact hours: 30 hours over 3–5 months, 52 hours over 1 year and 36 hours over 6 months; Duration: 6 months to 2 years | Strategies: face-to-face; Form: 5 to 10 participants group to group | Inpatient settings, postdischarge, other | HbA1c level, lifestyle outcomes, Diabetes knowledge, Self-management skills, Psychological outcomes, Mortality rate, JBI, Blood pressure, Lipid profile | Meta-analysis using Review Manager V7 |
| Amashah, 2012; Podiatry Now | 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 | Strategies: face-to-face; Form: in three of the studies, educational interventions were delivered to the participants in groups, while the other we provided individualised (one-to-one) foot care education to the participants | Inpatient settings, postdischarge, other | LEA; Self-care | Narrative synthesis |
| First author, year; journal | Primary objectives (to assess effect of interventions on...) | Studies details | Intervention | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes (primary outcomes were in bold.) | Synthesis methods |
|-----------------------------|------------------------------------------------------------|----------------|-------------|---------------------|----------|------------------------------------------------|------------------------------------------|-------------------|
| Liu X, et al. BMJ Open 2017;7:e016857. doi:10.1136/bmjopen-2017-016857 | Oral hypoglycaemic adherence | Number of studies: seven studies; Types of studies: RCTs and quasi-experimental trials; Total sample: unclear | Educational interventions | √ BEMA (↓) √ DIET (↓) √ EXERCISE (↓) √ PSY (↓) √ MED (↓) √ SMOKING (SELF-) | 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 | Meta-analysis |
| Bulka, 2017 | HbA1c level | Number of studies: 11 RCTs and 4 quasi-experimental trials; Types of studies: RCTs and quasi-experimental trials; Total sample: 30–40 patients | Group medical visits | √ BEMA (↓) √ DIET (↓) √ EXERCISE (↓) √ PSY (↓) √ MED (↓) √ SMOKING (SELF-) | 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 | Implant settings, postdischarge, other | Not statistically combined and re-analysed |
| Ramadas, 2011 | HbA1c level | Number of studies: 13 different studies; Types of studies: RCTs and quasi-experimental studies; Total sample: unclear | Web-based behavioural interventions | √ BEMA (↑) √ PSY (↑) √ MED (↑) | Dieticians; 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 27.5±18.3 weeks | Strategies: email and SMS technologies that were separately used together with the websites to reinforce the intervention, and website, print materials; Format: unclear; Theoretical approach: Wagner’s Chronic Care Model, self-efficacy theory/social support theory, TTM, HBM, SCT | Implant settings, postdischarge, other | Meta-analysis |
| Mie, 2010 | Glycemic control | Number of studies: 47 different studies; Types of studies: RCTs; Total sample: unclear | Self-care management interventions | √ BEMA (↓) √ PSY (↓) | Case nurse manager; group facilitator; nurse educator; multidisciplinary team: physiologist, physician, peer counsellor; researcher and pharmacist | Number of session: 3–48; Total contact hours: unclear; Duration: 4 weeks to 4 years | Strategies: face-to-face; Format: group and individual; Theoretical approach: unclear | Implant settings, postdischarge, other | Not statistically combined and re-analysed |
| Hawthorne, 2010 | Effects of culturally appropriate health education | Number of studies: 10 trials; Types of studies: RCTs; Total sample: 1603 patients | Culturally appropriate health education | √ BEMA (↓) √ PSY (↓) | Exercise physiologists; 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 interactive and a mixed approach; Theoretical approach: SAT, Empowerment Behaviour Change Model, SCT, Management model and the Theory of Planned Behaviour | Implant settings, postdischarge, other | Meta-analysis and meta-regression using Stata's meta command |
| Fan, 2009 | Canadian Journal of Diabetes | Number of studies: 50 studies; Types of studies: RCTs; Total sample: unclear | DSME intervention | √ BEMA (↓) √ PSY (↓) | Undesc. did not describe | Number of session: 10 range: 1–52; Total contact hours: 17 contact hours (range: 1–52); 50% (49%) 11–20 (21%); >20 (37%); Duration: 12 weeks (range: 1–48); 24 weeks (range: 36%); 9–12 weeks (37%); >34 weeks (37%) | Strategies: Online/web-based (9%), video (4%), face-to-face (60%), phone contact (4%), Mixed (30%); Format: one-on-one (32%) group (40%); mixed (28%); Theoretical approach: unclear | Implant settings, postdischarge, other | −QoL; −HbA1c; −BP; −BMI; −Lipid levels; −Diabetic complications; −Mortality rates, hospital admissions, hypoglycaemia | Meta-analysis using the Review Manager and narrative review |

Continued
### Table 3 Continued

| First author, year; journal | Primary objectives (to assess effect of interventions on...) | Studies details | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes (primary outcomes were in bold) | Synthesis methods |
|-----------------------------|------------------------------------------------------------|----------------|---------------------|----------|-----------------------------------------------|------------------------------------------|------------------|
| Duke, 2009<sup>a</sup>; The Cochrane Library | Metabolic control, diabetes knowledge and psychosocial outcomes | Number of studies: nine studies; Types of studies: RCTs and RCTs and CBTs; Total sample: 1399 participants | Individual patient education | Diabetes educators and dieticians | Number of session: 1–6; Total contact hours: 20 min – 7 hours; Duration: 4 weeks – 1 year | Strategies: face to face; telephone; Format: individual; Theoretical approach: unclear | Meta-analysis |
| Alam, 2009<sup>a</sup>; Patient Education and Counseling | Glycemic control and psychological status | Number of studies: 30 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: 30 min – 2 hours; Duration: about 11.7 (± 11.06) weeks | Strategies: face to face; telephone calls; Format: group format; a single format and used a combination; Theoretical approach: TTM; motivational interviewing | Meta-analysis |
| Khunti, 2008<sup>a</sup>; Diabetic Medicine | Knowledge and biomedical outcomes | Number of studies: nine studies; Types of studies: RCTs and RCTs and CBTs; Total sample: unclear | Any educational intervention | Undersaid; did not describe | Number of session: unclear; Total contact hours: unclear; Duration: 3–12 months | Strategies: face to face; group and individual; Theoretical approach: unclear | Unclear |
| Loveman, 2008<sup>b</sup>; 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; physicians; or physician assistant | Number of session: two to four intensive education of 1.5–5 hours followed up with additional education at 3 and 6 months; Total contact hours and duration: about 100 mins over 6 months or 61–52 hours over 1 year | Strategies: face to face; telephone; Format: group and individual; Theoretical approach: cognitive behavioral strategies; pedagogical principle | Narrative review |
| Wens, 2008<sup>c</sup>; Diabetes Research and Clinical Practice | Improving adherence to medical treatment recommendations | Number of studies: 50 studies; Types of studies: RCTs and CBTs; 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: 6 months or under | Strategies: face to face; telephone; Format: face to face; group based and telephone; Theoretical approach: unclear | Cochrane Review Manager software |
| Hawthorne, 2008<sup>d</sup>; 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 | 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 session; intervention method: one-to-one interview; mixture of the two methods; purely interactive patient-centred method semi-structured didactic format and combination of both approaches; Theoretical approach: SAT: Empowerment Behaviour Change Model; Behaviour Change Theory; SCT; Management Model and the Theory of Planned Behaviour | Narrative presentation and meta-analysis |
Table 3 Continued

| First author, year, journal | Primary objectives (in a narrative format) | Studies details | Educational content | Provider | Number of session(s), delivery mode, time, setting | Outcomes (primary outcomes were in bold) | Synthesis methods |
|-----------------------------|------------------------------------------|----------------|---------------------|----------|-----------------------------------------------|------------------------------------------|------------------|
| Nield, 2007[17]: The Cochrane Library | Metabolic control | Number of studies: 36 articles (18 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 | Strategies: face-to-face; Format: group and individual; Theoretical approach: unclear | Meta-analysis |
| Zabaklia, 2007[18]: British Journal of Community Nursing | Clinical effectiveness | Number of studies: 21 articles; Types of studies: controlled trials; Total sample: unclear | Structured group diabetes education | Diabetes nurse educator; physician’s assistant and physicians | Number of session: 4–6 or unclear; Total contact hours: 6–12 hours or unclear; Duration: 1–6 months or unclear | Strategies: face-to-face; Format: group; Theoretical approach: unclear | Meta-analysis |
| Deakin, 2008[19]: The Cochrane Library | Clinical, lifestyle and psychosocial outcomes | Number of studies: 14 publications, reporting 11 studies; Types of studies: RCTs and CBTs; Total sample: 1532 participants | Group-based educational programmes | Did not describe the content of the intervention | Number of session: unclear; Total contact hours: from 6 to 52 hours; Duration: 6 hours per year for 2 years and 3 to 4 hours per year for 4 years | Health professionals, lay health advisors | Summarised statistically |
| Vermaak, 2009[20]: 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: 4136 participants | Interventions that were aimed at improving the adherence to treatment recommendations | Nurse, pharmacist and other healthcare professionals | Number of session: unclear; Total contact hours: unclear; Duration: unclear | Strategies: face-to-face; Format: telephone; home visit; video; mailed educational material; Theoretical approach: unclear | A descriptive review and subgroup meta-analysis |
| Gary, 2009[21]: Diabetes Educator | Body weight and glycaemic control | Number of studies: 63 RCTs; Types of studies: RCTs, Total sample: 2730 patients | Educational and behaviour change interventions | Nurse (39%); dietitian (29%); physician (17%); other or not specified (31%); other professional (15%); psychologist (9%); exercise psychologist (9%); and health educator (4%) | Number of session: 1–12; Total contact hours: 9.2 (1–28) hours; Duration: 6 (1.0–27) months | Strategies: unclear; Format: group; Theoretical approach: unclear | Meta-analysis |
| Norris, 2007[22]: Diabetes Care | Total HbA1c | Number of studies: 31 studies; Types of studies: RCTs, Total sample: 4263 patients | Self-management education | Dietitian, lay healthcare worker, nurse, physician, or team; self-teaching; computer-assisted instruction; and team (nurse, dietitian, etc) | Number of session: 1–16; Total contact hours: 9.2 (0–28) hours; Duration: 6 (1.0–27) months | Strategies: online/web-based; video; face-to-face; phone contact; Format: group, individual and mixed; Theoretical approach: unclear | Meta-analysis and meta-regression |
| Norris, 2007[23]: Diabetes Care | Clinical outcomes, knowledge, metabolic control | Number of studies: 72 studies (84 papers); Types of studies: RCTs, Total sample: unclear | Self-management training interventions | OHWs; nurse; or other healthcare professionals | Number of session: 1–16; Total contact hours: 22 hours; Duration: 36 months | Strategies: online/web-based; video; telephone; Format: group, individual and mixed; Theoretical approach: unclear | Outcomes are summarised in a qualitative fashion |
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 studies31 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 dieticians, nurses and a multidisciplinary team. The number of sessions, total contact hours and durations varied. Thirteen reviews30 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 et al, 2010<sup>51</sup> did not give the total sample size) | Ghisi, 2014<sup>50</sup> | Knowledge 91% studies*                                                                   | Some evidence                        |
|                                       |                                                                  |                    | Behaviour 77%/84%/65% studies*                                                            |                                      |
|                                       |                                                                  |                    | Psychosocial indicators 43% studies*                                                      |                                      |
|                                       |                                                                  | Brown, 2013<sup>37</sup> |                                                                                          |                                      |
|                                       |                                                                  |                    | Total mortality                                                                          |                                      |
|                                       |                                                                  |                    | MI                                                                                       |                                      |
|                                       |                                                                  |                    | Revascularisations                                                                      |                                      |
|                                       |                                                                  |                    | Hospitalisations                                                                         |                                      |
|                                       |                                                                  |                    | HRQoL                                                                                    |                                      |
|                                       |                                                                  |                    | Withdrawals/dropouts                                                                     |                                      |
|                                       |                                                                  |                    | Healthcare utilisation and costs                                                         |                                      |
|                                       |                                                                  | Brown, 2011<sup>70</sup> |                                                                                          |                                      |
|                                       |                                                                  |                    | Total mortality                                                                          |                                      |
|                                       |                                                                  |                    | MI                                                                                       |                                      |
|                                       |                                                                  |                    | CABG                                                                                    |                                      |
|                                       |                                                                  |                    | Hospitalisations                                                                         |                                      |
|                                       |                                                                  |                    | HRQoL                                                                                    |                                      |
|                                       |                                                                  |                    | Healthcare costs                                                                         | 63.6% studies*                        |
|                                       |                                                                  |                    | Withdrawal/dropout                                                                        | 40% studies*                          |
|                                       |                                                                  | Goulding, 2010<sup>51</sup> | Beliefs 30.08% studies*                                                                   |                                      |
|                                       |                                                                  |                    | Secondary outcomes                                                                      |                                      |
|                                       |                                                                  | Fernandez, 2007<sup>48</sup> |                                                                                          |                                      |
|                                       |                                                                  |                    | Smoking                                                                                  |                                      |
|                                       |                                                                  |                    | Cholesterol level                                                                        |                                      |
|                                       |                                                                  |                    | Multiple risk factor modification                                                        |                                      |
|                                       |                                                                  | Kotb, 2014<sup>59</sup> |                                                                                          |                                      |
|                                       |                                                                  |                    | All-cause hospitalisation                                                                 |                                      |
|                                       |                                                                  |                    | All-cause mortality                                                                       |                                      |
|                                       |                                                                  |                    | Smoking cessation                                                                         |                                      |
|                                       |                                                                  |                    | Depression                                                                               |                                      |
|                                       |                                                                  |                    | Systolic blood pressure                                                                   |                                      |
|                                       |                                                                  |                    | Low-density lipoprotein                                                                  |                                      |
|                                       |                                                                  |                    | Anxiety                                                                                  |                                      |
| Psychoeducational interventions       | Six/37 883 patients                                              | Barth, 2015<sup>68</sup> | Abstinence by self-report or validated                                                   | Sufficient evidence                  |
|                                       |                                                                  |                    | Dickens, 2013<sup>46</sup> Depression                                                   |                                      |
|                                       |                                                                  |                    | Aldcroft, 2011<sup>31</sup> Smoking cessation                                           |                                      |
|                                       |                                                                  |                    | Huttunen-Lenz, 2010<sup>56</sup> Prevalent smoking cessation                             |                                      |
|                                       |                                                                  |                    | Continuous smoking cessation                                                             |                                      |
|                                       |                                                                  |                    | Total mortality                                                                          |                                      |
|                                       |                                                                  | Barth, 2008<sup>36</sup> | Abstinence by self-report or validated                                                   |                                      |
|                                       |                                                                  |                    | Smoking status                                                                           |                                      |
|                                       |                                                                  | Barth, 2006<sup>35</sup> | Abstinence                                                                               |                                      |
|                                       |                                                                  |                    | Smoking status                                                                           |                                      |
### 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    | Three/25 154 patients                                             | Devi, 2015        | Mortality                                                                                 | Some evidence                        |
| secondary prevention)                                                       |                                                                  |                   | Revascularisation                                                                         |                                      |
|                                                                            |                                                                  |                   | Total cholesterol                                                                         |                                      |
|                                                                            |                                                                  |                   | HDL cholesterol                                                                           |                                      |
|                                                                            |                                                                  |                   | Triglycerides                                                                             |                                      |
|                                                                            |                                                                  |                   | HRQOL                                                                                    |                                      |
|                                                                            |                                                                  | Auer, 2008        | All-cause mortality                                                                        |                                      |
|                                                                            |                                                                  |                   | Readmission rates                                                                         |                                      |
|                                                                            |                                                                  |                   | Reinfarction rates                                                                        |                                      |
|                                                                            |                                                                  |                   | Smoking cessation rates                                                                   |                                      |
|                                                                            |                                                                  | Clark, 2005       | Mortality                                                                                 | Most of the included studies*        |
|                                                                            |                                                                  |                   | MI                                                                                       |                                      |
|                                                                            |                                                                  |                   | Quality of life                                                                           |                                      |
| Patients with T2DM                                                          |                                                                  |                   |                                             |                                      |
| General health education                                                    | Five/2319 patients (Choi et al, 2016; Loveman et al, 2008;      | Choi, 2016        | HbA1c                                      | Some evidence                        |
|                                                                            | Zabaleta et al, 2007 did not give the total sample size)       | Saffari, 2014     | Glycaemic control                                                                         |                                      |
|                                                                            |                                                                  | Duke, 2009        | HbA1c                                      |                                      |
|                                                                            |                                                                  |                   | BP                                                                                       |                                      |
|                                                                            |                                                                  |                   | Knowledge, psychosocial outcomes and smoking habits                                        |                                      |
|                                                                            |                                                                  |                   | Diabetes complications                                                                    | No data                              |
|                                                                            |                                                                  |                   | or health service utilisation and cost analysis                                            |                                      |
|                                                                            |                                                                  | Loveman, 2008     | Diabetic control outcomes                                                                 | 46.15% studies*                      |
|                                                                            |                                                                  |                   | Weight                                                                                    | 66.67% studies*                      |
|                                                                            |                                                                  |                   | Cholesterol or triglycerides                                                             | 40.00% studies (+)                   |
|                                                                            |                                                                  | Zabaleta, 2007    | HbA1c                                      | 4.8% studies*                        |
| Culturally appropriate health education                                      | Eight/20622 patients (Ricci-Cabello et al, 2014; Gucciardi et  | Creamer, 2016     | HbA1c                                      | Some evidence                        |
|                                                                            | Zabalet et al, 2013 did not give the total sample size)        |                   | HRQoL                                      |                                      |
|                                                                            |                                                                  |                   | AEs                                        | No AEs                               |
|                                                                            |                                                                  | Ricci-Cabello, 2014 | HbA1c                                      | 73.3% studies*                      |
|                                                                            |                                                                  |                   | Diabetes knowledge                                                                       | 75% studies*                         |
|                                                                            |                                                                  |                   | Behaviours                                                                                | Fasting blood glucose, HbA1c and BP  |
|                                                                            |                                                                  |                   | Clinical outcomes                                                                         | improved in 71%, 59% and 57% of the  |
|                                                                            |                                                                  |                   |                                             | studies                              |

Continued
| Intervention | Number of systematic reviews/meta-analysis, total participants | First author, year | Primary results/findings | Rating the evidence of effectiveness |
|--------------|-------------------------------------------------------------|-------------------|--------------------------|-------------------------------------|
| Attridge, 2014 | HbA1c Knowledge scores Clinical outcomes Other outcome measures | Showed neutral effects |
| Gucciardi, 2013 | 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 | HbA1c level | |
| Hawthorne, 2010 | HbA1c Knowledge scores | |
| Khunti, 2008 | Knowledge levels | Only one study reporting a significant improvement |
| | Biomedical outcomes | Only one study reporting a significant improvement |
| Hawthorne, 2008 | HbA1c Knowledge scores Other outcome measures | |
| Lifestyle interventions+ behavioural programme | Six/10 440 patients (Huang et al, 2016; Pillay et al, 2015 and Ramadas et al, 2011 did not give the total sample size) | Huang, 2016 | HbA1c BMI LDL-c and HDL-c | Some evidence |
| | | Chen, 2015 | HbA1c BMI SBP DBP HDL-c | |
| | | Terranova, 2015 | HbA1c level Weight | |
| | | Pillay, 2015 | HbA1c levels BMI | |
| | | Ramadas, 2011 | HbA1c | 46.2% studies * |
| | | Gary, 2003 | Fast blood sugar Glycohaemoglobin HbA1 HbA1c Weight | |

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 et al, 2010⁶¹; Fan et al, 2009⁴⁷ and Norris et al, 2001⁶⁴ did not give the total sample size) | Pal, 2014⁴⁷       | Cardiovascular risk factors                                                             | Sufficient evidence                   |
|                                         |                                                                |                    | Cognitive outcomes                                                                      |                                       |
|                                         |                                                                |                    | Behavioural outcomes                                                                    |                                       |
|                                         |                                                                |                    | Only one study reporting a significant improvement                                       |                                       |
|                                         |                                                                |                    | AEs                                                                                    | No AEs                                |
|                                         |                                                                |                    | Health behaviours                                                                       | 7 of 13 studies *                     |
|                                         |                                                                |                    | Clinical outcomes measures                                                             | Nine studies *                         |
|                                         |                                                                |                    | Psychological outcomes                                                                  | Nine studies *                         |
|                                         |                                                                |                    | HbA1c                                                                                  |                                       |
|                                         |                                                                |                    | Depression                                                                              |                                       |
|                                         |                                                                |                    | Quality of life                                                                         |                                       |
|                                         |                                                                |                    | Weight                                                                                  |                                       |
|                                         |                                                                |                    | HbA1c                                                                                  |                                       |
|                                         |                                                                |                    | Main lifestyle outcomes                                                                  |                                       |
|                                         |                                                                |                    | Main psychosocial outcomes                                                              |                                       |
|                                         |                                                                |                    | Glycaemic control                                                                       |                                       |
|                                         |                                                                |                    | Diabetes knowledge                                                                      |                                       |
|                                         |                                                                |                    | Overall self-management behaviours                                                      |                                       |
|                                         |                                                                |                    | Overall metabolic outcomes                                                               |                                       |
|                                         |                                                                |                    | Overall weighted mean effect sizes                                                      |                                       |
|                                         |                                                                |                    | Metabolic control (HbA1c)                                                                |                                       |
|                                         |                                                                |                    | Fasting blood glucose levels                                                            |                                       |
|                                         |                                                                |                    | Weight                                                                                  |                                       |
|                                         |                                                                |                    | Diabetes knowledge                                                                       |                                       |
|                                         |                                                                |                    | SBP                                                                                    |                                       |
|                                         |                                                                |                    | Diabetes medication                                                                      |                                       |
|                                         |                                                                |                    | Total GHB                                                                               |                                       |
|                                         |                                                                |                    | Knowledge                                                                               |                                       |
|                                         |                                                                |                    | Self-monitoring of blood glucose                                                       |                                       |
|                                         |                                                                |                    | Self-reported dietary habits                                                            |                                       |
|                                         |                                                                |                    | Glycaemic control                                                                       |                                       |
| Therapeutic education                   | One/total sample: unclear                                      | Odnoletkova, 2014⁵⁶ | Cost-effectiveness                                                                      | Overall high in studies on prediabetes and varied in studies on T2DM                |
|                                         |                                                                |                    |                                                                                        | Insufficient evidence                  |
| Foot health education                   | One/total sample: unclear                                      | Amaesh⁵²           | Diabetes complications                                                                   | Some evidence                          |
|                                         |                                                                |                    | Incidence of LEA                                                                        |                                       |

*Continued*
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 reviews34 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
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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{71 72}

Uptake and maintenance of medication regimes
The statements are based on our synthesis of results from three publications.\textsuperscript{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.\textsuperscript{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. There is some evidence that group medical visits are effective for improving HbA1c and systolic BP management. There is also some evidence that psychoeducational programmes are effective for improving HbA1c regulation and psychological status.

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

**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. 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?

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. 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.

**Use of theoretical orientation to develop educational intervention**

For patients with ACS

Use of theory when designing behavioural change interventions may also influence effectiveness. Health education using a cognitive behavioural strategy is most consistently effective in changing maladaptive illness beliefs, and studies using more than two behavioural change strategies reported significant differences between the intervention and control groups. 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 planning; 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. 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). Three reviews suggested 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. 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. Theories could help to specify the key target health behaviours and behavioural change techniques required to generate the desired outcomes. The decision regarding the theory should be based on the aim of the programme and factor for intervention. Only one review reported that a theoretical approach underpinning the health education programme is not necessary for better outcomes. Fourteen reviews 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. Age, cognitive factors, environmental factors and social and economic background are also important considerations. 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. Psychoeducation, which is defined as multimodal, educationally based, self-management interventions, 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. Moreover, psychoeducational interventions were more effective for patients with T2DM than other types of health education.

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. In addition, based on the current evidence, the educational content should be culturally sensitive, especially for patients with T2DM; culturally appropriate diabetes health education may have a greater impact on the management of glycaemia and reduce diabetes complications. 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. 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. 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.

However, one systematic review reported that individual and group patient education demonstrated similar outcomes among patients with T2DM.

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. Another review reported that face-to-face health education programmes generated a greater benefit for metabolic management than those delivered using electronic communication technology.

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

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. 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) and that at least 12 months of follow-up is needed to evaluate the impact of telephone-based education. 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, 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 reviews31 36 43 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 behaviour 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 reviews32 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                       | Format                           | Format                           |
|                                   | Face to face; telephone or mixed | Individual (one by one) or mixed  | Individual (one by one) or mixed  |
|                                   | Face-to-face, written materials; telephone 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 |
|                                   | Duration                         | At least 6 months                | About 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 intervention), 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 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.

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. 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. The variability in the approaches, tools or scales used to measure outcomes between the included studies are likely to introduce some heterogeneity. 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. 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.

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 last 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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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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