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Effective components of nurse-coordinated care to prevent recurrent coronary events: a systematic review and meta-analysis

Marjolein Snarterse,¹ Jos Dobber,¹ Patricia Jepma,¹ Ron J G Peters,² Gerben ter Riet,³ S Matthijs Boekholdt,² Bianca M Buurman,⁴ Wilma J M Scholte op Reimer¹

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¹Amsterdam School of Health Professions, University of Applied Sciences, Amsterdam, The Netherlands

²Department of Cardiology, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

³Department of General Practice, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

⁴Department of Internal Medicine, Section of Geriatric Medicine, Academic Medical Center, Amsterdam, The Netherlands

Correspondence to

Marjolein Snarterse, Amsterdam School of Health Professions, University of Applied Sciences, Tafelbergweg 51, Amsterdam 1105 BD, The Netherlands; m.snarterse@hva.nl

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ABSTRACT

Current guidelines on secondary prevention of cardiovascular disease recommend nurse-coordinated care (NCC) as an effective intervention. However, NCC programmes differ widely and the efficacy of NCC components has not been studied. To investigate the efficacy of NCC and its components in secondary prevention of coronary heart disease by means of a systematic review and meta-analysis of randomised controlled trials. 18 randomised trials (11 195 patients in total) using 15 components of NCC met the predefined inclusion criteria. These components were placed into three main intervention strategies: (1) risk factor management (13 studies); (2) multidisciplinary consultation (11 studies) and (3) shared decision making (10 studies). Six trials combined NCC components from all three strategies. In total, 30 outcomes were observed. We summarised observed outcomes in four outcome categories: (1) risk factor levels (16 studies); (2) clinical events (7 studies); (3) patient-perceived health (7 studies) and (4) guideline adherence (3 studies). Compared with usual care, NCC lowered systolic blood pressure (weighted mean difference (WMD) 2.96 mm Hg; 95% CI 1.53 to 4.40 mm Hg) and low-density lipoprotein cholesterol (WMD 0.23 mmol/L; 95% CI 0.10 to 0.36 mmol/L). NCC also improved smoking cessation rates by 25% (risk ratio 1.25; 95% CI 1.08 to 1.43). NCC demonstrated to have an effect on a small number of outcomes. NCC that incorporated blood pressure monitoring, cholesterol control and smoking cessation has an impact on the improvement of secondary prevention. Additionally, NCC is a heterogeneous concept. A shared definition of NCC may facilitate better comparisons of NCC content and outcomes.

INTRODUCTION

Coronary heart disease (CHD) remains a major cause of morbidity and mortality worldwide. Important determinants are the ageing of populations and unhealthy lifestyles.^{1 2} Patients with established CHD are at very high risk for recurrent cardiovascular events and mortality and are therefore considered the first priority in secondary prevention.³ Although adequate risk factor control to guideline-recommended target levels is highly effective in the secondary prevention setting, recent surveys have shown that risk factor control in clinical practice is far from ideal, leaving substantial room for improvement.^{4–6} Secondary prevention provided and coordinated by nurses, that is, nurse-coordinated care (NCC), has the potential to improve patient compliance and risk factor control

in patients with CHD, although previous reports on the effect of NCC have not shown clear and convincing results.^{7 8} A previous review concluded that NCC in secondary prevention has a beneficial effect on quality of life.⁹ However, no consistent relationships were observed between NCC interventions and other outcomes; in another review, almost half of the interventions had no significant effect on study outcomes.¹⁰ Heterogeneity in intervention strategies and outcomes hinders comparison between the various studies.¹⁰ The European guidelines on cardiovascular disease prevention state that NCC prevention programmes are effective, based on two trials.^{11 12} Available research is, however, more extensive and the overall findings appeared less conclusive. In the present study, we therefore systematically reviewed the available evidence on the efficacy of NCC in secondary prevention of CHD.

METHODS

Search strategy and selection

Using a comprehensive search strategy, we searched MEDLINE, the Cochrane Central Register of Controlled Trials and CINAHL from 1990 up to January 2015, with no language restriction. Since evidence for NCC has evolved after the 1990s, the review was limited to studies published after 1990. The following search terms were entered as independent terms, text words or medical subject headings (MESH) terms: (1) coronary heart disease or cardiovascular patient or cardiovascular diseases and (2) nurse led or case manager* or nurse practitioner or managed care programs/organization and administration. In addition, reference lists of existing reviews were manually searched to identify additional relevant studies. Our MEDLINE search strategy is described in detail in online supplement 1.

Two reviewers independently screened all titles and abstracts identified by the search. Studies that were classified as possibly relevant by at least one reviewer were retrieved in full text and assessed for inclusion using a standardised inclusion form. Multiple publications reporting on the same study were included only when additional relevant outcomes were presented; they were counted as one study. Disagreements were solved by discussion between the two reviewing authors. We conducted our systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement.¹³



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Selection criteria

Studies were included only if (a) they were designed as a randomised controlled trial (RCT); (b) patients were hospitalised or being treated by a general practitioner (GP) for secondary prevention of CHD; (c) Trials were included as at least 70% of their included study population had cardiovascular disease (CVD) or reported data separately on a secondary prevention group; (d) a registered nurse was involved as a 'nurse coordinator', using Krumholz's description of coordinated care: the development and implementation of a therapeutic plan to integrate the efforts of multiple health professionals¹⁴ and (e) the outcomes reported included risk factors, health behaviours, clinical events, patient-perceived health or guideline adherence. For studies meeting these criteria, all other outcomes, except costs, were taken into account in our analysis.

Quality assessment

Two reviewers independently assessed the risk of bias in the included studies using the Cochrane Collaboration's risk of bias tool, which requires critical evaluation of the following domains: sequence generation, allocation concealment, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and other source of bias.¹⁵ After this evaluation, each domain of the studies was classified as having low, high or unclear risk of bias.

Data extraction

Data were extracted about the setting and study population, NCC intervention components and both primary and secondary outcomes of included studies. Two reviewers independently extracted all relevant information using a data extraction form. Due to heterogeneity of the data, a descriptive approach was used to summarise components of NCC and their effect on outcomes. Based on consensus, we distinguished three intervention strategies: (1) risk factor management, (2) multidisciplinary consultation and (3) shared decision making. We rated the intensity of the intervention as high (>4 visits plus more than one NCC strategy used), intermediate (3–4 visits) or low (1–2 visits). We defined a multidisciplinary team as a team with >2 disciplines. Furthermore, we classified the observed outcomes into four categories: (1) risk factor levels, (2) clinical events, (3) patient-perceived health and (4) guideline adherence. In our meta-analysis, we pooled the sufficiently homogeneous outcomes to determine the effectiveness of the NCC intervention.

Statistical analysis

We used forest plots to visualise the effects of NCC on systolic blood pressure (SBP), low-density lipoprotein (LDL) cholesterol and smoking cessation compared with usual care, stratified for treatment intensity (high, intermediate, low, unknown). To indicate the differences between these methods, random effects and fixed effects models were used to pool treatment effects. Mantel-Haenszel fixed effect pooling assumes a single true treatment effect and ignores between-study heterogeneity. DerSimonian-Laird random effects pooling takes between-study heterogeneity into account and leads to wider CIs. However, in random effects pooling, small studies receive more weight and this may affect the pooled treatment estimates. If no between-study heterogeneity exists, both methods yield identical results. Heterogeneity was expressed using the I^2 statistic. (Pooled) risk ratios were calculated from 2×2 tables, which were derived from the publications, using the metan command (V3.04, 21 September 2010) in Stata V.13.1.

RESULTS

Study selection

A total of 3524 publications were initially identified (figure 1). Screening the references in these publications yielded another four potentially relevant studies. After two reviewers reviewed titles and abstracts, 44 publications were retrieved in full text. We excluded 25 of these publications after reading the full text (see online supplement 2). To prevent double counting, only Voogdt-Pruis' primary care study (2010) was included, as it matched our review purpose best.¹⁶ Campbell *et al* reported different outcomes of the same study in two publications. We counted these as one study.^{17 18} In total, we included 18 studies in our systematic review.

Trial characteristics

Total sample sizes ranged from 138 to 2142 participants in 12 countries of four continents (see online supplement 3). Patients with CHD were recruited during hospital admission^{11 19–26} or at outpatient clinics,^{27 28} a community health clinic,²⁹ a secondary prevention unit³⁰ or general practices.^{16 18 31 32} The study participants' mean age ranged from 54 to 75 years.^{22 29} 'Usual care' generally consisted of routine aftercare by a GP or cardiologist (see online supplement 3). In six of the trials, routine care was more intensive and included a cardiac rehabilitation programme.^{23 25 26 28 30 33}

Risk of bias in included studies

Online supplement 4 presents the risk of bias across the included studies; 13 of 18 studies (72%) were considered to have a high risk of bias for one or more domains. In general, there was a low risk of selection bias; all studies, except two,^{30 33} used a valid method for random sequence generation and 4 of 18 trials (22%) used non-individual randomisation methods.^{11 24 31 32} Allocation concealment was unsatisfactory or not reported in five trials (28%).^{11 18 24 30 33} In one trial, 'the patients were randomised by the researchers',¹⁸ which resulted in a high risk of bias. Blinding of intervention is not possible in this type of studies, which increases the possibility of performance bias. Four trials (22%) blinded the outcome assessors using an independent research assistant to carry out the clinical assessments,^{21 24 28 32} and in three additional trials, outcome data were independently retrieved from hospital records.^{22 23 25} The risk of detection bias in the other trials was classified as either unclear or high. Six trials collected outcome data incompletely,^{11 16 21 24 27 30} had many missing values¹⁶ or unclear exclusions from the analysis.¹¹ Seven studies (39%) did not report prespecified outcomes^{19–21 26 27 30 33} in the primary publication or in a trial registry or design paper, if available. Of 18 trials in total, five recent trials (28%) were registered in a trial registry.^{11 22 25 28 29} Eleven studies (61%) used one or more self-reported outcomes for lifestyle-related risk factors, which may have introduced bias.³⁴

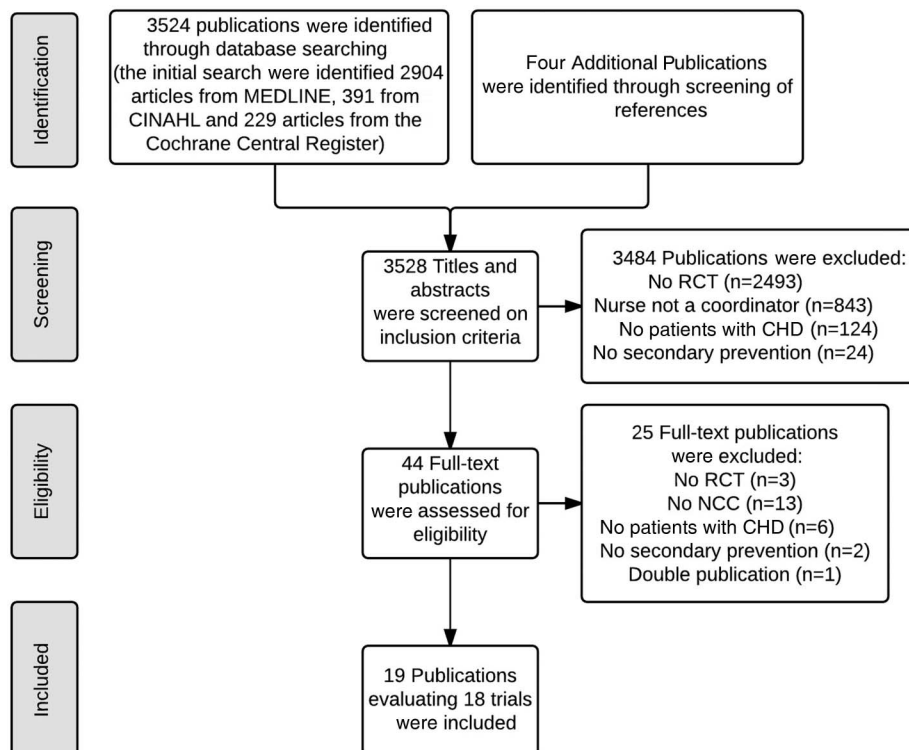
Description of the intervention by strategy

The NCC programmes varied in components and intensity (see online supplement 3). We identified 15 components of the NCC intervention and grouped them into three strategies (figure 2): (1) risk factor management, for example, lifestyle counselling, blood pressure and lipid control; (2) multidisciplinary consultation, for example, consultation and referral and (3) shared decision making, for example, goal setting and family support.

Risk factor management

Risk factor management was the most commonly used NCC strategy and was reported in 13 studies (72%). In six studies

Figure 1 Flow diagram of selection of trials. CHD, coronary heart disease; NCC, nurse-coordinated care; RCT, randomised controlled trial.



(33%), nurses were authorised to prescribe or titrate medication.^{20 26–29 31} In two of these studies, this was done according to prespecified algorithms.^{26 29} To encourage a more active lifestyle, NCC interventions consisted of ‘instruction to participate in a home-based exercise programme’,²⁹ ‘Stepping Out’ programmes to promote physical activity,¹⁸ starting a physical training programme in the first 3 months of the intervention,³⁰ recommendation to walk briskly for 20 min daily²⁶ or referral to a physiotherapist.¹¹

Multidisciplinary consultation

The second strategy, multidisciplinary consultation, was assessed in 11 studies (61%). ‘Involvement of a multidisciplinary team’ was part of this strategy in four trials (22%).^{11 26 28 29} Seven

trials^{11 16 20 23 25 28 31} (39%) incorporated ‘referral to more specialised disciplines’ as needed.

Shared decision making

The third strategy, ‘shared decision making’, was incorporated in 10 studies (56%). This strategy refers to implementing family support,^{11 21 30} goal setting for cardiac risk factor control^{11 18 19 21 28 29 33} and a personalised action plan.^{11 18 20 27 29 33}

The included studies varied in terms of the duration of the intervention (2–24 months), frequency of visits (3–14 contacts) and follow-up time (3–24 months). The majority used a 12-month follow-up period (see online supplement 6). In eight studies (44%), telephone follow-up was used,^{19 21 22 25–27 29 33}

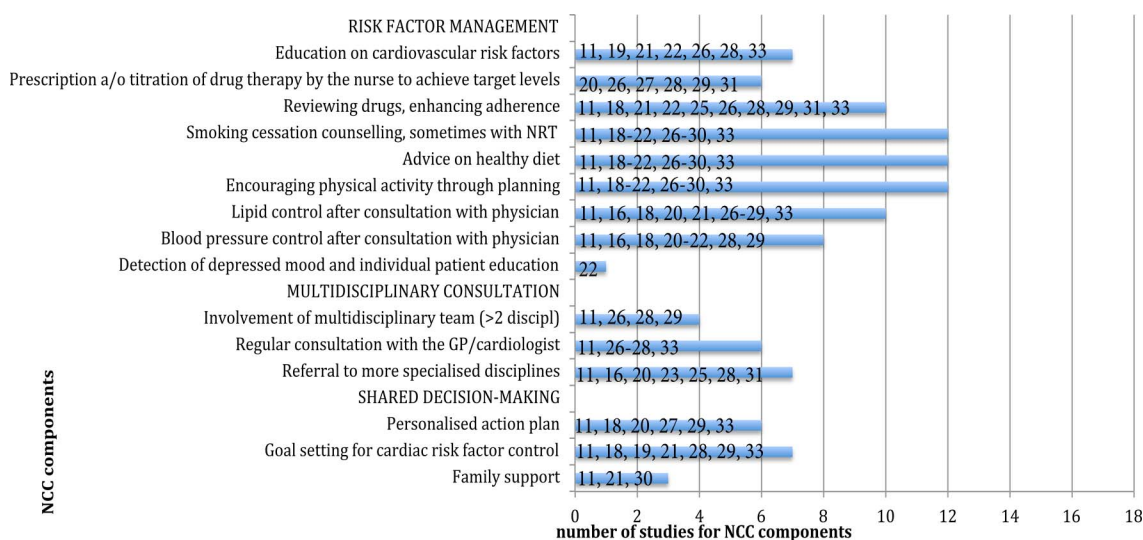


Figure 2 Components of nurse-coordinated care (NCC) by strategy in 18 studies. Presented numbers in the figure are study references. a/o, and/or; GP, general practitioner; NRT, nicotine replacement therapy.

and in six studies (33%) home visits were part of the intervention (see online supplement 3).^{19 21–23 25 27} Six trials included four or more visits plus more than one NCC strategy (high intensity)^{11 18 26–29}; six trials were rated as intermediate intensity,^{16 19–21 30 33} three trials were rated as low intensity^{22 25 31} and three studies were rated as unclear intensity (see online supplement 3).^{23 24 32}

Description of outcomes by category

Outcomes of NCC varied considerably (see online supplement 5a,b). In total, 30 NCC outcomes were measured. We grouped observed outcomes into four categories: (1) risk factor levels; (2) clinical events; (3) patient-perceived health and (4) guideline adherence.

Risk factor levels

In 14 studies (78%), outcomes of NCC studies were measured as improvement of risk factor levels with heterogeneous treatment effects (see online supplement 6). One study used SCORE, a comprehensive cardiovascular risk algorithm designed for the primary prevention setting, as the study outcome.²⁸ Figures 3–5 present our meta-analyses of weighted mean differences and relative risk (RR) calculations of trials reporting on SBP, LDL cholesterol and smoking cessation, respectively.

Seven studies reported on SBP outcomes. The NCC intervention decreased SBP by 2.96 mm Hg (95% CI 1.53 to 4.40 mm Hg) compared with usual care with low-to-moderate between-study heterogeneity ($I^2=37.1\%$). Eight trials reported on LDL cholesterol outcomes. The effect of NCC compared with usual care on LDL cholesterol was -0.23 mmol/L (95% CI -0.36 to -0.10 mmol/L), with substantial heterogeneity ($I^2=74.3\%$). Trials incorporating prescription and/or titration of drug therapy by nurses were associated with a significant reduction in LDL cholesterol and SBP, compared with usual care. Meta-analysis of eight trials comparing smoking cessation rates,

generally self-reported (75%), between NCC and usual care yielded a pooled RR of 1.25 (95% CI 1.08 to 1.43). Random effects and fixed effects models showed no between-study heterogeneity in treatment effects ($I^2=0.0\%$). Six studies reported smoking cessation rates at 12 months,^{16 19 24 26 28 30} one study at 6 months²¹ and one study at 12 weeks of follow-up.³³

Clinical events

In total, seven studies reported on clinical events (see online supplement 5b) and five studies reported on recurrent events and the duration of hospitalisation^{17 23 25} or readmission rates^{17 20 25 28} at assessment time >6 months. In four of these studies, a reduction was shown for all-cause and cardiovascular readmission rates or the duration of hospitalisation and other CVD rates or recurrent coronary events.^{17 18 20 23 28} A disease management programme²³ significantly reduced the secondary outcome emergency department encounters (incidence density ratio -2.08 , $p<0.001$), claims for diagnostic or therapeutic services (830 vs 1208 claims, $p=0.012$) and the use of laboratory services (1481 vs 2401, $p=0.007$) in favour of the NCC intervention. The trials that assessed the outcomes all-cause mortality,^{20 25} time to readmission or death²² or event-free survival²⁵ all showed no effect of NCC versus usual care on these outcomes.

Patient-perceived health

Six publications reported patient-perceived health outcomes with different instruments and showed small effects (see online supplement 5b and 6).^{18 20 24 25 29 31} Three studies showed a statistically significant improvement on the following questionnaires (or one of their subscales): the short form 36 (SF-36),¹⁸ chest pain,¹⁸ perception of chronic illness care²⁹ and the Seattle Angina Questionnaire.³¹

Figure 3 Forest plot of seven randomised trials on the effect of nurse-coordinated care (NCC) on systolic blood pressure. Trials are ordered by treatment intensity and year. Medication indicates trials using medication-titration; I-V, inverse-variance (fixed effects); D+L, DerSimonian-Laird (random effects). Random effects estimates in the subgroups are identical to the fixed effects estimates, no between-trial heterogeneity. Except for two trials (Gorden *et al*, Jiang *et al*), all trials used a 12-month follow-up period.

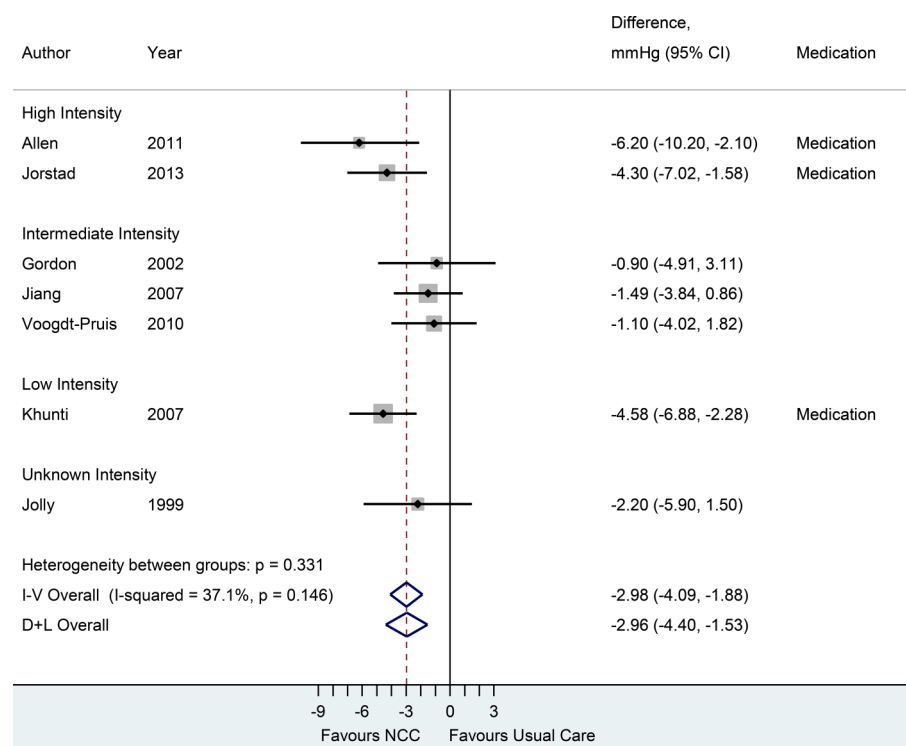


Figure 4 Forest plot of eight randomised trials on the effect of nurse-coordinated care (NCC) on serum low-density lipoprotein cholesterol concentrations. Trials are ordered by treatment intensity and year. Medication indicates trials using medication-titration; I-V, inverse-variance (fixed effects); D+L, DerSimonian–Laird (random effects). Except for three trials (Allison *et al*, Gordon *et al*, Jiang *et al*), all trials used a 12-month follow-up period.

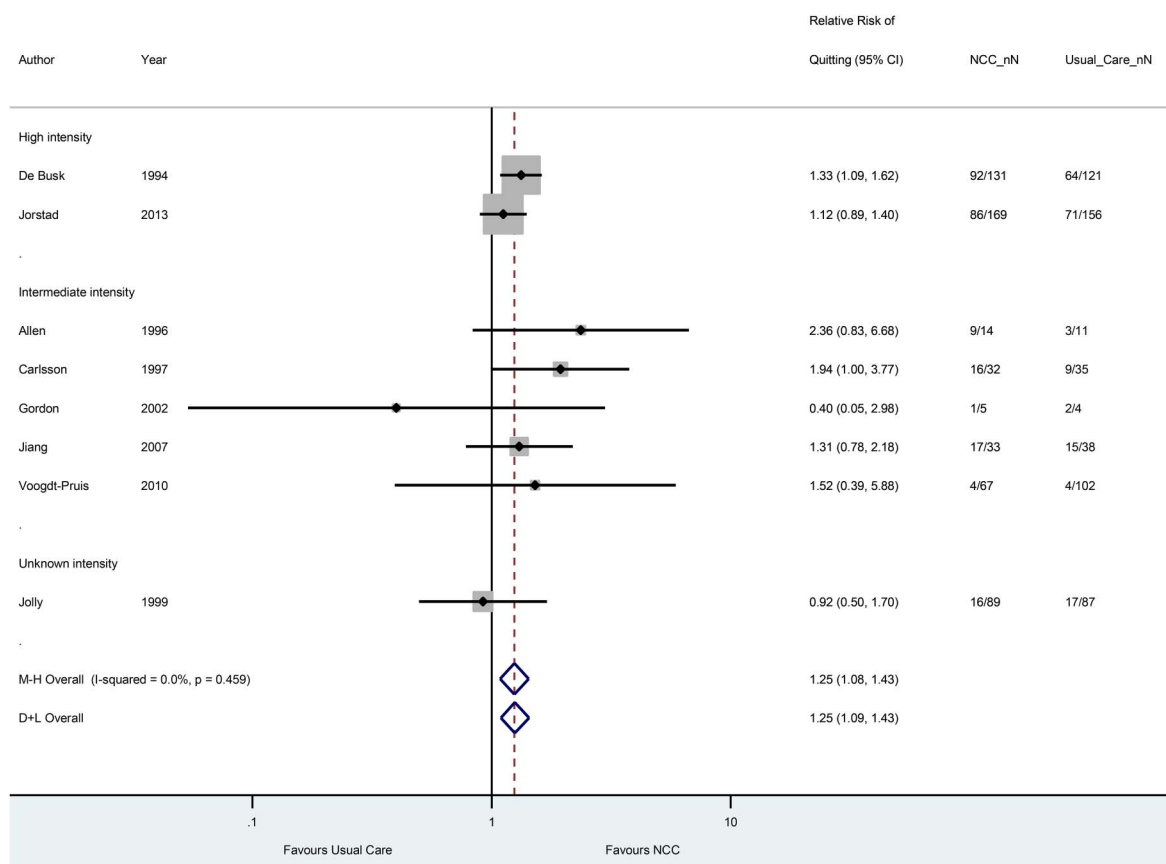
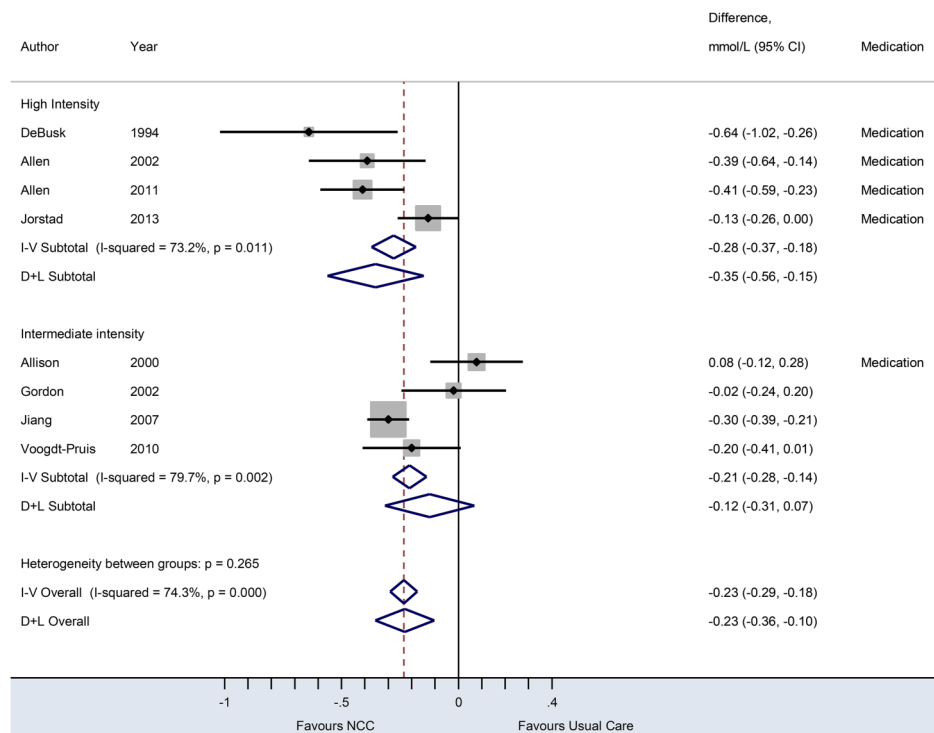


Figure 5 Forest plot of eight randomised trials on the effect of nurse-coordinated care (NCC) on smoking cessation rates. Trials are ordered by treatment intensity and year. M–H indicates Mantel–Haenszel (fixed effects), D+L indicates DerSimonian–Laird (random effects). The trial by Wood *et al*¹¹ was excluded since only the absolute cessation risk difference (of 10.4% (–0.30 to 21.20) in favour of NCC) was reported and pooling of absolute risk differences caused much heterogeneity in the stratum with the intermediate intensity trials. NCC_nN and Usual_Care_nN denote the number of quitters (n) of the total number of smokers at baseline (N) in the NCC intervention groups and usual care groups, respectively. Except for one trial (Jiang *et al*), all trials used a 12-month follow-up period.

Guideline adherence

Three trials reported better results for the NCC intervention compared with the usual care group on the outcome category 'guideline adherence', which implies assessment of risk factors according to secondary prevention guidelines.^{18 31 32}

Summary of effective interventions and their NCC components

We found that interventions that include independent prescription and/or titration of drug therapy by nurses and a high-intensity strategy appeared to be effective in reducing SBP and LDL cholesterol (figures 3 and 4).^{20 26–29 31} Effective components regarding behavioural interventions were goal setting for cardiac risk factor control plus identification of barriers, an approach that positively affected the risk factor profile in several studies.^{11 18 19 21 29}

Of 11 trials with prespecified primary outcomes, eight trials demonstrated positive outcomes for NCC compared with usual care: for the outcome category risk factor levels: total cholesterol,^{16 29 31} LDL cholesterol,²⁹ triglyceride,²⁹ pharmacological treatment,³¹ SCORE,²⁸ blood pressure^{28 29} and diet;¹¹ clinical events: all-cause and cardiovascular readmission (days)²³ and guideline adherence.^{18 32} Half of these studies were classified as high intensity, including >4 face-to-face contacts^{11 18 28 29} and frequent telephone follow-up in one of them.²⁹

DISCUSSION

The evidence summarised in this review suggests that prescription and/or titration of drug therapy by nurses, in combination with a high-intensity strategy, can decrease SBP and LDL cholesterol. NCC also improved smoking cessation substantially by 25%, but, although nurses' attention for lifestyle-related risk factors was a common component in the reviewed studies, this did not result in weight loss. Evidence from cardiac rehabilitation studies with exercise and multimodal interventions showed an effect on mortality.³⁵ This effect might have been achieved through improved adherence to lifestyle modification and medication, which may be a result of frequent follow-up visits by nurses. The intervention components and outcome measures were very heterogeneous. This indicates that NCC is not yet a clearly defined concept, as well as a complex intervention. Complex interventions, including several components, are made up of various interconnecting parts and it is therefore difficult to evaluate the contribution of individual components. Furthermore, breaking down these complex interventions into separate components does not take into account the synergistic effects of combining these components. In most studies, NCC interventions were multifaceted, broadly structured and therefore lacked focus. As there is a variation in the selection of outcomes in the included studies, it is important to answer the question what should be appropriate goals for NCC. Consensus about NCC content and reporting of outcome measurements for RCTs would facilitate a better evidence base for future. In 2006, the American Heart Association Disease Management Taxonomy Writing Group published a statement about defining and classifying different care models, in particular disease management.¹⁴ The interdisciplinary writing group designed a conceptual model and its proposed components to allow comparisons across interventions of disease management trials. This statement forms an ideal starting point to compare diverse disease management programmes and to assess specific components associated with effectiveness. Such an initiative would also be valuable for the development of NCC programmes.

Limitations

We encountered heterogeneity in our meta-analyses. We also observed between-study differences that we could not explain. Although the composition of NCC programmes was heterogeneous, this was not always the case for their relative effects on outcomes. The overall quality of the RCTs in this review was moderate. At the same time, it was encouraging that more recent studies had better methodological quality and clinical trial registration. One older study was deemed to be of low or unclear quality since it did not describe critical components for assessing the risk of bias.³⁰ We nevertheless included this study in the meta-analysis of smoking cessation. Many studies were at risk of selective reporting. In several studies, no prespecified primary and secondary endpoints were stated. Self-reported outcomes were used as well, so the observed effects could be overestimated or underestimated. The results should therefore be interpreted with caution.

Overweight and smoking remained persistent and prevalent risk factors in many of the studies. A recent review on the efficacy of lifestyle modification programmes to support behaviour change in patients with CHD found that comprehensive lifestyle modification programmes reduced mortality by 34% and cardiac readmissions by 35%.³⁶ Interventions incorporating four self-regulation techniques (ie, goal setting, planning, self-monitoring, feedback) were associated with greater lifestyle benefits. This is in line with our finding that goal setting is a successful component for both behavioural counselling and medication-regulated risk factors. Community-based comprehensive lifestyle programmes take this approach and this might be a new opportunity to achieve weight reduction in patients with CHD.^{37–40}

Despite clinical heterogeneity, we conclude that effective NCC interventions consist of these components: (i) prescription and/or titration of drug therapy by nurses^{26–29 31} particularly with predefined algorithms,^{26 29} (ii) tailored behavioural counselling with goal setting^{11 18 19 21 29 33} and (iii) frequent follow-up visits and telephone contacts.^{26 27 29}

Our review shows that when NCC incorporates blood pressure monitoring, cholesterol control and smoking cessation, it may improve secondary prevention. Finding effective interventions to achieve weight reduction in patients with CHD remains an important challenge for future. Additionally, NCC has shown to be a heterogeneous concept. We recommend a shared definition of NCC to facilitate better comparisons of NCC content and outcomes.

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Contributors MS, RJGP, BMB and WJMSOR participated in the design of the systematic review. MS, JD and PJ performed study selection, quality assessment and extraction of data. MS, GtR, PJ and JD were involved in the data analyses. MS, GtR, JD, RJGP, WJMSOR were involved in the interpretation and discussion of results. MS drafted the manuscript. JD, PJ and WJMSOR contributed to the drafting of the review. GtR, SMB, BMB and WJMSOR provided critical revision for important intellectual content. All authors approved the final version of the manuscript.

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- 33 Gordon NF, English CD, Contractor AS, et al. Effectiveness of three models for comprehensive cardiovascular disease risk reduction. *Am J Cardiol* 2002;89:1263–8.
- 34 Shiely F, Hayes K, Perry JJ, et al. Height and weight bias: the influence of time. *PLoS One* 2013;8:e54386.
- 35 Muller-Riemenschneider F, Damm K, Meinhard C, et al. Evaluation of medical and health economic effectiveness of non-pharmacological secondary prevention of coronary heart disease. *GMS Health Technol Assess* 2009;5:16.
- 36 Janssen V, De Gucht V, Dusseldorp E, et al. Lifestyle modification programmes for patients with coronary heart disease: a systematic review and meta-analysis of randomized controlled trials. *Eur J Prev Cardiol* 2013;20:620–40.
- 37 McEwen A, West R, McRobbie H. Effectiveness of specialist group treatment for smoking cessation vs. one-to-one treatment in primary care. *Addict Behav* 2006;31:1650–60.
- 38 Jebb SA, Ahern AL, Olson AD, et al. Primary care referral to a commercial provider for weight loss treatment versus standard care: a randomised controlled trial. *Lancet* 2011;378:1485–92.
- 39 Jolly K, Lewis A, Beach J, et al. Comparison of range of commercial or primary care led weight reduction programmes with minimal intervention control for weight loss in obesity: lighten up randomised controlled trial. *BMJ* 2011;343:d6500.
- 40 Pinto AM, Fava JL, Hoffmann DA, et al. Combining behavioral weight loss treatment and a commercial program: a randomized clinical trial. *Obesity (Silver Spring)* 2013;21:673–80.

Online supplement 1 MEDLINE search strategy

(systematic[*sb*] OR (Therapy/Broad[*filter*])) AND ("Coronary Disease"[*Majr*] OR coronary disease*[*tiab*] OR coronary heart disease*[*tiab*] OR cardiovascular patient*[*tiab*] OR "Cardiovascular Diseases"[*Majr*] OR cardiovascular disease*[*tiab*] OR "Coronary Artery Disease"[*Majr*] OR "Heart Diseases"[*Majr*] OR cardiac disease*[*tiab*] OR "Coronary Disease"[*Mesh:noexp*] OR coronary risk[*tiab*] OR "Myocardial Infarction"[*Majr*] OR cardiovascular[*ti*] OR coronary[*ti*] OR cardiac[*ti*] OR Myocardial Infarction[*ti*]) AND ("Disease Management"[*Mesh*] OR Disease Management[*tiab*] OR Diseases Management[*tiab*] OR "Patient Education as Topic"[*Mesh*] OR nurse led[*tiab*] OR nursing management[*tiab*] OR nurse case management[*tiab*] OR case manage*[*tiab*] OR registered nurse*[*tiab*] OR "Nurse Practitioners"[*Mesh*] OR nurse practitioner*[*tiab*] OR nurse coordinat*[*tiab*] OR nurse delivered[*tiab*] OR "Nurse's Role"[*MAJR*] OR "Models, Nursing"[*MAJR*] OR "Nurse Clinicians"[*Mesh*] OR "Managed Care Programs/organization and administration"[*Majr*] OR "Case Management"[*Majr*] OR nurse counselor*[*tiab*] OR advanced practice nurse*[*tiab*] OR ((led) AND (nurse*)) OR ((clinic) AND (nurse*)))

Online supplement 2 Excluded studies and reasons for exclusion

Study	Reason/ selection criterion
Allison TG, Squires RW, Johnson BD, et al. Achieving national cholesterol education program goals for low-density lipoprotein cholesterol in cardiac patients: Importance of diet, exercise, weight control, and drug therapy. <i>Mayo Clin Proc</i> 1999;74:466-473.	No nurse-coordinated care
Broers CJM, Smulders J, van der Ploeg TJ, et al. Nurse practitioner equally as good as a resident in the treatment of stable patients after myocardial infarction, but with more patient satisfaction. <i>Ned Tijdschr Geneesk</i> . 2006;150:2544-8.	No secondary prevention
Coburn KD, Marcantonio S, Lazansky R, et al. Effect of a community-based nursing intervention on mortality in chronically ill older adults: a randomized controlled trial. <i>PLoS Med</i> .2012;9(7).	No CHD patients
Giannuzzi P, Temporelli PL, Maggioni AP, et al. Global Secondary Prevention strategies to Limit event recurrence after myocardial infarction: the GOSPEL study. A trial rom the Italian Cardiac Rehabilitation Network. <i>Arch Intern Med</i> . 2008;168:2194-2204.	No nurse-coordinated care
Goessens BM. A Randomised, controlled trial for risk factor reduction in patients with symptomatic vascular disease: the multidisciplinary Vascular Prevention by Nurses Study (VENUS). <i>Eur J Cardiovasc Prev Rehabil</i> . 2006;13:996-1003.	No CHD patients
Goldie CL, Prodan-Bhalla N, Mackay M. Nurse practitioners in postoperative cardiac surgery: Are they effective? <i>Can J Cardiovasc Nurs</i> . 2012;22: 8-15.	No secondary prevention
Gould, KA. A Randomized controlled trial of a discharge nursing intervention to promote self-regulation of care for early discharge interventional cardiology patients. <i>Dimens Crit Care Nurs</i> 2011;30:117-25.	No nurse-coordinated care
Johnston M, Foulkes J, Johnston DW, et al. Impact on patients and partners of inpatient and extended cardiac counseling and rehabilitation: a controlled trial. <i>Psychosomatic medicine</i> 1999;61:225-233.	No nurse-coordinated care

Jun M. Case management to reduce risk of cardiovascular disease in a county health care system. <i>Arch Intern Med.</i> 2009;169:1988-1995.	No CHD patients
Lapointe F, Lepage S, Larrivee L, et al. Surveillance and treatment of dyslipidemia in the post-infarct patient: can a nurse-led management approach make a difference? <i>Can J Cardiol</i> 2006 Jul;22:761-767.	No nurse-coordinated care
Leemrijse CJ, vanDijk L, Jorstad HT, et al. The effects of Hartcoach, a life style intervention provided by telephone on the reduction of coronary risk factors: a randomised trial. <i>BMC Cardiovasc Disord.</i> 2012;12:47.	No RCT
Mainie PM. To examine the effectiveness of a hospital-based nurse-led secondary prevention clinic. <i>Eur J Cardiovasc Nurs.</i> 2005;4:308-13.	No RCT
McHugh F. Nurse led share care for patients on the waiting list for coronary artery bypass surgery: a randomised controlled trial. <i>Heart</i> 2001;86:317-23.	No nurse-coordinated care
Miller P. Regimen compliance two years after myocardial infarction. <i>Nursing Research</i> 1990;39:33-6.	No nurse-coordinated care
Mills M, Loney P, Jamieson E, et al. A primary care cardiovascular risk reduction clinic in Canada was more effective and no expensive than usual on demand primary care - a randomised controlled trial. <i>Health and Soc Care in the Community</i> 2010;18:30-40.	No CHD patients
Patja K, Absetz P, Auvinen A, et al. Health coaching by telephony to support self-care in chronic diseases: clinical outcomes from The TERVA randomized controlled trial. <i>BMC Health Services Research.</i> 2012;12:147.	No nurse-coordinated care
Roderick P, Ruddock V, Hunt P, et al. A randomized trial to evaluate the effectiveness of dietary advice by practice nurses in lowering diet-related coronary heart disease risk. <i>Br J Gen Pract</i> 1997;47:7-12.	No nurse-coordinated care
Selvaraj FJ, Mohamed M, Omar K, et al. DISSEMINATE study group. The impact of a disease management program (COACH) on the attainment of better cardiovascular risk control in dyslipidaemic patients at primary care centers (The DISSEMINATE Study): a randomised controlled trial. <i>BMC Fam Pract.</i> 2012;13:97.	No nurse-coordinated care

Shah BR, Adams M, Peterson ED, et al. Secondary prevention risk interventions via telemedicine and tailored patient education (SPRITE): a randomized trial to improve post-myocardial infarction management. <i>Circ Cardiovasc Qual Outcomes</i> 2011;4:235-242.	No RCT
Taylor CB, Houston N, Smith PM, et al. The effect of a home-based, case managed, multifactorial risk-reduction program on reducing psychological distress in patients with cardiovascular disease. <i>J of Cardiopulm Rehab.</i> 1997;17:157-162.	No nurse-coordinated care
Vale MJ, Jelinek MV, Best JD, et al. For the COACH Study Group. Coaching patients On Achieving Cardiovascular Health (COACH). <i>Arch Intern Med.</i> 2003;163:2775-2783.	No nurse-coordinated care
Voogdt-Pruis HR, Van Ree JW, Gorgels AP, et al. Adherence to a guideline on cardiovascular prevention: a comparison between general practitioners and practice nurses. <i>Int J Nurs Stud</i> 2011;48:798-807.	Double publication
Woollard J. Effects of general practice-based nurse-counselling on ambulatory blood pressure and antihypertensive drug prescription in patients at increased risk of cardiovascular disease. <i>J Hum Hypertens</i> 2003;17:689-95	No CHD patients
Woollard J. Effects of a general practice-based intervention on diet, body mass index and blood lipids in patients at cardiovascular risk. <i>J Cardiovasc Risk</i> 2003;10:31-40	No CHD patients
Zhao Y, Wong FK. Effects of a post-discharge transitional care programme for patients with coronary heart disease in China: a randomised controlled trial. <i>J Clin Nurs</i> 2009;18:2444-2455.	No nurse-coordinated care

Characteristics of included studies.

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Allen et al. (1996)	138	Women after CABG. Hospital (start pre-discharge) and outpatient clinic, USA. Usual care by primary provider, standard discharge teaching and physical therapy instructions, pre-discharge group class.	64	0%	I: Nurse-directed behavioural interventions with elements of self-efficacy construct, starting the day before hospital discharge with a videotape and workbook. Hospital-based smoking cessation counselling. Feedback on food questionnaire, short-term goals for diet, exercise and smoking cessation.	Consultation: first visit before hospital discharge, 1 follow-up counselling after one month. Home visits: 1 visit, after 2 weeks. Telephone follow-up: 1 phone call, after 2 months. Intensity: <i>intermediate</i>
Allen et al. (2002)	228	Hypercholesterolemia and CHD patients. Outpatient clinic, USA. Usual care by primary provider/cardiologist enhanced with feedback on lipids.	60	72%	I: NP (case manager) + cardiologist/primary provider participated in managing patient's lipids. NP had permission to prescribe and monitor lipid-lowering drug therapy. One outpatient visit 4-6 weeks after discharge to initiate a lipid management plan. Lipid testing, medication and lifestyle modifications were an integral part of lipid management. Nutritional counselling, physical activity, smoking cessation counselling and relapse prevention.	Consultation: first visit 4-6 weeks after discharge. 7 contacts per patient within 12 months. Home visits: 1 visit. Telephone follow-up: yes. Duration: average of 4.5 hours per patient Intensity: high
Allen et al. (2011)	525	African American or Caucasians CVD patients. Community health clinics, USA. Usual care from primary provider with enhanced feedback regarding CVD risk factors.	54	29%	I: Behavioural interventions to effect lifestyle changes. Aggressive pharmacologic management, lifestyle modification, identification of barriers to attainment of goals by a NP functioning as a case coordinator. Pre-appointment reminders. Specific algorithms for drug treatment were developed; a low-literacy Wellness Guide was developed specially for the study as a behavioural tool to promote lifestyle changes. Instructions to participate in a home-based exercise program.	Consultation: 7 visits within 12 months. Telephone follow-up: 6 contacts between the consultations. Intensity: <i>high</i>

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Allison et al. (2000)	326	<p>Instable AP or elective PCI patients without myocardial infarction from chest pain unit. Cardiovascular health clinic, USA.</p> <p>Usual care from cardiologist, one follow-up appointment within 48 hours after discharge.</p>	58	56%	I: Risk factor modification plan by a nurse interventionist, pharmacologic lipid management, referrals, and additional follow-up as indicated (check lipids).	<p>Consultation: 3 one-hour visits or more if indicated within 6 months after discharge.</p> <p>Duration: 3 hours or more</p> <p>Intensity: <i>intermediate</i></p>
Campbell et al. (1998)	1343	<p>CHD patients, 19 general practices. North Scotland.</p> <p>Usual care from general practitioner.</p>	66	58%	I: Nurse clinic visits contains (1) symptoms reviewing to identify poor control and referral, (2) assessing drug treatment, (3) blood pressure and lipid control, (4) behavioural risk factors were assessed. Feedback, goal planning and an agreed action plan were outlined on a take home form. Leaflets to help with dietary modifications and Stepping Out programmes to promote physical activity were available. Health visitors, district nurses or practice nurses run the clinics. A clinic coordinator provided support by phone.	<p>Consultation: 2 to 6 visits within 12 months.</p> <p>Duration: first visit around 45 min., follow-up visits around 20 minutes.</p> <p>Intensity: <i>high</i></p>
Carlsson et al. (1997)	168	<p>Acute myocardial infarction patients. Secondary prevention unit, Sweden.</p> <p>Usual care from general practitioner, 2 or 3 visits in one year.</p> <p><i>Before randomization:</i> The first five weeks all patients were scheduled for two visits: at a nurse and one visit at a cardiologist. They were informed about CAD risk factors and the effect of lifestyle changes on the prognosis. All patients were invited to join an exercise program, with extra information about the positive effects of physical activity.</p>	62	75%	I: 3- month period education program, individually and in group sessions: counselling for smoking cessation, dietary education -information orally and in writing- and physical activity. Continued with 2-3 times weekly exercise training sessions for 10-12 weeks (40 min.)	<p>Consultation: 4 visits within ten months.</p> <p>Duration: total of 9 hours per patient.</p> <p>Intensity: <i>intermediate</i></p>

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Carrington et al. (2013)	602	<p>Elective and emergency patients with any cardiac diagnosis requiring ongoing management. Home visits, Australia.</p> <p>Usual care consists of ongoing care by their treating specialists physician and family physician. Access to follow-up health care services (including cardiac rehabilitation program).</p>	70	72%	I: Home visit within 7-14 post index hospitalization according to GARDIAN system. Intensity of management by the cardiac nurse including repeat home visits, telephone coaching, and referral was adjusted accordingly. Detailed clinical report and recommendations were sent to the patient's specialist and family physician. Patients were able to contact the cardiac nurse for continued advice and support.	<p>Home visits: 1 or more</p> <p>Telephone follow-up: average of 3.3 calls per patient (duration of 7.5 minutes)</p> <p>Intensity: <i>low</i></p>
DeBusk et al. (1994)	585	<p>Acute myocardial infarction patients. Hospital (start pre-discharge) and outpatient clinic, USA.</p> <p>Usual care consists of follow-up care by internist, physician counselling on smoking cessation (50 dollar) and nutritionist counselling.</p>	57	79%	I: (1) Nurse-initiated telephone contacts, (2) Computer-generated progress reports mailed to the patients, (3) visits for treadmill exercise testing, nutritional counselling, lipid lowering drug therapy (algorithms), or smoking relapse counselling by nurses. Nurses obtained permission to add a new drug; changes in dosage did not require permission.	<p>Consultations: 4 visits to nurse case manager within 6 months.</p> <p>Telephone follow-up: max. 14 calls.</p> <p>Duration: 9 hours.</p> <p>Intensity: <i>high</i></p>

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Gordon et al. (2002)	155	Diagnosed CAD patients. Cardiac rehabilitation clinic (I ₁), outpatient clinic (I ₂), and shopping mall kiosk/hospital outpatient complex (I ₃), USA. No usual care, 3 interventions.	60	75%	All patients received a computer-generated cardiac risk factor report, goal level based on guidelines and an individualized action plan. Usual care by physicians. I ₁ : Cardiac rehabilitation program. 3 days/week, additionally education on CAD disease, risk factors and lifestyle modification. Included written materials, audiotapes, group education, one-on-one counselling. Referral for medication changes. I ₂ : Physician-supervised, nurse-care-managed program. Education on CAD disease, risk factors and lifestyle modification. Included written materials, audiotapes, one-on-one counselling. Home-based exercise plan, nutrition, weight, stress management, smoking cessation program. Supervising physician made medication changes or referral. I ₃ : Community-based program at a shopping mall kiosk or hospital outpatient complex. Administered by exercise physiologists. Counselling on site or via telephone, 1-2/week. Education on CAD disease, risk factors and lifestyle modification, ca. 15 min. Included written materials, audiotapes, one-on-one counselling. Home-based exercise plan, nutrition, weight, stress management, smoking cessation program. Referral for medication changes.	Consultation: 2 visits with the physician and nurse. Telephone follow-up: 4 calls Intensity: <i>intermediate</i>

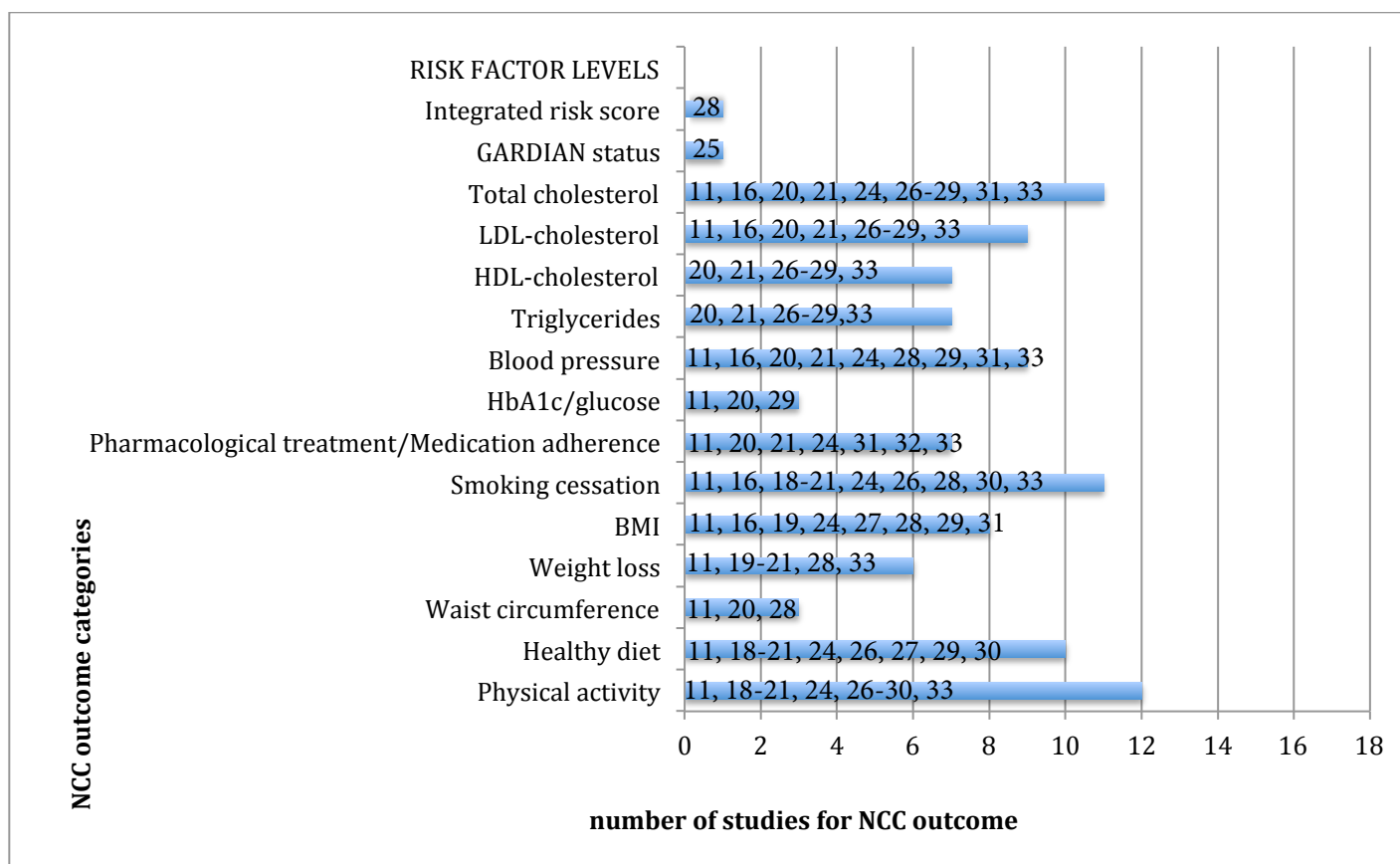
Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Jiang et al. (2007)	167	First hospitalization with AP or myocardial infarction. Hospital (start pre-discharge) and home visits, China. Usual care unclear.	62	71%	I: Cardiac rehabilitation program: <i>Phase I: Hospital based patient/family education on seven topics:</i> (1) CHD and self-management principles, (2) medication management (3) angina prevention and management (4) physical exercise (5) dietary management (6) smoking cessation and (7) family support. <i>Phase II: Home-based rehabilitative care</i> (1) setting of daily behavioural goals (2) setting of goals for cardiac physiological risk control (3) goal directed self-management (4) log record (5) participated family members (6) follow-up care through home visits and telephone calls for monitoring, facilitating and reinforcing the self-management practice of the patients and supportive behaviours of family members.	Consultation: 3 months, intensity unclear Home visits: yes Telephone follow-up: yes Intensity: <i>intermediate</i>
Jolly et al. (1999)	597	Newly diagnosed patients with myocardial infarction and angina. General practices, United Kingdom. Usual care unclear.	64	71%	I: An undefined program to coordinate preventive care from hospital-home led by three specialist liaison nurses. Coaching of practice nurses to provide structured follow-up care and seek advice. Responsibility for coordinating follow-up care. Each patient received a record, which prompted and guided follow up at standard intervals.	Consultations: visit practice staff every 3-6 months. Telephone follow-up: yes, support of practice staff by phone. Intensity: <i>unclear</i>
Jorstad et al. (2013)	754	ACS patients. 11 outpatients clinic, The Netherlands. Usual care by cardiologist and cardiac rehabilitation programme.	58	80%	I: Nurse-coordinated prevention program in addition to UC based on guidelines. Focus on (1) healthy lifestyles (2) biometric risk factors (3) medication adherence. This included medication titration as needed. Referral to other health professions or treating physician for diabetes as needed.	Consultations: 4 visits in six months. Intensity: <i>high</i>
Khunti et al. (2007)	1316	CHD and CHF patients from 20 general practices, United Kingdom. Usual care from primary healthcare team, also open access to ECG and secondary care clinic.	70	62%	I: In addition to UC, two peripatetic nurse specialists trained in the management of CHD and CHF travelled between practices, where they held weekly clinics. Including assessment, conformation of diagnosis by investigations, medication management and titration and liaison between primary and secondary care.	Consultations: Weekly clinics, intensity unclear. Home visits: only for housebound patients with CHF. Intensity: <i>low</i>

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Meisinger et al. (2013)	340	MI patients of ≥ 65 years. Hospital (start pre-discharge) and home visits, Germany. Usual care unclear.	75	62%	I: Intervention combining (1) case management and (2) disease management components: (1) identification of individual care problems, the facilitation of care coordination, (2) management of cardiac risk factors and the provision of information and individual education, including medication and medication adherence.	Home visits: Varying number of home visits (0-4), dependent on patients' needs and risk level. First consultation before discharge. Telephone follow-up: at least every 3 months, average of 19 minutes per phone call. Duration: Average of 117 minutes per home visit. Intensity: <i>low</i>
Moher et al. (2011)	2142	CHD patients from 21 general practices, United Kingdom. No usual care, 3 interventions.	66	68%	3 methods of promoting secondary prevention. I ₁ : Audit group. Audit of summary feedback by primary health care team at a practice meeting; amount of patients with CHD, proportion of patients with adequate assessment, data from other practices for comparison. I ₂ : GP group. Same information as audit group. Recall to general practitioner for patient assessment according to guidelines. Setting up a disease register and systematic recall of patients. I ₃ : Nurse group. Same information as GP group. Recall to nurse-clinic for patient assessment according to guidelines of secondary prevention. Nurses received education to implement it. Setting up a disease register and systematic recall of patients in a nurse led clinic.	Consultations: unclear Intensity: <i>unclear</i>
Voogdt-Pruis et al. (2010)	701	Patients with high risk for or documented CVD. Primary care, The Netherlands. Usual care from the general practitioner. Treatment protocol adhered to the Dutch guideline.	64	64%	I: Nurse consultation for cardiovascular risk management according to Dutch guideline with referral to other professions (dietician). Lifestyle and medical advice.	Consultations: 3 to 4 consultations within 12 months. Intensity: <i>intermediate</i>

Study	Sample size (=n)	Study population, setting, usual care	Mean age in years	Men (%)	Intervention content and coordinating activities	Intensity
Wood et al. (2008)	946 (hospital)	ACS or high-risk patients and their partners. Only hospital arm taken, 12 hospitals in Europe. Usual care unclear.	63	70%	I: Initial assessment of risk factors, lifestyle, drug treatment of patients and partners. Reassessment of patient and partner at 16 weeks, reassessment at one year. Medication titration by <i>cardiologist</i> . <i>Dieticians</i> (hospital) gave advice in terms of food and patterns and set realistic goals for patient and families. <i>Nurse</i> smoking cessation, quit date+ plan. Blood pressure cholesterol and glucose monitoring, education to improve medication compliance. <i>Physiotherapist</i> patterns, capacity, plan+ goals, step counter, 7-day activity recall diary.	Consultations: at least 8 sessions, plus a group workshop and exercise class in 4 months. Intensity: <i>high</i>
Young et al. (2003)	162	MI patients at hospital discharge, home visits. Canada. Usual care consists of follow-up by own cardiologist, information in cardiac teaching class and cardiac rehabilitation programme.	69	60%	I: Disease management program. A standardized pathway 'the nursing checklist', referral criteria for specialty care, communication system with the family physician and patient education.	Home visits: minimum of 6 home visits within 8 weeks. Intensity: <i>unclear</i>

Abbreviations: ACS: Acute Coronary Syndrome, AP: Angina pectoris, C: Control, CABG: Coronary arterial bypass graft, CHD: Coronary heart disease, CHF: Coronary heart failure, CVD: Cardiovascular disease, ECG: Electrocardiogram, GP: General practitioner, I: Intervention, MI: myocardial infarct, NP: Nurse practitioner, PCI: Percutaneous coronary intervention.

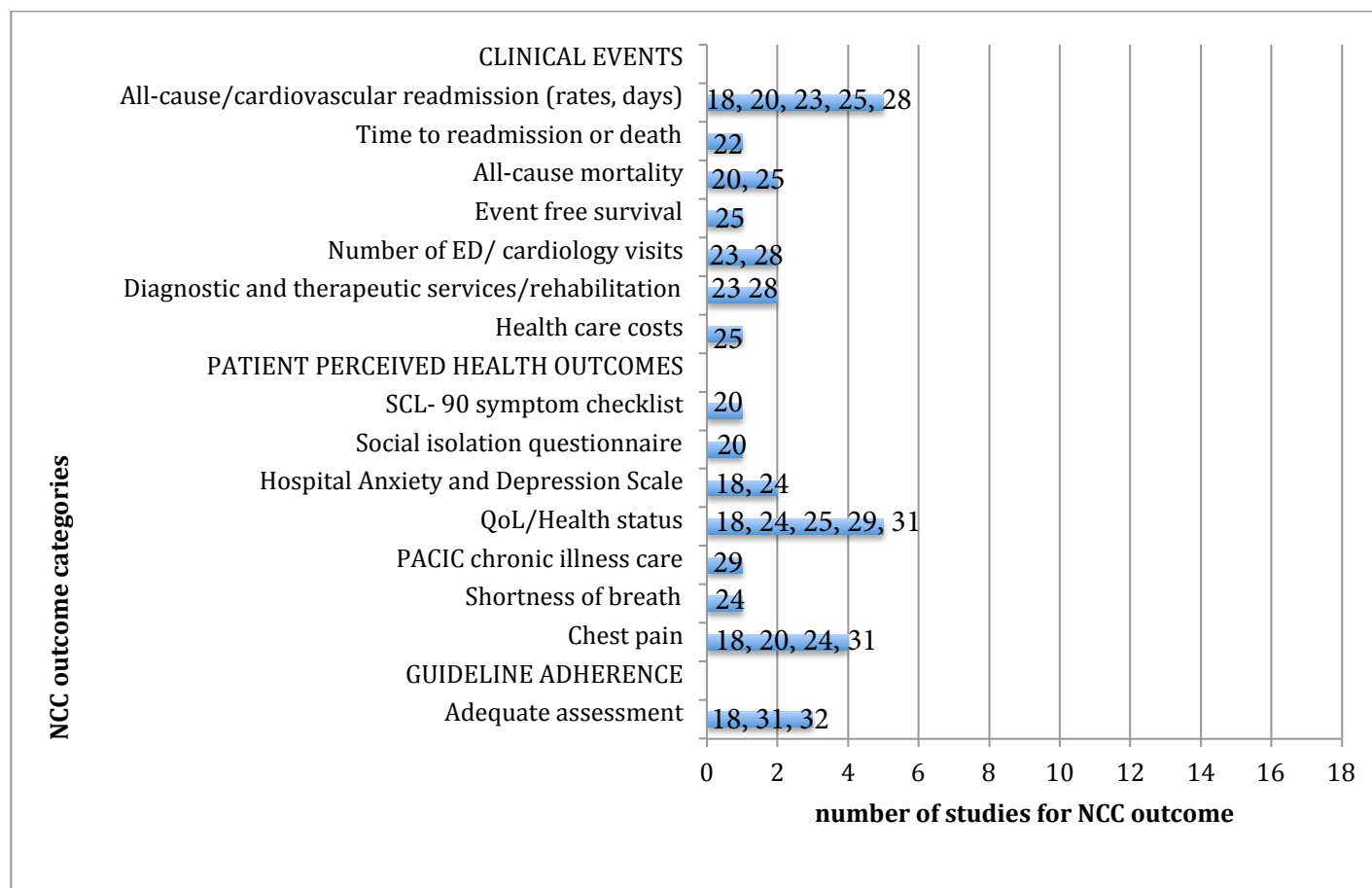
	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
1994, DeBusk	+	+	-	+	-	+
1996, Allen	+	+	-	+	-	-
1997, Carlsson	?	?	?	-	-	-
1998a, Campbell	+	-	?	+	+	+
1999, Jolly	+	?	+	-	+	+
2000, Allison	+	+	-	?	+	?
2001, Moher	+	+	+	+	+	-
2002, Allen	+	+	?	-	?	-
2002, Gordon	?	?	?	+	-	+
2003, Young	+	+	+	+	+	?
2007, Jiang	+	+	+	-	+	?
2007, Khunti	+	+	-	+	+	?
2008, Wood	+	?	?	-	-	-
2010, Voogdt-Pruis	+	+	?	-	+	-
2011, Allen	+	+	?	+	+	+
2013, Carrington	+	+	+	+	+	+
2013, Jorstad	+	+	+	+	+	+
2013, Meisinger	+	+	+	+	+	+



5a. Assessed outcomes of nurse-coordinated care by category in 18 studies

Presented numbers in figure are study references.

Abbreviations: NCC nurse-coordinated care.




5b. Assessed outcomes of nurse-coordinated care by category in 18 studies

Presented numbers in figure are study references.

Abbreviations: ED emergency department; NCC nurse-coordinated care; SCL-90 Symptom Check List; QoL quality of life; PACIC Patient Assessment of Chronic Illness Care.

Online supplement Description of outcomes

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
Allen et al. (1996)	Risk factor levels	Smoking	Self-reported	NS	12 months
		BMI	Kg/m ²	NS	
		Weight loss	Not reported	NS	
				NS	
		Dietary intake	Questionnaire: dietary intake of previous month	Fat(%) p=0.008, saturated fat (%) p=0.02	
		Physical activity	Questionnaire: 7-day activity recall	NS	
Allen et al. (2002)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	-0.4 mmol/L, p=0.008	12 months
			LDL-C (mmol/L)	-0.39 mmol/L, p=0.001	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	NS	
			LDL-C<2.59 mmol/L, n (%)	NR	
		Smoking	Exhaled carbon monoxide + self-reported	NR	
		Dietary intake	Questionnaire: fat intake (%)	-3.7%, p=0.004	
			Questionnaire: saturated fat intake (%)	-1.4%, p=0.004	
			Questionnaire: cholesterol intake (mg)	-62.5 mg, p=0.017	
			Questionnaire: fiber intake	NS	
		Physical activity	Questionnaire: physical activity	18 METS, p=0.05	
Allen et al. (2011)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	-0.51 mmol/L, p<0.001	12 months
			LDL-C (mmol/L)	-0.41 mmol/L, p<0.001	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	-0.18 mmol/L, p=0.003	
		Blood pressure	Systolic BP (mmHg)	-6.2 mmHg, p=0.013	
			Diastolic BP (mmHg)	-3.1 mmHg, p=0.013	
		HbA1c	Mean HbA1c	-0.5%, p=0.034	
		Smoking cessation	Not reported	NR	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
Allison et al.  (2000)	Perceived health outcomes	BMI	Kg/m ²	NS	6 months
		Dietary intake	Questionnaire: Habits and History Food Frequency	NS	
		Physical activity	Questionnaire: Stanford 7-Day Physical Activity	NS	
		Quality of life	Questionnaire: EQ-5D	Reported elsewhere	
		Perception of chronic illness care	Questionnaire: PACIC	1.2 points, p<0.001	
	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	NS	
			LDL-C (mmol/L)	NS	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	-0.37 mmol/L, p<0.001	
		Blood pressure	Systolic BP (mmHg)	NS	
			Diastolic BP (mmHg)	NS	
		Glucose	Fasting blood glucose (mg/dL)	NS	
		Pharmacological treatment	Pharmacological treatment rates	NS	
		Smoking	Exhaled carbon monoxide + self-reported	NS data not applicable for meta-analysis	
		Weight loss	Kg	-1.0 kg, p=0.007	
		Low fat diet	Questionnaire: no data	p=0.012	
		Regular exercise	Questionnaire (in min.)	25 min, p=0.049	
	Clinical events	Recurrent events			
		Recurrent coronary event	Rate	-8%, p=0.002	
		Rehospitalization	Rate	NS	
		Death	All causes	NS	
	Perceived health outcomes	Psychosocial evaluation	Questionnaire: SCL-90-R	NS	
			Questionnaire: Social isolation questionnaire	NR	
		Chest pain	Reporting episodes (%)	NS	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
Campbell et al. (1998)	Risk factor levels	Aspirin management	On target (%)	NS	12 months
		Blood pressure management	On target (%): $\leq 160/90$ mmHg	RR=1.09 (1.06-1.13)	
		Lipid management	On target (%): $\leq 5,2$ mmol/L	RR=1.9 (1.59-2.29)	
		Smoking cessation	On target (self-reported) (%)	NS data not applicable for meta-analysis	
		Low fat diet	On target (DINE-score) (%)	RR=1.16 (1.03-1.31)	
		Physical activity	On target (%)	RR=1.35 (1.16-1.58)	
	Clinical events	Use of health service	Difference in length of stay (days)	NS	
			Hospital admissions (OR)	OR=0.64 (0.48-0.86), p=0.003	
	Perceived health outcomes	Anxiety and depression	Questionnaire: HADS	NS	
		Health status	Questionnaire: SF-36 score		
		Physical domain		4.33, p<0.001	
		Social domain		3.51, p=0.007	
		Role domain		8.52, p<0.001	
		Role emotional domain		4.66, p=0.045	
		Mental domain		NS	
		Energy domain		NS	
		Pain domain		2.50, p=0.035	
		General domain		2.34, p=0.013	
		Chest pain	Worsening	OR=0.59 (0.37-0.94), p=0.025	
			Reporting chest pain	NS	
Carlsson et al. (1997)	Risk factor levels	Smoking habits	Questionnaire, self-reported	NS	12 months
		Food habits	Questionnaire	Unclear, p=0.008	
		Physical activity	Questionnaire	NS	
Carrington et al. (2013)	Risk factor levels	Clinical status	GARDIAN risk status (effect sizes unknown)		24 months
			Low risk group	p<0.001	
			Medium risk group	p=0.004	
			High risk group	p=0.004	
	Clinical events	All-cause and cardiovascular hospitalization	Rate	NS	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
DeBusk et al. (1994)	Risk factor levels	All cause hospital stay	Days/patient per month	NS	12 months
		All-cause mortality	Rate	NS	
		Event free survival	Rate	NS	
		Health care costs	Associated costs/patient per month	NS	
		Perceived health outcomes	Quality of life	Questionnaire: SF-12 (physical domain)	
				Questionnaire: SF-12 mental domain)	
				Questionnaire: EQ-5D (health state)	
				Potential depression	
		Lipids	Total Cholesterol (mmol/L)	-0,63 mmol/L, p<0.001	
			LDL-C (mmol/L)	-0,64 mmol/L, p<0.001	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	NS	
		Smoking cessation	Biochemically + self-reported (%)	17%, p=0.03	
		Nutritional management	Questionnaire: food frequency	Unclear	
		Functional capacity	Treadmill exercise test (METS)	0.9 METS, p=0.001	
Gordon et al. (2002)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	NS	12 weeks
			LDL-C (mmol/L)	NS	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	NS	
		Blood pressure	Systolic BP (mmHg)	NS	
			Diastolic BP (mmHg)	NS	
		Medication use	Change in %	NS	
		Smoking	Self-reported	NS	
		Weight loss	LBS	NS	
		VO2 max	VO2 max (ml/kg/min)	NS	
Jiang et al. (2007)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	-0.33 mmol/L, p=0.001	6 months
			LDL-C (mmol/L)	-0.30 mmol/L, p=0.001	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	-0.10 mmol/L, p=0.011	
		Blood pressure	Systolic BP (mmHg)	NS	
			Diastolic BP (mmHg)	NS	
		Medication adherence	Self-reported	NS	
		Smoking	Self-reported	NS	
		Weight	Kg	NS	
		Diet	Mean no. of patients with step II diet adherence	-10.28, p=0.002 (netto change)	
		Walking	Activity total score: Jenkins Activity Checklist for Walking	1.91, p=0.002 (netto change)	
Jolly et al. (1999)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	NS	12 months
		Blood pressure	Systolic and diastolic differences (mmHg)	NS	
		Pharmacological treatment	Difference in prescribed drugs (%)	NS	
		Smoking cessation	Biochemically + self-reported (%)	NS	
		BMI	Kg/m2	NS	
		Diet	Mean difference in score for intake (self-reported)	NS	
		Exercise	Distance walked in 6 min. (test)	NS	
	Clinical events	Practice attendance	Difference in mean no. of visits	NS	
		Rehabilitation	Attendance at at least one session (%)	18%, p<0.001	
	Perceived health outcomes	Anxiety	Questionnaire: HADS subscale	NS	
		Depression	Questionnaire: HADS subscale	NS	
		Quality of life	Questionnaire: EuroQol	NS	
		Shortness of breath	Self-reported (%)	NS	
		Chest pain	Self-reported (%)	NS	
Jorstad et al. (2013)	Risk factor levels	10-year cardiovascular mortality (SCORE)	Estimation of SCORE risk reduction (%)	-17.4%, p=0.021	12 months
		Reduction of 10-year incidence of coronary mortality and morbidity	Framingham Coronary Risk Score (FCRS)	-12.5%, p=0.017	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
	Clinical events	Lipids	Total Cholesterol (mmol/L)	NS	
			LDL-C (mmol/L)	NS	
			HDL-C (mmol/L)	NS	
			Triglycerides (mmol/L)	NS	
		Blood pressure	Systolic BP (mmHg)	-4.3 mmHg, p=0.002	
			Diastolic BP (mmHg)	NS	
		Smoking	Self-reported	NS	
		BMI	Kg/m2	NS	
		Weight	Kg	NS	
		Waist circumference	Cm	-2.1 cm , p=0.048	
		Total number of readmissions	N (%)	-22%, p=0.023	
		Readmissions for ACS	N (%)	NS	
		Other CVD readmissions	N (%)	-48%, p<0.001	
		Elective interventions	N (%)	NS	
Khunti et al. (2007)	Risk factor levels	Total cholesterol	Total Cholesterol (mmol/L)	- 0.18 mmol/L (-0.30, -0.05)	12 months
		Systolic BP	mmHg	-4.58 mmHg (-6.88, -2.28)	
		Diastolic BP	mmHg	-3.53 mmHg (-4.78, -2.29)	
		ACE inhibitor	Prescribed drugs (OR)	NS	
		Aspirin	Prescribed drugs (OR)	NS	
		Beta-blocker	Prescribed drugs (OR)	1.43 (1.19-1.99)	
		Lipid lowering medication	Prescribed drugs (OR)	1.99 (1.06-3.74)	
		BMI	Kg/m2	NS	
	Process of care	Risk factor management			
		Cholesterol measured	OR	NS	
		Cholesterol < 5mmol/L	OR	1.58 (1.05-2.37)	
		BP measured	OR	22.61 (6.47-70.13)	
		BP < 140/85 mmHg	OR	1.61 (1.22-2.37)	
		Smoking status recorded	OR	33.96 (14.49-79.62)	
		BMI/weight measured	OR	10.14 (4.99-20.55)	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
	Perceived health outcomes	Quality of life	Questionnaire: SF-36		
		Physical functioning		5.33, p=0.02	
		Role physical		NS	
		Body pain		NS	
		General health		2.56, p=0.0001	
		Vitality		5.53, p=0.0001	
		Social functioning		7.76, p=0.0002	
		Role emotional		NS	
		Mental health		4.49, p=0.001	
		Angina pectoris	Questionnaire: Seattle Angina Questionnaire		
		Exertional capacity		5.25, p=0.001	
		Angina stability		NS	
		Angina frequency		2.69, p=0.045	
		Treatment satisfaction		NS	
		Quality of life		NS	
Meisinger et al. (2013)	Clinical events	First unplanned readmission or death	Time-to-event from initial discharge (HR)	NS	12 months
		Intervention costs		Reported elsewhere	
	Perceived health outcomes	Functional ability	Questionnaires: the Barthel Index, HAQ-DI, IADL	Not yet been published	
		Social support	Questionnaire: F-sozU		
		Depressive symptoms	Questionnaire: GDS		
		Emotional well-being	Questionnaire: WHO-5		
Moher et al. (2001)	Risk factor levels	Pharmacological treatment			18 months
		Antiplatelets	Mean (range percentage)	Nurse-Audit: 10%, p=0.009	
		Hypotensive	Mean (range percentage)	NS	
	Process of care	Lipid lowering	Mean (range percentage)	NS	
		Overall adequate assessment	Mean (range percentage)	Nurse: 85%, GP:76%, Audit: 52%	
				Nurse vs. audit p<0.001 GP vs. Audit p=0.002	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
		Adequate assessment of:			
		Blood pressure	Mean (range percentage)	GP:97%, Audit:86%, p<0.001	
		Cholesterol	Mean (range percentage)	Nurse:88%, Audit:67%, p=0.001	
		Smoking status	Mean (range percentage)	Nurse:95%, Audit:78%, p=0.001	
Voogdt-Pruis et al. (2010)	Risk factor levels	Lipids	Total Cholesterol (mmol/L)	-0.2 mmol/L, p=0.009	12 months
			LDL-C (mmol/L)	NS	
		Blood pressure	Systolic BP	NS	
		Smoking cessation	Self-reported	NS	
		BMI	BMI (kg/m2)	NS	
Wood et al. (2008) Hospital arm	Risk factor levels	Lipids	Total Cholesterol <5 mmol/L	NS	12 months
			LDL-C (<3mmol/L)	NS	
		Blood pressure	BP < 140/90 mmHg	10.4%, p=0.04	
		HbA1C	Difference (%)	NS	
		ACE inhibitor	Difference (%)	NS	
		Antiplatelet drug	Difference (%)	NS	
		Beta-blocker	Difference (%)	NS	
		Statin	Difference (%)	NS	
		Not smoking	Exhaled carbon monoxide + self-reported	NS data not incorporated in meta-analysis	
		BMI	BMI < 25 kg/m2	NS	
		Weight loss	Weight loss \geq 5% in patients	NS	
			with BMI >25 kg/m2 at initial assessment (%)		
		Waist circumference	Women <80cm, men <94cm	NS	
		Diet	Questionnaire: food habits		
			Saturated fat <10% of total energy (table 3) (%)	17.4%, p=0.009	
			Saturated fat <10% of total energy (p.2003) (%)	NS	
			Eating oily fish \geq 3 times per week (%)	8.9%, p=0.04	
			Eating fruit/vegetables >400 gr per day (table 3) (%)	37.3%, p=0.004	
			Eating fruit/vegetables >400 gr per day (p.2003) (%)	15.8%, p=0.03	
		Physical activity	Physical activity \geq 30 min. \geq 4 times per week (%)	35.6%, p=0.002	

Study	Outcome category	Outcomes	Unit of measurement	Results: difference between I and C	Follow-up
Young et al. (2003)	Clinical events	All-cause readmission days	Days per 1000 follow-up days (IDR)	1.53, p<0.001	454 days
		Readmission days for angina, CHF and COPD	Days per 1000 follow-up days (IDR)	1.59, p<0.001	
		ED visits	Number of ED visits	2.08, p<0.001	
		Physician visits		NS	
		Diagnostic and therapeutic services	Absolute numbers (\leq 225 days of discharge)	-378, p=0.012	
		Laboratory services	Absolute numbers (\leq 225 days of discharge)	-920, p=0.007	

Abbreviations:

A: Audit group, ACE: Angiotensin converting enzyme, ACS: Acute Coronary Syndrome, BMI: Body mass index, BP: Blood pressure, C: Control, CHF: Chronic Heart Failure, Cm: Centimeters, ED: Emergency Department EQ-5D: 5 item EuroQoL questionnaire, GP: General practitioner, HDL-C: High density lipoprotein cholesterol, I: Intervention, kg: Kilograms, LDL: Low density lipoprotein, Mg: Milligram, MET(S): Metabolic Equivalent Task, NR: Not reported, NS: Non-significant, OR: Odds ratio, PACIC: Patient assessment of chronic illness care, QoL: Quality of life, RR: Relative Risk .