Extended cardiac rehabilitation for socially vulnerable patients improves attendance and outcome

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ABSTRACT

INTRODUCTION: Patients living alone or having a low socioeconomic status are likely to quit cardiac rehabilitation. We aimed to compare patients being offered extended rehabilitation (ERP) with those being offered standard rehabilitation (SRP) as concerns 1) attendance rates and 2) achievement of treatment goals at 12 months.

MATERIAL AND METHODS: During a five-year period, 508 consecutive myocardial infarction patients below the age of 70 years were included. In the first two years of the study, 205 patients were offered SRP (historic controls); during the last three years of the study, 303 patients were identified of whom socially non-vulnerable patients were assigned to SRP and socially vulnerable patients were assigned to ERP.

RESULTS: Socially vulnerable patients achieved significantly higher participation rates (97.7%) than controls (75.0%), $p < 0.0001$, if they were offered ERP. There was no difference in cardiac rehabilitation attendance rate among socially non-vulnerable patients compared to controls (84.7% versus 82.1, $p = 0.64$). Socially vulnerable patients being offered ERP also had lower levels of cholesterol, systolic blood pressure and body mass index, and a higher level of compliance with medication than controls.

CONCLUSION: Extended offers for socially vulnerable patients improve attendance rates for cardiac rehabilitation and seem to improve the share of patients achieving treatment goals.

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TRIAL REGISTRATION: not relevant.

Coronary artery disease is a major health problem in virtually all countries of the world although there are signs of a decrease in the incidence of myocardial infarction (MI) [1]. Systematic reviews of randomised controlled trials show that cardiac rehabilitation (CR) is effective in reducing mortality risk after MI [2, 3]. Patients in an everyday clinical setting who attend CR may also have a lower mortality, which may partly be attributed to the selection of healthy patients for CR [4]. In observational studies, the reported attendance rate for CR is often less than 50% [5]. The problem is apparent especially among elderly women [5, 6], patients with several risk factors [7], patients with a low socioeconomic status [7-10] and patients with limited social support [8, 11].

It is important to ensure that patients who do not attend CR are characterised and that efforts are made to include them into CR programmes [12, 13]. A strong focus on different kinds of health behaviour among socially vulnerable and socially non-vulnerable patients is important to improve the risk factor profile. Compared with the general population, socially vulnerable patients are less likely to reduce their risk factor profile, i.e. they are less likely to comply with the prescribed medicine, quit smoking, lose weight, exercise sufficiently and reduce their blood glucose levels, etc. [12, 14]. It remains largely unexplored if these modifiable risk factors can be improved by the use of extended rehabilitation programmes (ERPs) for socially vulnerable patients. Our own studies [15] suggest that socially differentiated strategies are important in improving attendance and adherence to CR programmes. The present study adopts a more clinical approach. It evaluates if risk factor levels are improved in socially vulnerable patients participating in ERP as compared with standard rehabilitation programmes (SRP).

The aims of our study were 1) to compare CR attendance rates among patients being offered SRP with those being offered ERP, and 2) to compare risk factor levels and treatments among patients receiving SRP with those receiving ERP at one year follow-up.

MATERIAL AND METHODS

Design and patients

From April 2000 to December 2005, consecutive pa-

The current high attendance rate for cardiac rehabilitation may be improved further through socially differentiated offers.

ORIGINAL ARTICLE

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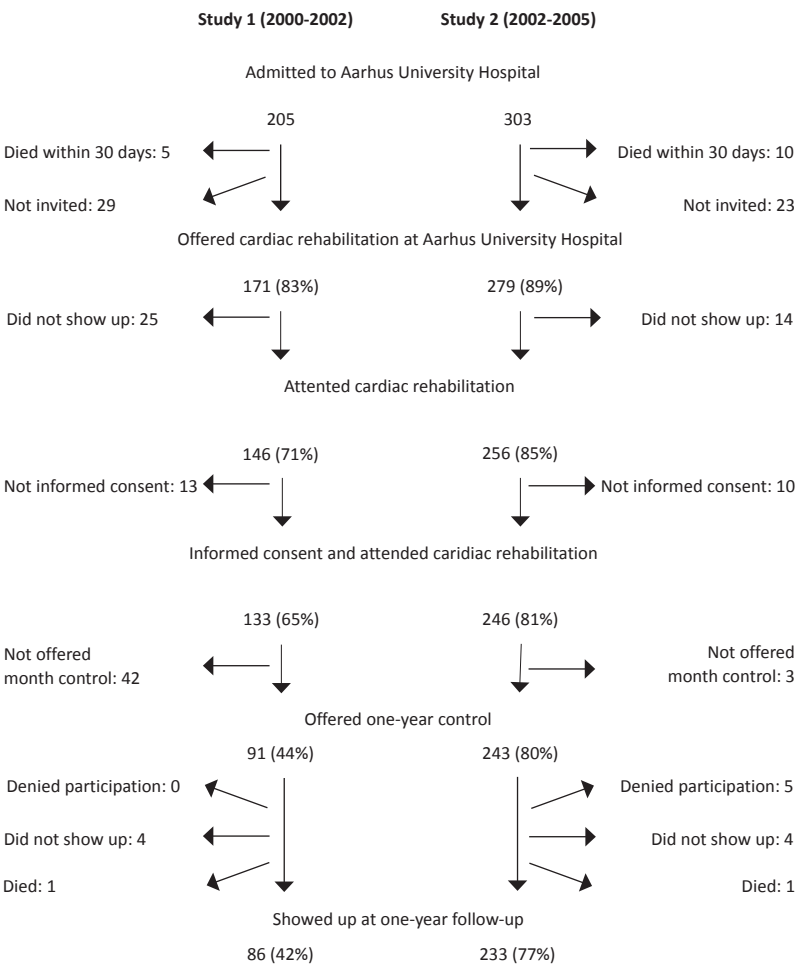
FIGURE 1

Flow – chart of patients with myocardial infarction admitted 2000-2005.



tients in the 30-69-year age group who were admitted to the Coronary Care Unit at Aarhus University Hospital, Denmark, were screened for MI as previously described [16]. During the first two years of the study (study 1), patients identified with incident MI were all offered participation in the SRP. During the last three years of the study (study 2), socially differentiated CR was offered to all incident MI patients. Socially non-vulnerable patients were offered SRP and socially vulnerable patients were offered ERP. For further details, we refer to a previous publication [15].

Standard cardiac rehabilitation programme offered to socially non-vulnerable patients

Patients were encouraged to participate. The staff started up medical, social and behavioural counselling at the Coronary Care Unit and advised patients to continue CR after discharge. The first appointment at the Rehabilitation Unit was set within two weeks after discharge. The medical check-up at the cardiologist was closely linked to other parts of the comprehensive CR. The comprehensive CR programme is divided into three phases: 1) the *acute phase* during the initial admission when all patients are offered and motivated to attend CR as part of the standard treatment, and 2) the *rehabilitation phase*, which takes place at an outpatient clinic and starts at the latest 1-2 weeks after discharge. Four individual consultations are offered, including two with a physician, focusing on needs for invasive and medical treatment. Laboratory tests concerning plasma lipids, blood glucose, blood pressure, and chest X-ray as well as an exercise test are performed. Smoking cessation training, dietary instruction, and six weeks of exercise twice-a-week are offered. In this phase, a cross-functional team takes care of patient education, life style changes, exercise and psychosocial factors. Finally 3) the *follow-up phase*, in which the general practitioner is involved in the continuous motivation and the control of the patient to achieve individualised treatment targets.

Extended cardiac rehabilitation offered to socially vulnerable patients

Patients were recruited to either SRP or ERP. All patients who were well-educated according to the Danish Educational Nomenclature (DUN) classification 5-8, Statistics Denmark and their cohabitants were invited to SRP. Identification of socially vulnerable patients: low education, i.e. 1-4 according to the DUN classification, single living or experiencing a high level of life stress combined with lack of a social network. Further details of the definition have previously been described [15]. Socially vulnerable patients were offered extended rehabilitation and eight weeks of individualised CR [15]. The exclusion criteria were severe co-morbidities, severe apoplexy, dementia, psychiatric disease, retardation and alcohol or drug addiction. Patients rejecting participation in rehabilitation and excluded patients were followed up by phone, and if relevant offered a home visit by a nurse specializing in cardiac conditions.

Case finding

Patients surviving until admission with possible MI were identified from the Coronary Care Unit at Aarhus University Hospital based on daily visits in the unit by one of

ABBREVIATIONS

CABG = coronary arteries bypass grafting
CR = cardiac rehabilitation
ERP = extended rehabilitation programme
MI = myocardial infarction
PCI = percutaneous coronary intervention
SRP = standard rehabilitation programme

the members of the research team. All patients were screened for possible MI. The diagnosis was evaluated according to international criteria within 72 hours of admission, [17].

Clinical data

Information concerning clinical parameters was obtained from the patients' charts as were the 12-lead electrocardiogram and measurements of troponin T and creatine kinase MB (CKMB). Details of re-admissions were obtained from patients' charts and from the online hospital register which covers all admissions to hospitals in Denmark. A clinical examination was performed one year after the initial admission. A structured interview concerning clinical symptoms (chest pain, dyspnoea and functional capacity), medication and psycho-social factors was obtained. Cholesterol level, blood pressure, blood glucose and body weight were measured.

Socio-demographic data

Linked data on age, sex, marital status, citizenship, number of adults and children in the household, and death were obtained from the Central Office of Civil Registration. From Statistics Denmark, we received information concerning the individual's family type, education, gross income, socio-economic status and immigration status. There was no missing information on any of these data sets.

Statistical analysis

The statistical analysis included Pearson's χ^2-test or Fisher's exact test for the 2 × 2 table. Two-way analysis of variance (ANOVA) test was used for the continuous variables.

Ethics

The Regional Committee of Ethics in Medical Science and the Danish Data Protection Agency approved the study and its database. The study conformed to the principles embodied in the Declaration of Helsinki. Patients included for clinical follow-up all signed informed consent.

Trial registration: not relevant.

RESULTS

During study 1, a total of 205 MI patients (controls) were identified and offered SRP. Patients identified during study 2 (n = 303) were assigned to either SRP (socially non-vulnerable patients) or ERP (patients living alone or who had a low educational level).

Among the controls, 133 (65%) patients signed informed consent and participated in SRP; 78 of these were socially vulnerable. Among the actively treated patients, 246 (81%) signed informed consent and participated in rehabilitation; 130 of these were socially vulnerable and were offered ERP (**Figure 1**).

The attendance rate for CR was significantly higher among patients during study 2 (81%) than among patients during study 1 (65%) ($p < 0.001$). For patients being offered CR, the CR attendance rate was significantly higher among socially vulnerable patients during study 2 (97.7%) than among socially vulnerable patients during study 1 (75.0%), $p < 0.0001$. There was no difference in CR attendance rate among socially non-vulnerable patients (84.7% versus 82.1%, $p = 0.64$).

At admission, the baseline characteristics of the patients were almost similar for patients included during

TABLE 1

Overview of baseline characteristics among incident myocardial infarction patients admitted during 2000-2005 who participated in cardiac rehabilitation at Aarhus University Hospital. Historic controls were offered standard rehabilitation (the same as offered to socially non-vulnerable patients). The values are average values.

	Socially vulnerable patients rehabilitation type			Socially non-vulnerable patients rehabilitation type		
	extended (n = 130)	controls (n = 78)	p-value	standard (n = 116)	controls (n = 55)	p-value
Total cholesterol conc., mmol/l	5.1	5.7	0.003	5.1	5.2	ns
LDL cholesterol conc., mmol/l	3.1	3.5	0.007	3.1	3.3	ns
HDL cholesterol conc., mmol/l	1.3	1.2	ns	1.3	1.3	ns
Triglyceride conc., mmol/l	1.7	2.0	0.01	1.6	1.5	ns
Fasting glucose conc., mmol/l	7.0	7.5	ns	6.7	6.8	ns
Max troponine T conc., µg/l[a]	2.9	3.6	ns	4.3	4.0	ns
STEMI, %	53.6	48.5	ns	51.1	53.8	ns
EF < 30%, %	3.5	1.9	ns	0.8	2.7	ns
Body mass index, kg/m^2	26.1	27.3	ns	26.3	26.4	ns
Cigarettes, n/day	15.2	14.1	ns	11.3	10.2	ns
Days admitted, n	6.3	5.9	ns	5.7	6.5	ns

EF = ejection fraction; HDL = high-density lipoprotein: LDL = low-density lipoprotein; ns = non-significant; STEMI = ST-elevation myocardial infarction.
a) Troponine T ≥ 0.1 µg/l was considered abnormal.

TABLE 2

Medical and invasive treatments at 12 months among incident myocardial infarction patients admitted in the 2000-2005 period who participated in cardiac rehabilitation at Aarhus University Hospital.

	Socially vulnerable patients rehabilitation type			Socially non-vulnerable patients rehabilitation type		
Treatment	extended, % (n = 118)	controls, % (n = 52)	p-value	standard, % (n = 115)	controls, % (n = 34)	p-value
Aspirin	93.1	92.3	ns	93.9	88.2	ns
Statin	83.9	75.0	0.04	89.4	79.8	0.02
Beta-blocker	76.9	82.7	ns	84.1	76.5	ns
ACE inhibitor	46.9	28.9	0.03	50.8	44.1	ns
PCI	67.4	50.0	0.03	67.4	44.5	0.01
CABG	3.6	7.7	ns	4.4	11.8	ns

ACE inhibitor = angiotensin-converting enzyme inhibitor; CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

TABLE 3

Modifiable risk factors at 12 months among incident myocardial infarction patients admitted in the 2000-2005 period who participated in cardiac rehabilitation at Aarhus University Hospital. The values are average values.

	Socially vulnerable patients			Socially non-vulnerable patients		
	rehabilitation type			rehabilitation type		
	extended (n = 118)	controls (n = 52)	p-value	standard (n = 115)	controls (n = 34)	p-value
Total cholesterol conc., mmol/l	4.4	4.9	0.0006	4.3	5.0	0.0001
LDL cholesterol conc., mmol/l	2.4	3.1	0.001	2.3	2.9	0.0001
HDL cholesterol conc., mmol/l	1.4	1.2	0.005	1.4	1.5	ns
Triglyceride conc., mmol/l	1.5	1.9	0.003	1.4	1.3	ns
Fasting glucose conc., mmol/l	6.3	6.1	ns	6.2	5.4	0.005
Systolic BP, mmHg	133	140	0.04	130	133	ns
Body mass index, kg/m^2	26.7	28.3	0.03	26.8	26.4	ns
Cigarettes, n/day	5.8	5.5	ns	2.4	3.3	ns
Stopped smoking, %	38.6	40.0	ns	58.6	49.9	ns
< 2-h exercise, %	20.3	17.5	ns	12.7	11.9	ns

BP = blood pressure; HDL = high-density lipoprotein; LDL = low-density lipoprotein; ns = non-significant.

study 1 and study 2, respectively (**Table 1**). The cholesterol level was higher among socially vulnerable patients included during study 1 than among patients included during study 2, and they had higher levels of CKMB, but not of troponins. Furthermore, the mean number of cigarettes smoked was higher among patients included during study 2 than among patients included during study 1.

The fraction of patients treated with beta-blocker, ACE inhibitor and percutaneous coronary intervention (PCI) at 12 months was higher in the group offered ERP (**Table 2**) than in the group offered SRP. The level of cholesterol was lower at 12 months in the group offered ERP than in the group offered SRP (**Table 3**). Finally, systolic blood pressure and body mass index was lower in the ERP group than in the SRP group.

DISCUSSION

In the present study, we found a higher attendance rate for CR among patients being offered a socially differentiated CR programme than among controls. The CR attendance rate was significantly higher among socially vulnerable patients during study 2 than among socially vulnerable patients during study 1 (97.7% versus 75.0%). There was no difference in CR attendance rate among socially non-vulnerable patients (84.7% versus 82.1). Although we cannot conclude on causality in the present study setting, we have the impression that it is possible by simple techniques to improve the attendance rate for CR, especially among socially vulnerable patients. We compared data from two different time periods. This raises methodological issues. We are unable to conclude on causality in the study setting as the study is not randomised, and we cannot know for certain if the effect was caused by other factors such as change of treatment principles from study 1 to study 2 (e.g. more patients were treated with primary angioplasty and clopidogrel during study 2). There were some changes in treatment principles from study 1 to study 2; these changes were mainly caused by two large clinical trials [18, 19].

Additionally, more patients with a high degree of physical and psychiatric co-morbidity might have been included during study 2 as the attendance rate was higher. This could result in an underestimation of the effect of socially differentiated rehabilitation.

The study is hypothesis generating and we need randomised trials in order to document any causal effect of socially differentiated rehabilitation. Treatment goals (level of cholesterol, blood pressure, blood glucose and body mass index, smoking cessation and compliance with medication) were in general sufficiently reached in both study periods, although more patients were treated sufficiently in study 2. We found the level of systolic blood pressure, the triglyceride level and the body mass index to be lower in socially vulnerable patients who were offered ERP than in controls, as were the fraction being treated with ACE inhibitors. In general, the cholesterol level was lower during study 2 (at admission and at 12 months) and so was the fraction treated with statins. In this study, socially very disadvantaged patients were also included, as few patients were excluded. It is therefore an important finding of this study that levels of cholesterol among socially vulnerable patients who participated in ERP were just as low as among socially non-vulnerable patients.

This study is limited by the relatively small number of MI patients included and by the exclusion of patients above the age of 70. Co-morbidity was the main reason why we excluded elderly patients. Although our study results are context dependent, we believe that they show a realistic picture of the everyday clinical setting for MI patients since all patients from a well-defined cohort were included during a five-year period. Whether a patient was considered socially vulnerable or non-vulnerable was predefined by their status as singles or their low educational level.

Only few patients rejected to participate in study 2, and thus a systematic screening method and knowledge of motivational interview techniques are important. In study 1, the attendance rate was higher than that observed in most other studies [5] as three out of four MI patients attended CR. The CR referral procedure for MI patients at Aarhus University Hospital is a well-established routine in the Coronary Care Unit. Patients are presented to CR in the acute phase of the MI, and as a result the motivation to attend rehabilitation may be

stronger than known from most studies. Another explanation for the high attendance rate in this study is the age limit which excludes patients above the age of 70. Females and elder included patients were not less likely to attend CR, which has been found by others [5, 6].

Socio-economic and psycho-social factors, such as lack of social support, are well-known to influence the prognosis after MI [7, 20]. Single living may be associated with lack of social support and with social habits related to eating, drinking and smoking.

CONCLUSION

An already high attendance rate for CR can be improved further through socially differentiated offers. Simple screening tools and easily defined definitions of socially vulnerable and non-vulnerable patients are important factors in improving the attendance rate for CR. Furthermore, levels of modifiable risk factors at twelve months were improved. We still need longer follow-up periods and randomised trials in order to sufficiently document the effect of socially differentiated CR.

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CORRECTION: In the first published edition of this article a regrettable mistake occurred in the subheadings of Table 1 and Table 2 under the category Socially non-vulnerable patients.

The subheading was written ,,extended", instead of the correct ,,standard".

The mistake has been corrected per 13 March 2013.