A Case-management Program of Medium Intensity Does Not Improve Cardiovascular Risk Factor Control in Coronary Artery Disease Patients: The Heartcare I Trial

Alain Nordmann*, MD, Iris Heilmbauer*, MD, Tobias Walker, MD, Benedict Martina, MD, Edouard Battegay, MD

BACKGROUND: Case-management programs for secondary prevention of coronary artery disease that utilize extensive resources can reduce cardiovascular risk factors, but less intensive approaches have failed to show benefits. This randomized trial evaluated whether a medium intensity case-management program improves risk factor control in patients with coronary artery disease.

METHODS: We assigned 201 consecutive patients hospitalized for acute coronary events in the intensive care unit of University Hospital, Basel, Switzerland, to either a risk factor case-management program (n = 99) or care as usual (n = 102) using the patients’ primary care physicians as the unit of randomization (cluster randomization). The case-management program consisted of an hour of counseling by a clinician during hospitalization and two short reminders by phone and mail 3 and 6 months later. Treatment decisions were left to patients and their primary care physicians.

RESULTS: After 9 and 18 months of follow-up, there were no significant differences in lipid values, blood pressure control, fasting blood glucose, body-mass index, or number of smokers between the two groups. However, significantly more patients in the intervention group than in the care as usual group achieved target cholesterol values after 18 months (48% versus 27%, P = 0.002 and remained significant after Bonferroni-Holms correction) but not after 9 months of follow-up (31% versus 27%, P >0.2).


Cardiovascular disease is the leading cause of death and disability in industrialized countries. Most patients admitted to hospital with acute coronary artery disease have treatable coronary risk factors such as lipid abnormalities, hypertension, or smoking. Risk factor intervention substantially decreases cardiovascular events and cardiovascular and overall mortality (1–4). Nevertheless, risk factors often remain unrecognized or insufficiently controlled (5). Unfortunately, efforts directed at reducing coronary risk factors are often minimal during a patient’s hospitalization (5,6). Thus, risk factor interventions shown to be effective in clinical trials have not proven equally effective in clinical practice (5).

To improve risk factor awareness and treatment of risk factors such as hyperlipidemia or smoking, several programs of varying intensity have been tested. Intensive case-management systems effectively reduce cardiovascular risk factors. In order to implement such programs, hospitalizations for either angiography or acute coronary events have been substantially extended to educate patients about their cardiovascular risk factors (6), or there was frequent, intensive direct contact between patient and study personnel after hospital discharge, or both (4,7). For example, an intensive case-management system for patients with myocardial infarction resulted in increased smoking cessation, improved functional capacities, and reduced plasma low-density lipoprotein (LDL) levels 6 months after myocardial infarction (4). The program consisted of treatment interventions and counseling for smoking cessation, exercise training, and dietary and drug therapy for hyperlipidemia by a specially trained nurse (4). A community-based program with counseling at the patient’s home and at local health centers significantly reduced health care consumption after myocardial infarction in older patients (7). Also, intensive rehabilitation programs may yield considerable benefits for exercise capacity, psychosocial indexes, and lipids (6,7–9). In all of these intensive programs, the decision to modify therapy was most often made by special nurse...
case managers and not by the treating primary care physicians.

In contrast, short and less intensive counseling sessions have not been effective in reducing cardiovascular risk factors, even though they may have improved risk factor awareness (10,11). A recently described program to coordinate preventive care led by specialist liaison nurses to improve communication between hospital and general practice promoted follow-up in general practice but failed to increase the rate of smoking cessation or to improve blood pressure and lipid control (11). In this program treatment decisions were left to primary care physicians (11).

The efficacy of a medium intensity program to improve coronary risk factor awareness and coronary risk factors has not been fully investigated yet. We defined “medium intensity case-management program” as a program that does not prolong duration of hospitalization and is restricted to a few follow-up contacts by phone or mail. Patients continued to be managed by their primary care physicians. Medium intensity case-management systems may be easier to implement, because they are less costly and allow patients to continue treatment with their primary care providers.

The aim of this study was to test whether a hospital-based medium intensity case-management outreach program contributes to effective reduction of coronary risk factors in patients after a myocardial infarction.

**METHODS**

**Enrollment**

After approval by the local Human Subjects Committee all consecutive patients admitted to the intensive care unit (ICU) of the University Hospital, Basel, for myocardial infarction or unstable angina from April 1996 to July 1997 were prospectively screened for study inclusion. Myocardial infarction was diagnosed by the attending cardiologist based on the presence of two of the following three criteria: ischemic chest pain for at least 30 minutes, typical changes on the electrocardiogram, or typical cardiac enzyme elevations. Unstable angina pectoris was defined as ischemic chest pain for no longer than 30 minutes, ST-T segment changes present only during chest pain, and absence of typical cardiac enzyme elevations. Every patient who fulfilled inclusion criteria was informed and counseled about specific risk (dyslipidemia, hypertension, diabetes mellitus, and smoking) that were uncontrolled or insufficiently controlled at the time of the actual cardiovascular event. Each patient was informed and counseled about specific risk factors by the study physician for an average of 1 hour.

Information consisted of verbal advice and delivery of information booklets about coronary risk factors. In general, the following targets concerning risk factor control were formulated: total cholesterol less than 5.2 mmol/L and total cholesterol/high-density lipoprotein (HDL) cholesterol less than 5 (13); blood pressure less than 140/90 mm Hg; fasting glucose values less than 6.4.
mmol/L; smoking cessation; brisk walking for at least 30 minutes three times a week (or comparable activity); and reduction of atherogenic diet intake (14).

To enhance patients’ motivation, a mutual agreement was negotiated about personal aims that the patient agreed to achieve concerning risk factor control, eg, weight loss to reach a target weight, diet modification, or smoking cessation. These individually negotiated aims could be slightly different from the general aims mentioned above. Aims were listed in a letter to the primary care physician and to the patient, and a suggestion of lipid-lowering drug therapy was made according to the national guidelines for secondary prevention of cardiovascular disease in place at the time the study was performed (13,14). In addition, patients and primary care physicians were supplied with risk factor flow charts to monitor individual risk factors at follow-up visits in the primary care physician’s office. Each patient was given a study call-in hotline number through which the study physician could be reached for questions concerning the risk factors.

Three and 6 months after hospital discharge written reminders about personal risk factors were sent to patients and their primary care physicians. A few days later the study physician called patients by phone to ask if they had been successful in achieving their aims and to encourage them in case of insufficient risk factor control.

Laboratory Analysis at Baseline
Total, LDL, and HDL cholesterol levels of nearly all patients were determined using routine methods at hospital admission during the first 24 hours of coronary pain initiation (15,16). Fasting glucose values and body mass index were then calculated using the Mann-Whitney U test (GB-STAT V6.0 software; Dynamic Microsystems, Silver Springs, Maryland). To detect differences in the rate of patients achieving target cholesterol levels, optimal blood pressure control (<140/90 mm Hg), or number of smokers in the two groups we used chi-square testing (Epi 6.0; Centers for Disease Control, Atlanta, Georgia). In addition, a second round of analysis was performed by analyzing data of all patients of each primary care physician as a single data point to account for the fact that randomization took place at the level of the primary care physicians (cluster randomization) and not at the patient level. Those are the results given in results and tables. However, results of analysis in consideration of cluster-randomization were not different from results obtained when cluster-randomization was not taken into account. All analyses were performed on an intention-to-treat basis using the last value carried forward method for missing data. P values were calculated with a two-sided alpha of 0.05. The Bonferroni-Holms method was used to account for multiple testing (18).

RESULTS

Patients
From April 1996 to July 1997, all 389 consecutive patients who were admitted to the intensive care unit (ICU) of
University Hospital, Basel, for myocardial infarction or unstable angina were assessed for eligibility. One hundred eighty-eight patients (48%) were excluded: 59 were older than 75 years, 59 died before randomization, 50 were transferred to other hospitals, 32 refused to participate, 22 were addicted to alcohol or drugs, and 14 had insufficient language skills.

Ninety-nine patients of 67 primary care physicians were randomly assigned to the case-management program (mean number of patients per primary care physician 1.5, range 1 to 3), and 102 patients of 68 primary care physicians were assigned to receive care as usual (mean number of patients per primary care physician 1.5, range 1 to 8; Table 1). Demographic and medical characteristics of study participants were similar in the two groups (Table 1). There also were no significant differences in educational level, specialty of treating physicians, and amount of exercise performed per week. At 9 months’ follow-up the dropout rate was 14% in the case-management group and 17% in the care as usual group. Reasons for dropout at 9 months’ follow-up in the case-management group and care as usual groups were as follows: lost to follow-up, 10% in both groups; death, 4% in the case-management and 7% in the care as usual group. The cumulative dropout rates at 18 months’ follow-up were as follows: lost to follow-up, 20% in both groups; death, 6% in the case-management group, and 9% in the care as usual group.

### Lipid Changes from Baseline and Percentage of Patients Achieving Target Cholesterol Values

There were no significant differences in lipid value changes between the two groups after 9 and 18 months of follow-up (Table 2). At baseline 80% of the patients in the care as usual group and 77% of the patients in the case-management group had total cholesterol values greater than 5.2 mmol/L or a total/HDL cholesterol ratio greater than 5, or both (P > 0.2) (13). At 9 months of follow-up the rate of patients having achieved a target total cholesterol of less than 5.2 mmol/L and a total/HDL cholesterol ratio of less than 5 (13) was not significantly different in the two groups (31% in the case-management group and 27% in the care as usual group, P = 0.2). At 18 months of follow-up significantly more patients in the case-management group than in the care as usual group had achieved target cholesterol values (48% versus 27%, P = 0.002, which remained significant after Bonferroni-Holms correction).

### Lipid-lowering Drug Therapy

At baseline 18% of the patients in the case-management group and 15% of the patients in the care as usual group were taking lipid-lowering drugs (P > 0.2). At 9 months significantly more patients in the intervention group than in the care as usual group were taking lipid-lowering drugs (54% versus 36%, P = 0.01; not significant after Bonferroni-Holms correction). This difference was no

---

**Table 1. Baseline Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Care as Usual Group (n = 102)</th>
<th>Case-Management Group (n = 99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (range) number of patients per primary care physician</td>
<td>1.5 (1–8)</td>
<td>1.5 (1–3)</td>
</tr>
<tr>
<td>Age, mean ± SD</td>
<td>61 ± 10</td>
<td>62 ± 9</td>
</tr>
<tr>
<td>Men/women</td>
<td>85/17</td>
<td>80/19</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>27 ± 4</td>
<td>26 ± 4</td>
</tr>
<tr>
<td>Number with previous myocardial infarction</td>
<td>47</td>
<td>40</td>
</tr>
<tr>
<td>Lipid values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC (mmol/L)</td>
<td>5.9 ± 1.1</td>
<td>5.8 ± 1.1</td>
</tr>
<tr>
<td>HDL-C (mmol/L)</td>
<td>1.3 ± 0.5</td>
<td>1.4 ± 0.9</td>
</tr>
<tr>
<td>LDL-C (mmol/L)</td>
<td>3.5 ± 1.2</td>
<td>3.3 ± 1.1</td>
</tr>
<tr>
<td>TC/HDL-C ratio</td>
<td>5.0 ± 1.9</td>
<td>4.8 ± 1.3</td>
</tr>
<tr>
<td>Blood pressure (mm Hg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>125 ± 16</td>
<td>122 ± 16</td>
</tr>
<tr>
<td>Diastolic</td>
<td>76 ± 10</td>
<td>75 ± 9</td>
</tr>
<tr>
<td>Fasting blood glucose (mmol/L)</td>
<td>6.4 ± 1.8</td>
<td>6.1 ± 1.6</td>
</tr>
<tr>
<td>Number of smokers</td>
<td>44</td>
<td>41</td>
</tr>
</tbody>
</table>

TC = total cholesterol; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol.
longer present at 18 months, when the use of lipid-lowering drugs remained stable at 57% in the intervention group but increased to 45% in the care as usual group ($P < 0.1$).

**Mean Blood Pressure Changes and Percentage of Patients Achieving Target Blood Pressure**

After 9 months the mean systolic blood pressure had increased slightly more in the case-management group than in the care as usual group. The mean change was $+5$ mm Hg (95% confidence interval [CI] 1 to 9) in the case-management group and $0$ mm Hg (95% CI $-4$ to 4) in the care as usual group ($P = 0.04$; not significant after Bonferroni-Holms correction). There was no difference in diastolic blood pressure. After 18 months there were no significant changes in blood pressure between the two groups compared with baseline (Table 3).

There was no statistically significant difference between the groups in the percentage of patients with insufficient blood pressure control at baseline. Thirty-two percent of patients in the care as usual group and 21% of patients in the case-management group had blood pressure values $\geq 140/90$ mm Hg ($P = 0.07$). At 9-month follow-up the percentage of patients with insufficient blood pressure control in the care as usual group had remained constant, whereas in the case-management group the percentage of patients with insufficient blood pressure control had risen from 21% to 34%. The between-group difference in patients not achieving target blood pressure values at 9-month follow-up was not significant ($P > 0.2$). At 18-month follow-up 42% of patients in the care as usual group and 46% of patients in the case-management group had not reached target blood pressure ($P > 0.2$; Table 3).

**Body Mass Index and Atherogenic Diet Index**

There was no statistically significant differences in the changes in the body mass index during the study between

<table>
<thead>
<tr>
<th>Table 2. Lipid Value Changes from Baseline (mmol/L) and Percentage of Patients on Target Cholesterol Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Month Follow-up</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Care as Usual Group</strong></td>
</tr>
<tr>
<td>TC, mean (95% CI)</td>
</tr>
<tr>
<td>LDL-C, mean (95% CI)</td>
</tr>
<tr>
<td>HDL-C, mean (95% CI)</td>
</tr>
<tr>
<td>TC/HDL-C ratio, mean (95% CI)</td>
</tr>
<tr>
<td>Percentage (%) of patients achieving target cholesterol values*</td>
</tr>
</tbody>
</table>

*Total cholesterol $<5.2$ mmol/L and total cholesterol/high-density lipoprotein cholesterol ratio $<5$ mmol/L.

CI = confidence interval; TC = total cholesterol; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol.

<table>
<thead>
<tr>
<th>Table 3. Blood Pressure Value Changes from Baseline and Percentage of Patients Not at Target Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Month Follow-up</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Care as Usual Group</strong></td>
</tr>
<tr>
<td>Mean change in systolic blood pressure, mm Hg (95% CI)</td>
</tr>
<tr>
<td>Mean change in diastolic blood pressure, mm Hg (95% CI)</td>
</tr>
<tr>
<td>Percent of patients not reaching target blood pressure†</td>
</tr>
</tbody>
</table>

* $P > 0.1$ after Bonferroni-Holms correction (30).

† $P < 140/90$ mm Hg.

CI = confidence interval.
DISCUSSION

The hospital-based case-management system described in this study did not lead to substantial improvements of lipid values or other cardiovascular risk factors in patients who had been hospitalized for acute coronary events. Although there was no difference between groups in achieving target cholesterol values 9 months after hospitalization, significantly more patients in the case-management group than in the care as usual group achieved target cholesterol values after 18 months of follow-up (48% versus 27%, P = 0.002, which remained significant after Bonferroni-Holms correction). This observation is difficult to explain as there were no significant differences in atherogenic diet intake or use of lipid-lowering drugs between the two groups at that time. Thus, the improved lipid control in the case-management group after 18 months, but not after 9 months, of follow-up is not easily explainable. Possible explanations include an unidentified long-term effect of the intervention such as better medication compliance, a chance finding, or use of a higher dosage of lipid-lowering drugs in the intervention group. Unfortunately, the doses of lipid-lowering drugs used were not recorded during the study, but greater use of lipid-lowering drugs in the intervention group 9 months after hospitalization may have resulted in more rapid dosage adjustments in patients failing to achieve target cholesterol values in the case-management group than in the care as usual group.

In the past some intensive case-management systems and diet or lifestyle interventions in patients with established coronary artery disease have shown an effective improvement of coronary risk factors (4,6,7), regression of coronary artery disease (1,19–23), and reduction in rate of reinfarction or need for revascularization (24,25). However, all these interventions required either substantial human and financial resources or radical lifestyle modifications. Undoubtedly, intensive case-management systems or drastic changes in lifestyle cannot be easily implemented outside of clinical trials. Scarce financial and human resources and insufficient motivation of patients to change their lifestyle outside of clinical trials limit the application of these systems to general practice. Therefore, positive results of clinical trials may not be valid for patients in general practice (26). In contrast, simple interventions based on existing resources and well accepted by patients and their physicians are more likely to prove beneficial outside of clinical trials. Unfortunately, simple interventions of low intensity addressing the modification of multiple cardiovascular risk factors can improve awareness but only rarely have shown a clinical benefit (10,11).

Two recently described approaches of medium intensity to improve lipid control after myocardial infarction failed to show significant effects on lipid control. One
program led by specialist liaison nurses to coordinate and support follow-up care in general practice after hospitalization for coronary artery disease failed to improve lipid control after 1 year of follow-up (11). In another study, information mailed about effective secondary prevention after myocardial infarction to patients and their primary care physicians did not improve the prescribing of cholesterol-lowering drugs and beta-adrenergic antagonists (10). Our study investigated the combination of both these approaches in a single case-management program.

The hospital-based case-management system described in this study consisted of 1 hour of counseling, negotiation, and agreed-upon risk factor targets during the acute hospitalization; two short follow-up contacts by phone with mailing of reminders about treatable cardiovascular risk factors were made 3 and 6 months after hospitalization. The program used an approach of individualized counseling by a physician, but preserved the relationship between patient and primary care physician. There are several possible reasons why the case-management system described in our study did not substantially improve risk factor control. A main reason may be that in successful programs case management was left to the discretion of specialized physicians or nurses assisted by lipid specialists (4,27). In our study, however, there was only a mailing of specifically designed letters to the primary care physicians summarizing a patient’s individual risk factor targets according to accepted guidelines. The ultimate choice to start or modify therapy was completely up to the patient’s primary care physician. Furthermore, contacts between patients and the study physician may have been too short or too infrequent to yield a benefit concerning risk factor control. Other studies have shown that intensive counseling during hospitalization on specialized metabolic wards for 3 weeks (6) or frequent phone contacts may achieve better medical outcome than follow-up visits alone (28). Our study was especially designed to test the effectiveness of a case-management system that would be less difficult to incorporate into existing facilities; however, our study and similarly designed studies (10,11) demonstrate that effective modification of multiple cardiovascular risk factors is difficult with a hospital-based intervention of medium intensity alone.

In our view, several aspects seem to be crucial for effective modification of cardiovascular risk factors: (1) the intensity and amount of time spent counseling the patients during hospitalization, (2) the establishment of a powerful link between inpatient and outpatient care to encourage action by primary care physicians in case of insufficient risk factor control, (3) the continuity of care in collaboration with medical personnel trained in cardiovascular risk factor control, and (4) the necessity to aim at multiple and not single risk factor modification (29). One way to implement this may be the creation of computerized monitoring systems addressing risk factor control (30) or the establishment of nurse case-management systems supported by lipid and hypertension specialists with direct communication between nurse and primary care physicians (31). Additionally, simple modifications of guidelines to allow decisions to be made about initiation of lipid-lowering drug therapy in the hospital might increase the rate of patients treated (32). Decisions on lipid-lowering drug treatment often lie with primary care physicians because most guidelines unintentionally defer the decision about drug treatment after discharge, ie, they call for an initial phase of nutritional intervention. We recently conducted a prospective randomized multicenter study comparing immediate initiation of lipid-lowering drug treatment during hospitalization with deferred treatment: immediate initiation substantially improved the rate of treated patients at 6 months (32).

Two of the strengths of this study are that very few patients eligible for the study declined informed consent (31 of 389 patients, 7.6%) and that the study had a high follow-up rate. Therefore, a selection of highly motivated patients is unlikely, and the results of this study seem to be generally valid for patients after heart attacks.

Our study has several limitations. It did not include patients older than 75 years, and its results may therefore not be applicable to an elderly population. Furthermore, several aspects of the study may have led to an underestimation of potential effects of the intervention. For example, we cannot rule out the possibility that our intervention led to a general improvement of activities addressing risk factors and thus to an underestimation of the effects of the intervention. Furthermore, compared with similar trials (5) risk factor control was quite good in the care as usual group of this study. This may also have led to an underestimation of the effects of the intervention. For all of these reasons, the case-management system may well be more effective where attention to cardiovascular risk factors during normal care is minimal.

In conclusion, the case-management system described in this study did not substantially improve risk factor control in patients who had been hospitalized for acute coronary artery disease. Innovative strategies and continued efforts at different levels are required to ensure improved risk factor control for the secondary prevention of coronary artery disease.

ACKNOWLEDGMENTS
We acknowledge Prof. D. Siscovick, University of Washington, Seattle, Washington, for helpful discussions of the study protocol and Prof. M. J. Campbell, Northern General Hospital, Sheffield, United Kingdom, for advice concerning statistical analysis of the data with respect to cluster randomization. We thank Mrs. Marianne Wigg for her excellent secretarial assistance, Mrs. Verena Brenneisen for technical and administrative assistance, and the nursing staff of the ICU at the University Hospi-
tal, Basel, who helped to ensure that every single patient admitted to the ICU was screened for study inclusion.

REFERENCES


