Title: A SYSTEMATIC REVIEW OF PATIENT EDUCATION IN CARDIAC PATIENTS: DO THEY INCREASE KNOWLEDGE AND PROMOTE HEALTH BEHAVIOR CHANGE?

Authors: Gabriela Lima de Melo Ghisi[a,b], Flavia Abdallah[b], Sherry L. Grace[b,c], Scott Thomas[a], Paul Oh[b] .

Institutions:

[a]Exercise Sciences Department, Faculty of Kinesiology & Physical Education, University of Toronto, Toronto, Canada.

[b]Cardiac Rehabilitation and Prevention Program, Toronto Rehabilitation Institute, University Health Network, Toronto, Canada.

[c]School of Kinesiology and Health Science, York University, Toronto, Canada.

Corresponding author: Gabriela Lima de Melo Ghisi

Toronto Rehabilitation Institute, University Health Network

Cardiac Rehabilitation & Secondary Prevention Program

347 Rumsey Road

Toronto, On Canada M4G 1R7

Email: gabriela.meloghisi@utoronto.ca gabriella.meloghisi@uhn.ca

Phone: +1(416)597-3422 ext 5223

Abstract

Objective: (1) to investigate the impact of education on patients' knowledge; (2) to determine if educational interventions are related to health behavior change in cardiac patients; and (3) to describe the nature of educational interventions.

Methods: A literature search of several electronic databases was conducted for published articles from database inception to August 2012. Eligible articles included cardiac patients, and described delivery of educational interventions by a healthcare provider. Outcomes were knowledge, smoking, physical activity, dietary habits, response to symptoms, medication adherence, and psychosocial well-being. Articles were reviewed by 2 authors independently.

Results: Overall, 42 articles were included, of which 23(55%) were randomized controlled trials, and 16(38%) were considered "good" quality. Eleven studies (26%) assessed knowledge, and 10 showed a significant increase with education. With regard to outcomes, educational interventions were significantly and positively related to physical activity, dietary habits, and smoking cessation. The nature of interventions were poorly described and most frequently delivered post-discharge, by a nurse, and in groups.

Conclusions: Findings support the benefits of educational interventions in CHD, though increase in patients' knowledge and behavior change.

Practice Implications: Future reporting of education interventions should be more explicitly characterized, in order to be reproducible and assessed.

Word count: 198

Keywords: Patient Education as Topic, Coronary Disease, Health Behavior, Systematic Review

Introduction

Cardiovascular Diseases (CVDs) are the leading cause of mortality worldwide [1], and are a significant contributor to morbidity and health-related costs [2]. Coronary Artery Disease (CAD) – the most common type of CVDs – is considered a chronic condition and, therefore, requires a careful medical management with multiple recommendations for patients to achieve optimal secondary prevention [3-5]. As a consequence, patient education is a necessary first step to promote patient understanding of the recommended therapies and behavior changes, as well as to follow them [6-9].

Patient education has been formally defined as "the process by which health professionals and others impart information to patients that will alter their health behaviors or improve their health status" [10]. Research is beginning to demonstrate a positive effect of cardiac patient education on behavior change, including 4 reviews [11-14]. Of these, 3 demonstrated educational interventions produce a positive effect on behavior change. Although these reviews may be less subject to bias as they included only randomized controlled trials, they included a small number of trials and focus on outcomes, failing to describe the interventions in depth and aiming only to assess psycho-educational strategies. It is important to gain a clear picture of how these interventions are structured and how they impact not only behavior, but knowledge. To our knowledge, such a synthesis has not been published previously.

Cardiac rehabilitation (CR) is a comprehensive risk reduction program, of which patient education is considered a core component [15]. Thus, American and Canadian Cardiovascular Societies include education as a quality indicator of CR [16,17]. According to the Canadian Association of CR Guidelines [3], patient education should: be personalized; be led by a professional staff, with regular contact between staff and patients; be delivered in individual or

group settings; discuss specific health goals; and seek to influence outcomes beliefs, to elicit positive emotions, to increase optimism about the possibility of change, and to heighten the salience of personal experience or other evidence supporting self-efficacy. However, the nature of education delivery is not fully specified, and the impact of the education has not been often considered.

The first objective of this systematic review was to investigate the impact of education on patients' knowledge about health and disease. The second objective was to determine if educational interventions are related to health behavior change in CAD patients, namely smoking, physical activity, dietary habits, response to cardiac symptoms, and medication adherence, as well as psychosocial well-being. Finally, the third objective was to describe the nature of the educational interventions offered, as per the Workgroup for Intervention Development and Evaluation Research (WIDER) reporting guideline [18].

2. Methods

2.1 Search Methods for Identification of Studies

Literature published from database inception until August 2012 was searched using the MEDLINE, PsycINFO, CINAHL, EMBASE and EBM computerized databases, in conjunction with a subject librarian. Search results were downloaded into bibliographic software. The search strategy incorporated 3 concepts: (1) condition, which was divided into cardiac and rehabilitation aspects (e.g. coronary disease, myocardial infarction, and rehabilitation); (2) education (e.g. health education or patient education); and (3) outcomes (e.g. knowledge, health behavior, lifestyle, and attitude toward health). Search terms were specific to each database. The search strategy for 2 databases is shown in Appendix 1. A snowball hand-search was undertaken after the first selection of articles.

Inclusion and Exclusion Criteria

The criteria for considering studies for this review were:

(1) Design: peer-reviewed studies were considered for inclusion. Primary or secondary studies were included, whether they were observational or interventional in design. Qualitative studies were not included, however served to inform interpretation of quantitative findings. Reviews were identified as a source of additional primary studies.

(2) Participants: cardiac patients with primary diagnosis of CAD, myocardial infarction, or who have undergone coronary artery bypass graft surgery, or percutaneous coronary intervention. These patients are indicated for CR in clinical practice guidelines [3]. Heart failure patients were excluded from this review as these patients require additional education when compared to CAD patients.

(3) Education: any educational interventions about CAD and its management, delivered by a healthcare provider. In order for the article to be included, the educational intervention had to be described in accordance with the reporting guidelines for behavior change interventions developed by WIDER [18]. Specifically, at least 3 of the 8 recommended elements for intervention description had to be detailed: characteristics of those delivering the intervention (i.e. type of healthcare professional), characteristics of the recipients, the setting (i.e. time and place of intervention), mode of delivery, the intensity (i.e. contact time), the duration (i.e. number of sessions), adherence to delivery protocols, and a detailed description of the intervention content.

(4) Outcomes: Studies had to either report the impact on knowledge, behavior, or psychosocial indicators (e.g., stress). The 5 behaviors were: smoking, physical activity, dietary habits, response to cardiac symptoms, and medication adherence. These

behavioral outcomes were chosen because they are related to better health outcomes in cardiac patients [3-5, 19].

(5) Published in the English language.

2.2 Data Collection and Analysis

Two reviewers (GLMG and FA) independently screened the references identified by the search strategy by title and abstract. In order to be selected, abstracts had to clearly identify cardiac participants, educational interventions and one of the outcomes described above. The full-text reports of all remaining citations were obtained and assessed independently for eligibility by these 2 reviewers, based on the defined inclusion criteria. Any disagreements were resolved through discussion between the two investigators and, if needed, consultation with a third author (PO).

Data extraction was undertaken by a single reviewer (GLMG) and checked by a second reviewer (FA). The Downs and Black scale [20] - a checklist used to assess the methodological quality not only of randomized controlled trials but also non-randomized studies - was selected to assess the quality of the studies, as it is contained the highest number of relevant items for the needs of this review. Given not all items were relevant to all study types included in this review, 2 modified versions of the checklist were created. The one for cohort / cross-sectional studies consisted of 18 items with a maximum score of 18 points. The one for randomized controlled trials (RCT) consisted of 25 items. This tool was used to rate article quality in 4 areas: reporting, external validity, internal validity (bias), and internal validity (confounding). The total points for each article were categorized as "good", "fair", or "poor" based on the United States Preventive Services Task Force approach [21].

Given the nature of the literature, quantitative synthesis of data was not possible. The multiple sources of heterogeneity observed across studies (in terms of interventions and outcomes) meant that undertaking a formal meta-analysis was not considered appropriate. Heterogeneity amongst included studies was explored qualitatively. Studies were grouped accordingly to intervention characteristics (e.g., delivery format and education content) and the outcomes of interest.

3. Results

Initial searching yielded 6476 records, and 3 records were identified through the snowball hand-search. After the screen, 343 full-articles were assessed for eligibility. Overall, 42 articles were included in this systematic review. A flow diagram depicting the search results, reasons for exclusion, and study selection is presented in Figure 1.

3.1 Characteristics of included studies

Table 1 summarizes the methodological characteristics of the 42 included studies [22-63]. Thirty (71.4%) were experimental: 23 (55%) RCTs [22-44] and 7 (16.7%) quasi-experimental [46,49,50, 59-62]; and 11 (26.2%) observational: 6 (14.3%) cross-sectional in design [45,47,48,51-53] and 5 (12%) were cohort studies (4 prospective [54-57] and 1 retrospective [58]). One (2.5%) study used a mixed-methods design [63].

The included studies involved 16,079 participants from 187 centers. Thirteen (35%) studies were undertaken in the United States, 5 (12%) in the United Kingdom, 3 (7%) each in the Netherlands, Sweden, Australia and Canada, 2 (5%) each in China, France, Korea and Finland, and 1 (2.5%) each in Japan, Italy, Turkey and Portugal.

The quality ratings of the studies are also shown in Table 1. Overall, 16 (38%) studies were considered “good”, 24 (57%) studies “fair”, and 2 (5%) studies were considered “poor”

quality.

3.2 Nature of Education Interventions

Table 2 summarizes the nature of educational interventions. The educational interventions were categorised based on WIDER reporting guidelines [18], and no study reported complete characteristics. Seventeen studies (40.5%) reported 6 of the 8 WIDER intervention description elements. None of the studies reported of fidelity or adherence to delivery protocols.

With regard to those delivering the intervention, nurses delivered the education in 15 (35.7%) studies [22,24,25,31,32,36-38,41,42, 54,55,60,61,63], a multidisciplinary team in 13 (31%) studies [23,29,34,39,40,43,48,50,51,56-58,62], dietitians in 6 (14.3%) studies [28,33,45,49,52,53], and a cardiologist in 1 (2.4%) study [27].

With regard to setting, most studies (n=22; 52.4%) delivered the educational intervention after hospital discharge; of these, 11 (26.2%) were interventions in CR [23,27,33,44,47,49,50,52,53,57,63]. Six (14.3%) studies [30,36,41,51,54,61] provided the education intervention before hospital discharge. A total of 8 (19%) studies [29,31,32,3445,46,55,60] delivered education interventions both before and after hospital discharge, whereas 2 (4.8%) studies provided education only at discharge. Four studies reported providing education to ambulatory patients [26,28,35,37].

With regard to mode of delivery, group (n=37 studies; 88.1%) education was delivered by lectures in 17 (40.5%) studies [28,29,32,33,39,42,43,45,47-50,53,55-58], group discussions in 17 (40.5%) studies [23,29,32,35,39,40,42,43,47,48,52,55,58-60,62,63], and question and answer periods in 3 (7.1%) studies [48,52,58]. Individual education was used in 37 (88.1%) studies, including individual counselling in 21 (50%) studies [22-24,27,28,31,33-35,37,38,41,42,46,49-52,55,57,61], follow-up telephone contacts in 13 (31%) studies [22,24,28,30,34,37,41,

42,44,47,55,61,62] and home visits in 3 (7.1%) studies [31,47,60].

Few studies provided information regarding intensity. The contact time varied from 5-10 minutes [41] to 3 hours [39] as well as a full day of education [48]; 15 (35.7%) studies provided no duration information [23,5,31,32,35,36,38,44,47,50,51,54, 55,58,61]). With regard to duration, the average number of educational sessions offered was 6 (range 1 [25,38] to 24 [34,40,62], however this was not described in 5 (12%) studies [35,44,51,55,61]). The frequency of contact varied from daily education [54] to every 6 months [27]; most studies (n=17; 40.5%) described weekly education [22,23,27-29, 3,34,37,39,43,49,52,56,58,59,62,62] and 14 (33.3%) studies provided no frequency information [27,35,36,41,42,44,46,49-51,55,57,61].

With regard to intervention content, the educational interventions described in the 42 studies included 19 different topics, with an average of 3.3 topics per study (range from 1 to 7 topics). One study did not describe the educational content of its intervention [58]. Education content most-often concerned nutrition (n=26; 62%; [23,26-31,33,35,40,42,43,45,46,48-53,55-57,60-62]), exercise (n=19; 45.2%; [23,26,27,30,31,35,40,42,44,46-51,55,56,60,61]), risk factors (n=17; 40.5%; [23,26,27,29,30,34,39,40, 42,47,49-51,56,60-62]), psychosocial education (i.e. stress, anxiety, social support, emotions, relaxation techniques and self-management; n=16; 38.1%; [22,23,27,29,31,34,37,38,40,42,43,48,50,55,59,62]), and medications (n=13; 31%; [23,25,26,30,3,40,42,43,46,48, 54,60,62]). Other content topics were smoking cessation (n=8; 19%; [24,27,31,35,40,41,55,60]), responding to cardiac symptoms (n=7; 16.7%; [22,31,34,37,38,51,60]), behavior change strategies (n=6; 14.3%; [23,31,39,55,60,63]), surgical procedures (n=5; 11.9%; [32,38,46,51,61]), return to activities (n=4; 9.5%; [36,42,43,50]), management of CAD (n=4; 9.5%; [26,35,40,62]), physiology of the heart (n=3; 7.1%; [29,48,61]), and nature of the disease (n=2; 4.8%; [30,50]). Other topics were described only by

1 study: secondary prevention [36], quality of life [39], metabolic syndrome [56], sexual activity [43], health beliefs [43], and shared decision-making [26].

Finally, educational materials provided to patients included: teaching booklets in 11 (26.2%) studies [26,27,30,31,38,41,44,46,47,51,61], cookbooks in 3 (7.1%) studies [28,33,49], educational videos in 5 (11.9%) studies [23,26,41,50,51], educational audio-recordings in 2 (4.8%) studies [38,41], medication education kits in 2 (4.8%) studies [25,54] and in 1 study (2.4%) medication cards [46], a checklist [61], heart models [51], and illustration models [46]. Verbal orientation to educational materials was described in 6 (14.3%) studies [25,30,35,41,44,54].

3.3 Knowledge

Eleven studies (26%) reported the assessment of knowledge about their condition and 11 different tools were used to assess this knowledge. Six studies used tools developed by other authors – Response Questionnaire (used by [22], and developed by [64]), Medication Knowledge and Compliance Scale (used by [25], and developed by [65]), the Cardiac Health Knowledge Questionnaire (used by [34], and developed by [66]), the Rahe et al. format model (used by [61], and developed by [67]), the Acute Coronary Syndrome Response Index (used by [37], and adapted from [68]), and the Knowledge Questionnaire for Heart Patients (used by [43], and developed by [69]) . In 3 studies the authors developed a questionnaire [46,49,55], in 1 study the authors developed and pilot-tested a tool [26], and in 1 study the authors developed and psychometrically-validated their tool [54].

Of these 11 studies assessing knowledge, 6 (14.3%) were RCTs and 3 (7.1%) quasi-experimental. The majority (n=10; 91%; [22,26,37,43,46,49,54, 55,61,66]) reported a significant

increase in knowledge associated with the educational interventions. Results are shown in Table 1.

3.4 Behavior Change and Psychosocial Well-Being

Behavior change and psychosocial well-being were assessed via self-report in all (n=42; 100%) studies. In regards to behavior change, physical activity was measured in 26 studies (62%; [23,26,27,29-32,34-36,39,40,42-44,47,48,50,51,55,56,58-62]), while dietary habits were measured in 25 studies (60%; [26-28,31-36,39,40,42,43,45,46,48,49,51-53,55-57,60,62]). Twenty (48%) studies [24,26,27,29-31,35,39, 40-43,49,51,55,58-62] measured smoking, 4 (9.5%) studies [25,31,54,60] measured medication adherence, and 2 (5%) studies measured response to symptoms [22,37]. Results are described in Table 1.

Of the 26 studies measuring physical activity, 20 (77%; [23.26,27,30-32,34-36,39,40,42,44,48,51,55,56,60,61]) reported a significant positive relationship between education and physical activity, 5 (19%; [29,43,50,58,59]) reported no differences, and 1 (4%; [62]) reported a negative relationship. Of the 25 studies assessing dietary habits, 21 (84%; [26-28,31-34,36,40,42,43,45,46,48,49,51-53,55,60,62]) reported a significant positive relationship between education and dietary habits. No negative associations were found between dietary habits and educational strategies. Twenty studies assessed the influence of educational strategies on smoking and 13 studies (65%; [24,26,27,30,40,41,43,49,51,55,58,60,61]) reported significant and positive associations. No negative associations were found. With regard to response to symptoms, 1 (50%; [37]) study reported a significant positive association to education, and 1 (50%; [22]) study found no significant association. With regard to medication adherence, only 1 (25%; [31]) study reported a significant difference between educational and non-educational groups; however, significant differences were only demonstrated at the 3-month assessment

point (the association did not persist).

Finally, 7 (16%) studies examined psychosocial well-being: 4 depression and anxiety [37,42,50,63]), 2 stress [27,63], and 1 each general distress [38] and social support [23]. Three (43%; [27,37,50]) studies reported a significant and positive relationship behavior; and the other studies presented null results.

4. Discussion and Conclusion

4.1 Discussion

This systematic review investigated the impact of education on patients' knowledge and health behavior change in CAD patients and described the nature of educational interventions delivered. Overall results of this review suggest that educational interventions within cardiac care increase patients' knowledge and facilitate behavior change. All studies assessing knowledge but one reported an increase in patients' knowledge, in areas including appropriate responses to cardiac symptoms and medications. Analysis showed that educational interventions were related to increases in physical activity, healthier dietary habits and smoking cessation, but revealed equivocal relation to response to cardiac symptoms, medication adherence and psychosocial well-being.

Although the results were mainly positive, studies varied significantly with regard to educational interventions characteristics. This can be considered a significant gap as no data exists to guide healthcare providers on the optimal setting, mode of delivery, intensity, duration and content for provision of patient education for cardiac patients. Indeed, no study described all 8 characteristics according to the WIDER reporting guidelines [18], and less than half of the studies reported 6 characteristics. WIDER also makes the recommendation that authors articulate

the assumed change process and design principles underlying their intervention, and also that they provide access to manuals and protocols to enable reproducibility.

This review demonstrated that on average: nurses were the most frequent educator; most education was delivered post-discharge; lectures and group discussions were the most common delivery formats; most interventions also incorporated some form of follow-up telephone contact and individual counseling; the average number of educational sessions delivered was 6; and, an average of 3.3 topics per intervention were covered, with the most common ones being nutrition, exercise, risk factors, psychosocial well-being, and medications. Few studies provided information regarding education duration, but when reported it varied from 5-10 minutes to a day of education.

An underlying principle of patient education is that knowledge is necessary, but not sufficient to change health behaviours. Patient education involves more than telling people what to do or giving them instructional materials to read; age [65-67], gender [6,68], social and economic [69-71], cognitive factors [72,73], and environmental factors [74] are also important considerations. Studies suggest that younger patients learn more than older ones, and women may be better informed and more active in the decision-making process than men. Furthermore, economically-challenged patients will face additional barriers to learning. Even with good access to providers, patients with cognitive impairments and low literacy will need interventions tailored to their needs [75]. Different factors may affect patients' ability to learn or engage in interventions, and these factors should be addressed in educational programs as well as studies assessing educational interventions.

The findings presented in this review should be interpreted with caution. First, the broad variety of outcomes parameters across many time periods, and the variety of interventions mitigated the use of meta-analysis. Indeed, it was impossible to compare the effects of the interventions based

on their characteristics as they were so poorly described. Second, the majority of the trials utilized self-reported outcome measures, which can be subject to expectation bias. Third, multiple and simultaneous interventions were often implemented, and thus it is difficult to ascertain what components contribute to the outcomes. Fourth, generalizability is limited as only English articles were included. Finally, studies in CR setting offer multiple interventions and so we cannot rule out explanation of effect by these other interventions in uncontrolled studies. Potential biases in the review process were minimal.

4.2 Conclusion

In conclusion, we were unable to identify the nature of effective educational interventions to cardiac patients because it was poorly described in the studies. Yet, this systematic review supports the benefits of educational interventions in CAD, through increases in patients' knowledge, physical activity, nutrition behavior and smoking cessation. It is recommended that future reporting of education interventions should be more explicitly characterized.

4.3 Practice

The weight of evidence suggests the need for comprehensive multidisciplinary education programs offered in-hospital and post-discharge, through individual and group educational activities delivered in discursive rather than didactic fashion [3,5,6,8,64]. Ensuring CAD patient access to comprehensive, evidence-based and manualized education programs may optimize the benefits observed in relation to physical activity, diet and smoking cessation.

References

[1] WHO. Cardiovascular disease fact sheet n 317, September 2011. Available at: <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>

[2] Cardiac Care Network. The Ontario cardiac rehabilitation pilot project: Report and recommendations. 2002.

[3] Stone JA, Arthur HM, Suskin N (Eds.) Canadian guidelines for cardiac rehabilitation and cardiovascular disease prevention: Translating knowledge into action (3rd edition). Winnipeg, MB: Canadian Association of Cardiac Rehabilitation; 2009.

[4] Clark AM, Hartling L, Vandermeer B and McAlister FA. Meta-analysis: Secondary prevention programs for patients with coronary artery disease. Ann Intern Med 2005; 143: 659–72.

[5] Heran BS, Chen JM, Ebrahim S, Moxham T, Oldridge N, Rees K, et al. Exercise-based cardiac rehabilitation for coronary artery disease. Cochrane Database Syst Rev 2011; (7): CD001800.

[6] Kayaniyil S, Winstanley J, Parsons C, Brister S, Oh P, Stewart DG, et al. Degree and correlates of cardiac knowledge and awareness among cardiac impatiens. Patient Educ Counsel 2009; 75: 99-107.

[7] Alm-Roijer C, Fridlund B, Stagmo M, Erhardt L. Knowing your risk factors for coronary heart disease improves adherence to advice on lifestyle changes and medication. J Cardiovasc Nurs 2006; 21: E24-31.

[8] Boyde M, Turner C, Thompson DR, Stewart S. Educational interventions for patients with heart failure: a systematic review of randomized controlled trials. J Cardiovasc Nurs 2011; 26: E27-35.

[9] Brown JP, Clark AM, Dalal H, Weich K, Taylor RS. Patient education in the management of coronary heart disease. Cochrane Database Syst Rev 2011; (12):CD008895.

[10] Koongstvedt P. The managed health care handbook. Gaithersburg: Aspen Publishers, 2001.

[11] Aldcroft SA, Taylor NF, Blackstock FC, O'Halloran PD. Psychoeducational rehabilitation for health behavior change in coronary artery disease: a systematic review of controlled trials. J Cardiopul Rehabil Prev 2011;31:273-81.

[12] Dusseldorp E, van Elderen T, Maes S, Meulman J, Kraaij V. A meta-analysis of psycho-educational programs for coronary heart disease. Health Psychology 1999;18:506-19.

[13] Mullen PD, Mains DA, Velez R. A meta-analysis of controlled trials of cardiac patient education. Patient Educ Counsel 1992;19:143-62.

[14] Schadewaldt V, Schultz T. Nurse-led clinics as an effective service for cardiac patients: results from a systematic review. Int J Evid Based Healthc 2011;9:199-214.

[15] Buckley JP, Furze G, Doherly P, Speck L, Connolly S, Hinton S, et al. BACPR scientific statement: British standards and core components for cardiovascular disease prevention and rehabilitation. Heart 2013;99:1069-71.

[16] Thomas RJ, King M, Lui K, Oldridge N, Pina IL, Spertus J, et al. AACVPR/ ACC/ AHA 2007 performance measures on cardiac rehabilitation for referral to and delivery of cardiac rehabilitation/secondary prevention services. J Am Coll Cardiol 2007;50:1400-33.

[17] Canadian Cardiovascular Society. The Canadian Cardiovascular Society quality indicators e-catalogue: quality indicators for cardiac rehabilitation and secondary prevention. Final Draft v1.0, September 2013. Available at < http://ddqi.ccs.ca/index.php/quality-indicators/cardiac-rehabilitation-secondary-prevention-quality-indicators-chapter>

[18] WIDER Group. WIDER Recommendations to Improve Reporting of the Content of Behaviour Change Interventions. 2008. Available at <http://interventiondesign.co.uk/?page_id=9>

[19] Verril D, Graham H, Vitcenda M, Peno-Green L, Kramer V, Corbisiero T. Measuring behavioral outcomes in cardiopulmonary rehabilitation: an AACVPR statement. J Cardiopulm Rehabil Prev 2009;29(3):193-203.

[20] Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol Community Health 1998;52:377-84.

[21] Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, Teutsch SM, et al. Current methods of the US Preventive Services Task Force: a review of the process. Am J Prev Med 2001;20:21-35.

[22] Buckley T, McKinley S, Gallagher R, Dracup K, Moser DK, Aitken LM. The effect of education and counselling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. Eur J Cardiovasc Nurs 2007;6:105–11.

[23] Carlson JJ, Norman GJ, Feltz DL, Franklin BA, Johnson JA, Locke SK. Self-efficacy, psychosocial factors, and exercise behavior in traditional versus modified cardiac rehabilitation. J Cardipulm Rehabil 2001;21:363–73.

[24] Chan SS, Leung DY, Wong DC, Lau CP, Wong VT, Lam TH. A randomized controlled trial of stage-matched intervention for smoking cessation in cardiac-outpatients. Addiction 2012;107:829-37.

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

[26] Eckman MH, Wise R, Leonard AC, Dixon E, Burrows C, Khan F, et al. Impact of health literacy on outcomes and effectiveness of an educational intervention in patients with chronic diseases. Patient Educ Couns 2012;87:143–51.

[27] Giannuzzi P, Temporelli PL, Marchioli R, Maggioni AP, Balestroni G, Ceci V, et al. Global secondary prevention strategies to limit event recurrence after myocardial infarction: results of the GOSPEL study, a multicenter, randomized controlled trial from the Italian Cardiac Rehabilitation Network. Arch Intern Med 2008;168:2194-204.

[28] Heidal KB, Lewis NM, Evans SM, Boeckner L. Nutrition education intervention increases total -3 fatty acid intakes in heart patients living in the Midwest. Nutrition Research 2007;27:33–7.

[29] Horlick L, Cameron R, Firor W, Bhalerao U, Baltzan R. The effects of education and group discussion in the post myocardial infarction patient. J Psychosom Res 1984;28:485-92.

[30] Jeong HS, Chae JS, Moon JS, Yoo YS. An individualized teaching program for atherosclerotic risk factor reduction in patients with myocardial infarction. *Yonsei Medical Journal* 2002; 43:93–100.

[31] Jiang X, Sit JW, Wong TK. A nurse-led cardiac rehabilitation programme improves health behaviours and cardiac physiological risk parameters: Evidence from Chengdu, China. J Clin Nurs 2007;16:1886–97.

[32] Kummel M, Vahlberg T, Ojanlatva A, Karki R, Mattila T, Kivela SL. Effects of an intervention on health behaviors of older coronary artery bypass (CAB) patients. Arch Gerontol Geriatr 2008;46:227–44.

[33] Leslie WS, Hankey CR, Matthews D, Currall JEP, Lean MEJ. A transferable programme of nutritional counselling for rehabilitation following myocardial infarction: a randomised controlled study. Eur J Clin Nutr 2004;58:778–86.

[34] Lidell E, Fridlund B. Long-term effects of a comprehensive rehabilitation programme after myocardial infarction. Scand J Caring Sci 1996;10:67–74.

[35] Lindsay S, Smith S, Bellaby P, Baker R. The health impact of an online heart disease support group: a comparison of moderated versus unmoderated support. Health Education Research 2009; 24:646–54.

[36] Mayou RA, Thompson DR, Clements A, Davies CH, Goodwin SJ, Normington K, et al. Guideline-based early rehabilitation after myocardial infarction: A pragmatic randomised controlled trial. J Psychosom Res 2002;52:89–95.

[37] McKinley S, Dracup K, Moser DK, Riegel B, Doering LV, Meischke H, et al. The effect of a short one-on-one nursing intervention on knowledge, attitudes and beliefs related to response to acute coronary syndrome in people with coronary heart disease: a randomized controlled trial. Int J Nurs Stud 2009;46:1037–46.

[38] Moore SM, Dolansky MA. Randomized trial of a home recovery intervention following coronary artery bypass surgery. Research in Nursing & Health 2001;24:93–104.

[39] Oldenburg B, Martin A, Greenwood J, Bernstein L, Allan R. A controlled trial of a behavioral and educational intervention following coronary artery bypass surgery. J Cardiopulm Rehabil 1995;15:39–46.

[40] Otterstad JE. Influence on lifestyle measures and five-year coronary risk by a comprehensive lifestyle intervention programme in patients with coronary heart disease. Eur J Cardiovasc Prev Rehabil 2003;10:429–37.

[41] Smith PM, Burgess E. Smoking cessation initiated during hospital stay for patients with coronary artery disease: a randomized controlled trial. CMAJ 2009;180:1297-303.

[42] van Elderen-van Kemenade T, Maes S, van den Broek Y. Effects of a health education programme with telephone follow-up during cardiac rehabilitation. Br J Clin Psychol 1994;33:367-78.

[43] Van Elderen TM, Maes S, Seegers G, Kragten H, Relik-Can Wely L. Effects of a post-hospitalization group health education programme for patients with coronary heart disease. Psychology & Health 1994;9:317–30.

[44] Wolkanin-Bartnik J, Pogorzelska H, Bartnik A. Patient education and quality of home-based rehabilitation in patients older than 60 years after acute myocardial infarction. J Cardiopulm Rehabil Prev 2011;31:249–53.

[45] Froger-Bompas C, Laviolle B, Guillo P, Letellier C, Ligier K, Daubert JC, et al. Sustained positive impact of a coronary rehabilitation programme on adherence to dietary recommendations. Arch Cardiovasc Dis 2009;102:97–104.

[46] Linde BJ, Janz NM. Effect of a teaching program on knowledge and compliance of cardiac patients. Nursing Research 1979;28:282–6.

[47] Oliveira J, Ribeiro F, Gomes H. Effects of a home-based cardiac rehabilitation program on the physical activity levels of patients with coronary artery disease. J Cardiopulm Rehabil Prev 2008;28:392–6.

[48] Song R, Lee H. Managing health habits for myocardial infarction (MI) patients. Int J Nurs Stud 2001;38:375–80.

[49] Verges BL, Patois-Verges B, Cohen M, Casillas JM. (1998). Comprehensive cardiac rehabilitation improves the control of dyslipidemia in secondary prevention. J Cardiopulm Rehabil 1998;18:408–15.

[50] Yoshida T, Kohzuki M, Yoshida K, Hiwatari M, Kamimoto M, Yamamoto C, et al. Physical and psychological improvements after phase II cardiac rehabilitation in patients with myocardial infarction. Nursing & Health Sciences 1999;1:163–70.

[51] Fletcher GF. Rehabilitation after coronary angioplasty--is it effective? Arch Phys Med Rehabil 1986; 67:517–9.

[52] Frame CJ, Green CG, Herr DG, Taylor ML. A 2-year stage of change evaluation of dietary fat and fruit and vegetable intake behaviors of cardiac rehabilitation patients. Am J Health Prom 2003;17:361–8.

[53] Pelletier S, Kundrat S, Hasler CM. Effects of a functional foods nutrition education program with cardiac rehabilitation patients. J Cardiopulm Rehabil 2003;23:334–40.

[54] Jensen L. Self-administered cardiac medication program evaluation. Can J Cardiovasc Nurs 2003;13:35–44.

[55] Lisspers J, Hofman-Bang C, Nordlander R, Ryden L, Sundin O, Ohman A, et al. Multifactorial evaluation of a program for lifestyle behavior change in rehabilitation and secondary prevention of coronary artery disease. Scand Cardiovasc J 1999;33:9–16.

[56] Palomaki A, Miilunpalo S, Holm P, Makinen E, Malminiem K. Effects of preventive group education on the resistance of LDL against oxidation and risk factors for coronary heart disease in bypass surgery patients. Ann Med 2002;34:272–83.

[57] Timlin MT, Shores KV, Reicks M. Behavior change outcomes in an outpatient cardiac rehabilitation program. J Am Diet Assoc 2002;102:664–71.

[58] Bellman C, Hambraeus K, Lindbäck J, Lindahl B. Achievement of secondary preventive goals after acute myocardial infarction: a comparison between participants and nonparticipants in a routine patient education program in Sweden. J Cardiovasc Nurs 2009;24:362–8.

[59] Dracup K, Meleis AI, Clark S, Clyburn A, Shields L, Staley M. Group counseling in cardiac rehabilitation: effect on patient compliance. Patient Educ Couns 1984;6:169–77.

[60] Irmak Z, Fesci H. Effects of nurse-managed secondary prevention program on lifestyle and risk factors of patients who had experienced myocardial infarction. Appl Nurs Res 2010;23:147–52.

[61] Marshall J, Penckofer S, Llewellyn J. Structured postoperative teaching and knowledge and compliance of patients who had coronary artery bypass surgery. Heart Lung 1986;15:76–82.

[62] Van Elderen T, Dusseldorp E. Lifestyle effects of group health education for patients with coronary heart disease. Psychology & Health 2001;16:327–41.

[63] Davidson P, Digiacomo M, Zecchin R, Clarke M, Paul G, Lamb K, et al. A cardiac rehabilitation program to improve psychosocial outcomes of women with heart disease. J Womens Health 2008;17:123–34.

[64] British Association for Cardiovascular Prevention and Rehabilitation (BACPR). The BACPR standards and core components for cardiovascular disease prevention and rehabilitation. 2nd edition. Available at: www.bacpr.com/resources/15E_BACPR_Standards_FINAL.pdf

[65] Brown SA. Meta-analysis of diabetes patient education research: variations in intervention, effects across studies. Res Nurs Health 1992;15:409-19.

[66] Lane DS, Evans D. (1979). Measures and methods in evaluating patient education programs for chronic illness. Medical Care 1979;17:30-42.

[67] Kirkland SA, MacLean DR, Langille DB, Joffres MR, MacPherson KM, Andreou P. Knowledge and awareness of risk factors for cardiovascular disease among Canadians 55 to 74 years of age: results from the Canadian Heart Health Surveys, 1986-1992. CMAJ 1999; 161:S10-4.

[68] Stewart DE, Abbey SE, Shnek ZM, Irvine J, Grace SL. Gender differences in health information needs and decisional preferences in patients recovering from an acute ischemic coronary event. Psychosom Med 2004;66:42-8.

[69] Sui X, Gheorghiade M, Zannad F, Young JB, Ahmed A. A propensity-matched study of the association of education and outcomes in chronic heart failure. Int J Cardiol 2008;129:93-9.

[70] Rathore SS, Masoudi FA, Wang Y, Curtis JP, Foody JM, Havranek, FP, et al. Socioeconomic status, treatment, and outcomes among elderly patients hospitalized with heart failure: findings from the National Heart Failure Project. Am Heart J 2006;152:371–8.

[71] Loucks EB, Lynch JW, Pilote L, Fuhrer R, Almeda ND, Richard H, et al. (2009). Life-course socioeconomic position and incidence of coronary heart disease – The Framingham Offspring Study. Am J Epidemiol 2009;169:819-26.

[72] Schwarz B, Schoberberger R, Rieder A, Kunze M. Factors delaying treatment of acute myocardial infarction. Eur Heart J 1994;15:1595-8.

[73] Dracup K, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. Heart Lung 1997;26:253-62.

[74] Stern PC. New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. J Soc Issues 2000;56:407-24.

[75] Berckman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med 2011;155: 97-107.

[76] Michie S, Fixsen D, Grimshaw JM, Eccles MP. Specifying and reporting complex behaviour change interventions: the need for a scientific method. Implement Sci 2009;4:40-6.

Appendix 1 – Search Strategy

Concept	Search Terms - MEDLINE	Search Terms - EMBASE
1. Condition Aspect	Coronary disease	Coronary artery disease
1.1 Cardiac Aspect	Heart disease	Heart disease
1.2 Rehabilitation Aspect	Cardiovascular disease	Cardiovascular disease
	Coronary artery disease	Heart infarction
	Myocardial infarction	Myocardial infarction
	Rehabilitation	Rehabilitation
	Physical therapy modalities	Rehabilitation research/ medicine/patient
	Rehabilitation Centers	Rehabilitation Centers
	Physical medicine	Physical Medicine
	Cardiac Rehabilitation	Cardiac Rehabilitation
2. Education Aspects	Health education	Health education
	Educational status	Educational status
	Education	Education
	Education session/program/ support/target/patient/intervention	Education session/program/ support/target/patient/intervention
	Patient education as topic	Teaching
	Health literacy	Nurses role
	Teaching session	Nurse-patient relations
	Nurse patient relationship	
3. Outcomes	Health behavior	Health behavior
	Patient knowledge	Patient knowledge
	Self care	Self care
	Disease management	Disease management
	Treatment outcome	Treatment outcome
	Life style	Lifestyle
	Self-efficacy	Self concept
	Attitude to health	Attitude to health
	Outcome assessment	Outcome assessment
	Effect behavior change	Effect behavior change
	Behavior modification	Behavior modification
	Behavior change	Behavior change
	Lifestyle modification	Lifestyle modification
	Diet	Diet
	Blood glucose	Glucose blood level
	Sodium dietary	Sodium intake
	Smoking	Smoking
	Alcohol drinking	Drinking behavior
	Exercise	Exercise
	Physical fitness	Fitness
	Vital signs	Vital sign
	Body weights and measures	Morphometrics
	Health attitudes, practice	Attitude
	Lipids	Lipid blood level
	Adherence	Adherence
	Medication	Medication
	Psychosocial	Psychosocial
	Stress	Stress

Figure 1 – Flow Diagram of Study Selection Process

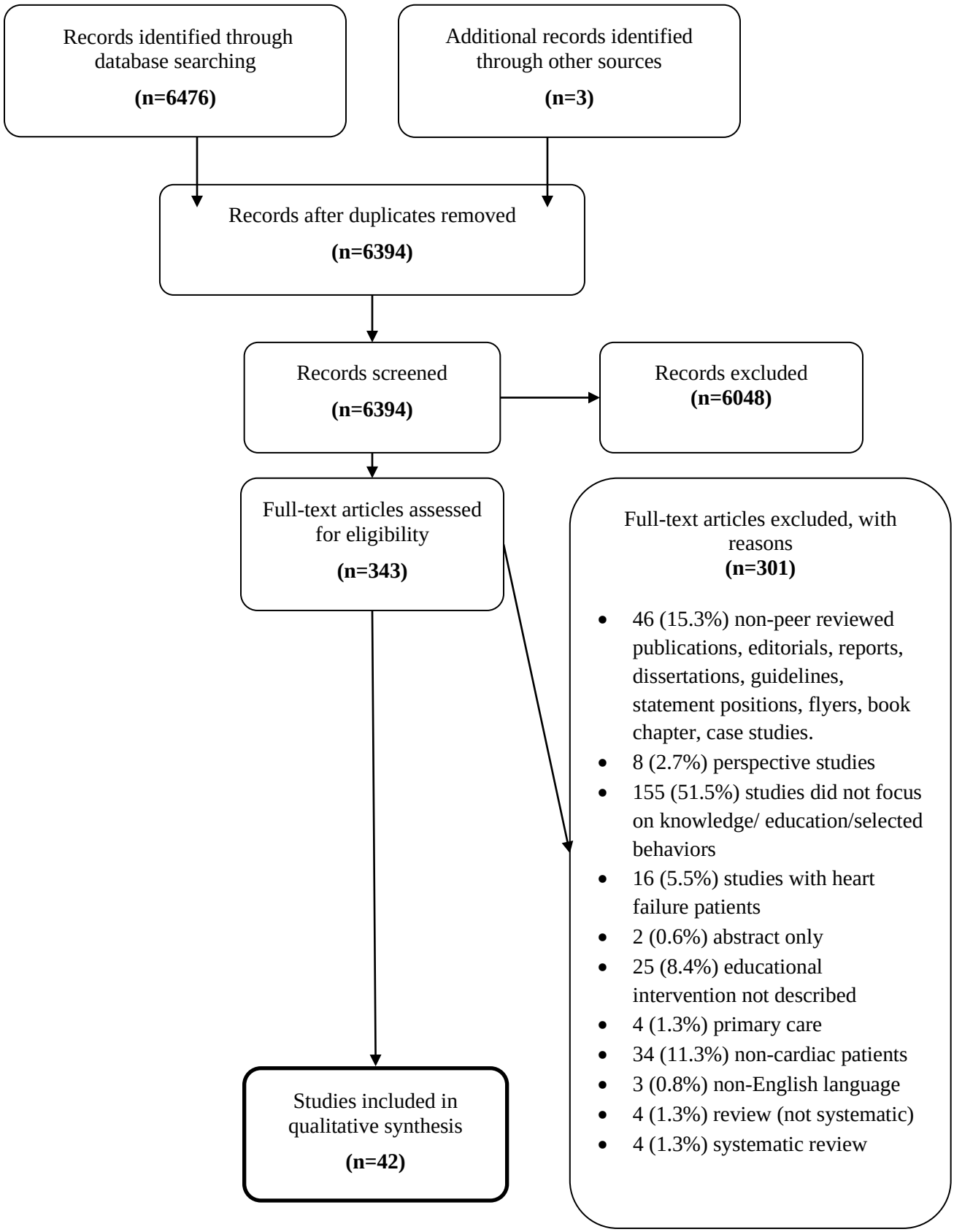

Table 1 – Characteristics of the included studies describing the relationship between education knowledge and behavior change, N=42

Study	Study Design Centers Sample Size	Quality Assessment Score (Classification)*	Primary outcome	Follow up (months)	Knowledge Assessment	Results
Bellman [58] 2009 Sweden	Cohort Retrospective 32 centers 2822 cardiac patients	16 (Good)	Physical activity Smoking	12	No	Physical activity habits: no statistical difference between groups (p=.052) at 1-year follow-up. Smoking cessation: among the patients who were smokers at admission for their AMI, 68.8% of the participants in the educational program had managed to stop smoking, compared with 51.9% of the non-participants (p<.001), at the 1-year follow-up.
Buckley [22] 2007 Australia	RCT 1 center 200 people with CHD	19 (Good)	Response to symptoms	12	Response Questionnaire [64], adapted for this study	Response to symptoms: the intervention had no effect on participants' response to AMI symptoms Knowledge: both groups increased the knowledge scores. The INT had higher scores than CON (p<.001).
Carlson [23] 2001 USA	RCT 1 center 80 CR patients	19 (Good)	Physical activity Social support	6	No	Physical activity habits: patients in INT demonstrated higher rates of exercise (p=.005) compared to CON. Social support: both groups had a high level of social support; no statistical differences.
Chan [24] 2012 China	RCT 10 centers 1860 cardiac outpatients	21 (Good)	Smoking	12	No	Smoking cessation: INT had higher smoking cessation rates (p<.002) compared to CON.
Cordasco [25] 2009 USA	RCT 1 center 210 cardiac inpatients	20 (Good)	Medication adherence	1	Medication Knowledge and Compliance Scale [65], adapted for this study	Medication adherence: no statistical differences found between groups; however INT self-reported their medication more accurately. Knowledge: no statistical differences between groups.
Davidson [63] 2008 Australia	Mixed-methods 2 centers 54 cardiac women	14 (Good)	Depression and anxiety Stress	6	No	Depression, anxiety and stress: no statistical differences between groups.
Dracup [59] 1984 USA	Quasi-experimental 4 centers 58 CR outpatients	7 (Fair)	Physical activity Smoking	6	No	Physical activity habits: no statistical differences between groups (p=.08). Smoking cessation: no statistical differences between groups.
Eckman [26] 2012	RCT 3 centers	17 (Fair)	Physical activity Dietary habits	6	A 12-item questionnaire	Physical activity habits: the INT had a significant improvement (p=.05).

USA	170 cardiac patients		Smoking		developed and pilot tested for this study	Dietary habits: significant improvement in diet, in both groups (p<.001). Smoking cessation: significant improvement in both groups (p<.001) Knowledge: significantly higher in INT (p<.001).
Fletcher [51] 1986 USA	Cross-sectional, longitudinal 1 center 30 cardiac patients	4 (Poor)	Physical activity Dietary habits Smoking	6	No	Physical activity habits: 16 of 30 patients started exercising regularly. Dietary habits: 18 of 30 patients adhere to a fat-controlled diet. Smoking cessation: 18 of 30 patients stopped smoking.
Frame [52] 2003 USA	Cross-sectional, longitudinal 1 center 118 CR patients	10 (Fair)	Dietary habits	24	No	Dietary habits: the reduction of dietary fat intake was sustained by patients 2 years after CR; and, little progress was observed in the increase intake of fruits and vegetables.
Froger-Bompas [45] 2009 France	Cross-sectional 1 center 136 cardiac patients	11(Fair)	Dietary habits	36	No	Dietary habits: intervention patients had significantly higher consumption of fruits and vegetables (p<.001), global cardiovascular protective diet score (p<.001) and lower consumption of saturated fatty acids (p<.001).
Giannuzzi [27] 2008 Italy	RCT 78 centers 3241 CR patients	20 (Good)	Physical activity Dietary habits Smoking Stress	12	No	Physical activity habits: significant differences between groups (p=.01) and time effect (p<.001). Dietary habits: significant differences between groups (p<.001) and time effect (p<.001). Smoking cessation: at 6 months after intervention, patients were more likely to stop smoking than control (p=.02). Stress: significant differences between groups (p<.001) and time effect (p<.001).
Heidal [28] 2007 USA	RCT 1 center 36 cardiac patients	12 (Fair)	Dietary habits	2	No	Dietary habits: both groups increased n-3 FA intakes from baseline to 1 month (p<.001) and from baseline to 2 months (p<.014). No significant differences between groups after 2 months.
Horlick [29] 1984 Canada	RCT 3 centers 116 MI patients	16 (Fair)	Physical activity Smoking	6	No	Physical activity habits: no statistical differences between groups. Smoking cessation: no statistical differences between groups.
Irmak [60] 2010 Turkey	Quasi-experimental 1 center	12 (Fair)	Physical activity Dietary habits Smoking	3.5	No	Physical activity habits: the proportion of patients exercising regularly increased significantly (p<.001).

	36 MI patients		Medication adherence			Dietary habits: the proportion of patients who were careful about their nutritional intake before and after the program increased significantly (p<.001). Smoking cessation: the proportion of smokers decreased significantly (p<.001). Medication adherence: no statistical differences.
Jensen [54] 2003 Canada	Cohort 3 centers 350 cardiac inpatients	12 (Fair)	Medication adherence	4	Medication Knowledge Questionnaire, developed and validated for this study	Medication adherence: no statistical differences. Knowledge: significantly increased from admission to 16 weeks after discharge (p<.001). Medication knowledge scores were found to be significantly higher for subjects in the INT compared to CON (p=.003).
Jeong [30] 2002 Korea	RCT 3 centers 45 MI patients	13 (Fair)	Physical activity Smoking	12	No	Physical activity habits: the number of subjects exercising at the INT was significantly higher (p=.001) compared to CON. Smoking cessation: after the education, the number of non-smokers had significantly increased, in both groups (INT p=.014, and CON p=.001). The number of non-smokers was significantly higher in the INT (p=.019).
Jiang [31] 2007 China	RCT 3 centers 167 CHD patients	18 (Good)	Physical activity Dietary habits Smoking Medication adherence	6	No	Physical activity habits: compared with baseline, the INT demonstrated a significantly greater increase in the mean scores of walking performance, both at 3 months (p=.001) and 6 months (p=.002), compared to CON. Dietary habits: compared with baseline, the INT demonstrated a significantly greater increase in the mean scores of diet adherence, both at 3 months (p=.001) and 6 months (p=.002), compared to CON. Smoking cessation: no significant differences between the percentages of quitters in the INT and CON. Medication adherence: significant differences were found only at 3 months between groups (p=.029). The mean scores for medication adherence of both groups were decreased, but to a significantly lesser extent in INT.
Kummel [32] 2008	RCT 1 center	15 (Fair)	Physical activity Dietary habits	12	No	Physical activity habits: the reported frequency of PE increased more among men in INT than in CON

Finland	117 CABG patients					(p<.001). A similar result was found, when men and women were analyzed together. At 3 months following operation, the change in PE was more favourable among women in CON than women in INT. At 6 months, the change was more favourable in INT, whereas at 12 months, women in CON exercise even more regularly than women in INT. These differences were significant between groups (p=.024). Dietary habits: in the 3-month follow-up, men in CON reported decreased frequency of eating fresh greens and vegetables, but they increased it by 12-month measurement. At 6 months, the frequency of eating vegetables increased among men in INT. Differences between groups were significant (p<.001).
Leslie [33] 2004 UK	RCT 2 centers 85 CR patients	16 (Fair)	Dietary habits	12	No	Dietary habits: differences between groups were significant at 3 months on portions of fruits and vegetables (p=.006), and macronutrients composition (p<.001). Differences in food intakes between groups observed at 3 months were no longer evident at 12 months.
Lidell [34] 1996 Sweden	RCT 1 center 97 MI patients	18 (Good)	Physical activity Dietary habits	60	The Cardiac Health Knowledge Questionnaire [66]	Physical activity habits: differences between groups favouring the INT after 1 year (p<.001) and after 5 years (p<.001). Dietary habits: differences between groups favouring the INT after 5 years (p<.04). Knowledge: INT group presented statistical higher knowledge compared to CON 5 years after MI (misconceptions; p<.04 and basic cardiac knowledge; p<.005).
Linde [46] 1979 USA	Quasi-experimental 1 center 48 cardiac patients	9 (Fair)	Dietary habits	4	A 10-item questionnaire developed for this study	Dietary habits: significant differences were found pre and post education in both groups (p=.01). Knowledge: general cardiac knowledge increased significantly (p=.0038). No significant differences observed in knowledge on medication.
Lindsay [35] 2009 UK	RCT 1 center 108 cardiac patients	11 (Fair)	Physical activity Dietary habits Smoking	12	No	Physical activity habits: patients in INT spent significantly more days per week exercising CON (p<.001). The CON also experienced a significant reduction in the number of days per week spent in

						moderate exercise comparing 6 and 9 months (p=.03). Dietary habits: no significant changes between groups. Smoking cessation: no significant changes between groups.
Lisspers [55] 1999 Sweden	Cohort 1 center 292 cardiac patients	12 (Fair)	Physical activity Dietary habits Smoking	12	Tool developed for this study	Physical activity habits: subjects exercised at the 12-months follow-up on average more than 4 times per week with a low to high intensity, which was a significant increase compared to baseline (p<.001). Dietary habits: significant changes in diet (healthy habits) were observed after 12 months (p<.0001). Smoking cessation: the number of nosmokers decreased significantly (p<.05) at the 12-months follow-up. Knowledge: knowledge about healthy diet increased at 12 months (p<.0001).
Marshall [61] 1986 USA	Quasi-experimental 1 center 60 CABG patients	6 (Poor)	Physical activity Smoking	6	A tool based on the format devise by Rahe et al [67]	Physical activity habits: INT patients had better compliance to physical activity compared to CON (p<.05). Smoking cessation: INT patients had better compliance to smoking cessation compared to CON (p<.05). Knowledge: a significant difference of knowledge was found between groups (p<.05) and time periods (p<.01). Knowledge was found to have increased significantly (p<.01) in all subtests.
Mayou [36] 2002 UK	RCT 1 center 114 MI patients	17 (Fair)	Physical activity Dietary habits	12	No	Physical activity habits: at 3 months, INT patients had significantly better activity levels compared to CON (p=.028). Dietary habits: at 1 month, INT patients were significantly more willing to have tried to change their diet compared to CON (p=.017).
McKinley [37] 2009 USA	RCT 6 centers 3519 cardiac patients	21 (Good)	Response to symptoms Depression and anxiety	12	The ACS Response Index, adapted from [68]	Response to symptoms: increased significantly (p=.0005) in the INT at 3 months and remained higher than CON at 12 months. Depression and anxiety: CON were less likely to have anxiety symptoms compared to INT (p=.029). There was no other statistically significant difference between groups on patients in the 12-

						month follow-up. Knowledge: knowledge increased significantly (p=.0005) in the INT at 3 months and remained higher than CON at 12 months.
Moore [38] 2001 USA	RCT 1 center 180 CABG patients	18 (Good)	Distress	1	No	Distress: no differences between groups over time.
Oldenburg [39] 1995 Australia	RCT 1 center 86 CABG patients	17 (Fair)	Physical activity Dietary habits Smoking	12	No	Physical activity habits: both groups level of activity generally changed over time (p<.001). Activity increased sharply from baseline to 4 months to a level that patients maintained over the rest of the follow-up period. Dietary habits: both groups presented a reduction in self-reported dietary fat intake over time (p<.001). However, no differences between groups were identified. Smoking cessation: rates for smoking differed at 4 months and at 12 months. However, these differences were not significant.
Oliveira [47] 2008 Portugal	Cross-sectional 1 center 30 MI patients	10 (Fair)	Physical activity	3	No	Physical activity habits: INT significantly increased daily PA index (p<.05) and time spent in moderate-intensity PA (p<.05). No changes were observed in CON.
Otterstad [40] 2003 UK	RCT 3 centers 191 cardiac patients	21 (Good)	Physical activity Dietary habits Smoking	24	No	Physical activity habits: there was no difference in the amount of exercise in the 2 groups at baseline. At 6 months, 93% of INT and 72% of CON exercised for more than 1 hour per week (p<.001). At 2 years, 7% of INT and 22% of CON had no exercise at all (p<.01). Dietary habits: after 6 months, INT patients had a significantly lower intake of saturated and monounsaturated fat, sugar and cholesterol combined with a higher intake of fibre when compared with CON (p<.001 for all). These differences tended to diminish after 2 years, but were still highly significant in favour to INT (p<.001 for fat; p<.01 for sugar and p<.001 for cholesterol. Smoking cessation: at baseline, 50% of patients in

						INT and 42% in CON were smokers. At 6 months, 55% of smokers in INT and 33% in CON had stopped smoking (p<.05). At 2 years, 45% in INT and 23% in CON were non-smokers (p<.05).
Palomaki [56] 2002 Finland	Cohort 3 centers 72 cardiac patients	16 (Good)	Physical activity Dietary habits	12	No	Physical activity habits: the weekly leisure time increased significantly during 8 months in the INT (p=.002) without any change in the CON. At 12 months, the physical activity remained at a higher level in the INT, compared to baseline (p=.017). The total amount of physical activity in leisure time was significantly higher at 8 months compared to baseline (p=.046) in the INT. In the CON this variable remained unchanged. Dietary habits: did not change significantly during the 1-yeaqr follow-up.
Pelletier [53] 2003 USA	Cross-sectional 2 centers 69 CR patients	9 (Fair)	Dietary habits	2	No	Dietary habits: all 4 functional foods consumption increased significantly from survey 1 and 2 (p<.001).
Smith [41] 2009 Canada	RCT 1 center 276 cardiac patients	22 (Good)	Smoking	12	No	Smoking cessation: more patients at INT than in CON reported not smoking at 3 months (p=.009), 6 months (p=.003), and 12 months (p=.007). The odds of quitting were 2 times greater for patients who received INT compared to CON in all endpoints. More patients at INT than in CON were confirmed nonsmokers at 12 months (p=.002).
Song [48] 2001 South Korea	Cross-sectional 1 center 86 MI outpatients	12 (Fair)	Physical activity Dietary habits	2	No	Physical activity habits: after the INT, participants tend to significantly be more active than before (p<.001). Dietary habits: after the INT, participants tend to significantly eat better (p=.025) than before.
Timlin [57] 2002 USA	Cohort study 2 centers 104 cardiac patients	16 (Good)	Dietary habits	3	No	Dietary habits: significantly improved in both groups from entry to discharge from the program (p=.0001), indicating overall dietary changes, but there was no effect related to group by time.
Van Elderen [62] 2001 The Netherlands	Quasi-experimental 3 centers 339 CHD patients	15 (Good)	Physical activity Dietary habits Smoking	12	No	Physical activity habits: at the first follow-up, patients in INT had a higher risk of maintaining a sedentary lifestyle than patients in CON. Dietary habits: participants in INT decrease the odds of maintaining unhealthy eating habits by a factor 0.30 than patients in CON.

						Smoking cessation: at the first follow-up treatment was not a significant predictor for smoking cessation. At the second follow-up, patients in INT1 had a higher risk of continuing smoking than patients in CON.
Van Elderen-van [42] 1994 The Netherlands	RCT 1 center 30 MI patients	11 (Fair)	Physical activity Dietary habits Smoking Depression and anxiety	12	No	Physical activity habits: in the short term (8 weeks after discharge; $p<.05$) the INT resulted in an increase in physical exercise. Dietary habits: in the short term (8 weeks after discharge; $p<.001$) and long term (1-year after discharge; $p<.05$) the INT resulted in an increase in healthy eating habits. Smoking cessation: no statistical differences were found. Depression and anxiety: no statistical differences were found.
Van Elderen [43] 1994 The Netherlands	RCT 1 center 217 CHD patients	15 (Fair)	Physical activity Dietary habits Smoking	12	The Knowledge Questionnaire for Heart Patients [69]	Physical activity habits: no statistical differences were found between patients in CON and INT in both short and long term. Dietary habits: a significantly higher number of patients in INT compared to CON decreased their salt intake in the short-term ($p=.009$). In the long-term patients in INT maintained a tendency to consume less salt than CON ($p=.107$). In the short-term, there is a tendency of INT patients to consume less fat than CON ($p=.08$); however, this did not persist in the long term. Smoking cessation: the number of smokers who quit smoking was significantly higher in INT than in CON, in the short-term ($p=.007$) and in the long-term ($p=.011$). Knowledge: Patients in INT showed a higher knowledge than patients in CON in the short-term (4- month assessment) ($p=.005$). In the long term (1-year assessment) this difference was not maintained ($p=.0704$).
Verges [49] 1998 France	Quasi-Experimental 1 center 52 CHD men	10 (Fair)	Dietary habits Smoking	2	A 16-item questionnaire developed for this study	Dietary habits: consumption of fat and fried food reduced in 82% and 52%, respectively, in the INT. Smoking cessation: 12 patients in INT and 11 in CON quit smoking.

						Knowledge: pre and post analysis showed a significant higher knowledge on the fat-content of the nutriments in 82% of the INT.
Wolkanin-Bartnik [44] 2011 UK	RCT 1 center 115 cardiac patients	11 (Fair)	Physical activity	12	No	Physical activity habits: at baseline, self-reported physical activity did not differ significantly between CON and INT. At 3 months, it was observed a significantly increase in INT ($p<.001$). The improvement is leisure PA was maintained for the 12-month period for the INT.
Yoshida [50] 1999 Japan	Quasi-Experimental 1 center 63 MI patients	11 (Fair)	Physical activity Depression and anxiety	6	No	Physical activity habits: there was no significant difference in the frequency of exercise between groups before the onset of MI. At the 6-month follow-up, the percentage of patients was: in the INT 74% had good physical activity, 4% had low, and 22% had very low, and in the CON, 31%, 24% and 45%, respectively (no p values reported). Depression status: before entry the program, the depression score in INT was significantly higher than CON ($p=.02$). At the 6-month follow-up, the score significantly decreased in INT ($p=.02$). In contrast, the depression score increased numerically in the CON, but it was not significant. At 6-months, there were no significant differences in SRQ-D score between the 2 groups ($p=.75$). Anxiety status: in INT, the anxiety scores improved significantly after the completion of the CR ($p=.04$). In the CON scores showed no change at the 6-month follow-up. However, there were no significant differences between groups ($p=.59$).

RCT: randomized controlled trial; CABG: coronary artery bypass grafting; CHD: coronary heart disease; MI: myocardial infarction; CR: cardiac rehabilitation; INT: intervention or intervention group; CON: control or control group; PA: physical activity; MI: myocardial infarction.

* For RCT scores ranged from 0-25 (Poor: 0-8; Fair: 9-17; Good: 18-25). Other types of study, scores ranged from 0-18 (Poor: 0-6; Fair: 7-12; Good: 13-18).

Table 2 - Characteristics of educational interventions (n=42)

Study	Health provider delivering the intervention	Setting	Delivery Format	Intensity - Contact time - Frequency of each educational session	Mean number of educational sessions*	Education Content
Bellman [58] 2009 Sweden	Multidisciplinary team	After D/C	Lectures Group discussions Q and A	NR Weekly	5	Not described
Buckley [22] 2007 Australia	Nurse	After D/C	Individual counselling Follow-up telephone contacts	45 minutes Weekly	5	Psychosocial education Symptoms
Carlson [23] 2001 USA	Multidisciplinary team	After D/C, CR	Group discussions Individual counselling Educational videos	NR Weekly	4	Behavior change strategies Exercise Medications Nutrition Psychosocial education Risk factors
Chan [24] 2011 China	Nurse	After D/C	Individual counselling Follow-up telephone contacts	1 hour Baseline, 1 week and 1 month	3	Smoking cessation counselling
Cordasco [25] 2009 USA	Nurse	At D/C	Medication education kit Verbal orientation	NR NA	1	Medications
Davidson [63] 2008 Australia	Nurse	CR	Group discussions	1 hour Weekly	6	Behavior change strategies
Dracup [59] 1984 USA	Not provided	After D/C	Group discussions	90 minutes Weekly	10	Psychosocial education
Eckman [26] 2012 USA	Not provided	Ambulatory patients	Teaching booklet Educational videos	NR NA	NA	Exercise Management of CAD Medications Nutrition Risk factors Shared decision making
Fletcher [51] 1986 USA	Multidisciplinary team	Before D/C	Individual counselling Teaching booklet Educational videos Heart models	NR NR	NR	Exercise Nutrition Risk factors Surgical procedures Symptoms

Frame [52] 2003 USA	Dietician	CR	Group discussions Q and A Individual counselling	1 hour Weekly	12	Nutrition
Froger-Bompas [45] 2009 France	Dietician	Before D/C, After D/C	Lectures	NR 2x/week	6	Nutrition
Giannuzzi [27] 2008 Italy	Cardiologist	CR	Individual counselling Teaching booklet	NR Monthly and every 6 months	12	Exercise Nutrition Psychosocial education Risk factors Smoking cessation
Heidal [28] 2007 USA	Dietician	Ambulatory patients	Lectures Teaching booklet (cookbook) Follow-up telephone contacts Individual counselling	1 hour Weekly	5	Nutrition
Horlick [29] 1984 Canada	Multidisciplinary team	Before D/C, After D/C	Lectures Group discussions	30-45 minutes Weekly	6	Nutrition Physiology of the heart Psychosocial education Risk factors
Irmak [60] 2010 Turkey	Nurse	Before D/C, After D/C	Group discussions Home visits	30-40 minutes Monthly	5	Behavior change strategies Exercise Medications Nutrition Risk factors Smoking cessation Symptoms
Jensen [54] 2003 Canada	Nurse	Before D/C	Medication education kit Verbal orientation	NR Daily	2	Medications
Jeong [30] 2002 Korea	Not provided	Before D/C	Verbal orientation Teaching booklet Follow-up telephone contacts	20-25 min 3rd and 5th days hospitalization	3	Exercise Medications Nature of the disease Nutrition Risk factors
Jiang [31] 2007 China	Nurse	Before D/C, After D/C	Individual counselling Teaching booklet Home visits	NR Weekly	12	Behavior change strategies Exercise Medications Nutrition Psychosocial education

						Symptoms Smoking cessation
Kummel [32] 2008 Finland	Nurse	Before D/C, After D/C	Lectures Group discussions	NR Every 2 months	5	Surgical procedures
Leslie [33] 2004 UK	Dietician	CR	Lectures Teaching booklet Individual counselling	1 hour Every 2 weeks	4	Nutrition
Lidell [34] 1996 Sweden	Multidisciplinary team	Before D/C, After D/C	Individual counselling Follow-up telephone contacts	2 hours Weekly	24	Psychosocial education Risk factors Symptoms
Linde [46] 1979 USA	Not provided	Before D/C, After D/C	Individual counselling Teaching booklets Medication education cards Illustration models	20-25 min NR	6	Exercise Medications Nature of the disease Nutrition Surgical procedures
Lindsay [35] 2009 UK	Not provided	Ambulatory patients	Computer-based: Individual counselling Group discussions Verbal orientation	NR NR	NR	Exercise Management of CAD Nutrition Smoking cessation
Lisspers [55] 1999 Sweden	Nurse	Before D/C, After D/C	Lectures Group discussions Individual counselling Follow-up telephone contacts	NR NR	NR	Behavior change strategies Exercise Nutrition Psychosocial education Smoking cessation
Marshall [61] 1986 USA	Nurse	Before D/C	Teaching booklet Checklist	NR NR	NR	Exercise Nutrition Physiology of the heart Risk factors Surgical procedures
Mayou [36] 2002 UK	Nurse	Before D/C	Individual counselling Follow-up telephone contacts	NR NR	4	Return to activities Secondary prevention
McKinley [37] 2009 USA	Nurse	Ambulatory patients	Individual counselling Follow-up telephone contacts	40 min Monthly	2	Psychosocial education Symptoms
Moore [38] 2001 USA	Nurse	At discharge	Individual counselling Educational audios Teaching booklets	NR NA	1	Psychosocial education Symptoms Surgical procedures
Oldenburg [39]	Multidisciplinary	After D/C	Lectures	3 hours	8	Behavior change strategies Quality of

1995 Australia	team		Group discussion	Weekly		life Risk factors
Oliveira [47] 2008 Portugal	Not provided	CR	Lectures Group discussions Teaching booklet Home visits Follow-up telephone contacts	NR NR	4	Exercise Risk factors
Otterstad [40] 2003 UK	Multidisciplinary team	After D/C	Group discussions	2 hours 2x/week	12	Exercise Management of CAD Medications Nutrition Psychosocial education Risk factors Smoking cessation
Palomaki [56] 2002 Finland	Multidisciplinary team	After D/C	Lectures	2 hours Weekly	6	Exercise Metabolic syndrome Nutrition Risk factors
Pelletier [53] 2003 USA	Dietician	CR	Lectures	90 minutes Every 2 months	2	Nutrition
Smith [41] 2009 Canada	Nurse	Before D/C	Teaching booklets Verbal orientation Individual counselling Educational videos Educational audios Follow-up telephone contacts	1 (45-60 min) and 7 (5-10 min) NR	8	Smoking cessation
Song [48] 2001 South Korea	Multidisciplinary team	After D/C	Q and A Lectures Group discussions	Daily activity Every 2 months	2	Exercise Medications Nutrition Physiology of the heart Psychosocial education
Timlin [57] 2002 USA	Multidisciplinary team	CR	Lectures Individual counselling	1 hour NR	3	Nutrition
Van Elderen [62] 2001 The	Multidisciplinary team	After D/C	Group discussions Follow-up telephone contacts	5 (2 hours) and 7 (NR) Weekly	12	Management of CAD Medications Nutrition Psychosocial education

Netherlands						Risk factors
Van Elderen-van [42] 1994 The Netherlands	Nurse	CR	Individual counselling Lectures Group discussions Follow-up telephone contacts	90 minutes NR	2	Exercise Medications Nutrition Psychosocial education Risk factors Return to activities
Van Elderen [43] 1994 The Netherlands	Multidisciplinary team	After D/C	Lectures Group discussions	2 hours 8 weekly and 1 2 months after the 8th session	9	Healthy beliefs Medications Nutrition Psychosocial education Return to activities Sexual activity
Verges [49] 1998 France	Dietician	CR	Lectures Individual counselling Teaching booklets	NR Weekly	8	Exercise Nutrition Risk factors
Wolkanin-Bartnik [44] 2011 UK	Not provided	CR	Teaching booklets Verbal orientation Follow-up telephone contacts	NR NR	NR	Exercise
Yoshida [50] 1999 Japan	Multidisciplinary team	CR	Lectures Educational videos Individual counselling	NR NR	7	Exercise Nature of the disease Nutrition Psychosocial education Return to activities Risk factors

* Including all types of intervention strategies

NA: not applicable (Only one intervention or no formal intervention – e.g., printed or audio/visual materials only); Q and A: Questions and answers; CAD: Coronary Artery Disease; D/C: discharge; CR: cardiac rehabilitation; NR: not reported.