



CARDIAC REHABILITATION

A survey on implementation in Denmark
and presentation of a local model

Ann-Dorthe Olsen Zwisler
PhD dissertation
University of Copenhagen
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This PhD dissertation is based on the following manuscripts, book chapters and home page prepared during the period January 2000 until May 2004.

A) Zwisler ADO, Træden UI, Videbæk J, Madsen M. Cardiac rehabilitation in Denmark. Still room for expansion. Provisionally accepted Scan J Pub Health, May, 2004.

B) Zwisler ADO, Schou L, and Sørensen LV (*red.*). [Cardiac Rehabilitation. Rationale, methods and experiences from Bispebjerg Hospital.] Copenhagen, H:S Bispebjerg Hospital, National Institute of Public Health; 2003. (<http://www.hjerterehab.dk/rehab/>, accessed May 31, 2004).

The original book was published in Danish in November 2003. The listed book chapters have been translated into English as part of this PhD dissertation.

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Zwisler ADO. Future challenges. Chapter 15.

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C) Zwisler ADO, Schou L, Soja AMB, Brønnum-Hansen H, Gluud C, Iversen L, Sigurd B, Madsen M, Fischer-Hansen J. A randomized clinical trial of hospital-based, comprehensive cardiac rehabilitation versus usual care for patients with congestive heart failure, ischemic heart disease or high risk of ischemic heart disease (the DANREHAB Trial) – design, intervention and population. Submitted, April 2004.

Contents

Preface	i
Acknowledgements	ii
Abstract (English).....	iii
Abstract (Danish)	iv
Abbreviations.....	vi
1. Introduction	1
1.1 Extent of comprehensive cardiac rehabilitation at hospitals in Denmark	
1.2 Implementing comprehensive cardiac rehabilitation in local clinical practice	
1.3 Evaluating comprehensive cardiac rehabilitation in a local setting in Denmark	
1.4 Aims	
2. Current recommendations	2
2.1 Evolution of cardiac rehabilitation	
2.2 Definition	
2.3 Current Danish guidelines	
2.4 Denmark's legislation	
2.5 Ethical aspects of cardiac rehabilitation	
3. The rationale of comprehensive cardiac rehabilitation.....	6
3.1 Health benefits and outcome measures	
3.2 Quality of life among cardiac patients in Denmark	
3.3 Body of evidence	
3.4 Evidence on cardiac rehabilitation	
3.5 Evidence of core components	
3.6 Integration of the core components	
4. Implementation of comprehensive cardiac rehabilitation at hospitals in Denmark.....	16
4.1 Introduction	
4.2 Acute care Hospitals	
4.3 Methods	
4.4 Main results	
4.5 Discussion	
5. A local model of comprehensive cardiac rehabilitation	21
5.1 Introduction	
5.2 Basic principles	
5.3 Experience	
6. Evaluation of the local comprehensive cardiac rehabilitation programme	27
6.1 Introduction	
6.2 Trial design	
6.3 Study population	
6.4 Discussion	
6.5 Publication plan	
7. Conclusion and perspectives.....	32
7.1 Introduction	
7.2 Definition	
7.3 Evidence of comprehensive cardiac rehabilitation	
7.4 Implementation in Denmark	
7.5 A local model of comprehensive cardiac rehabilitation	
7.6 Evaluation of the local model: study design and material	
7.7 Future challenges of cardiac rehabilitation in Denmark	
REFERENCES.....	37

Preface

Picture people sitting motionless in a chair because they believe that exercise will harm their heart. People who want to quit smoking but do not get any support even though professional support is known to make a difference. People who feel insecure about going to sleep because they are not sure whether they will wake up the next morning. In my capacity as a resident physician in cardiology, I often meet these people, who are all receiving optimal pharmaceutical and invasive treatment, raising the question of how to organize cardiac care to handle these important dimensions of health, too.

Comprehensive cardiac rehabilitation with potential benefits in reducing mortality, slowing down disease progression and improving health has been emphasized in guidelines to meet some of these demands in comprehensive cardiac care. Since scientific and documented practical experience on cardiac rehabilitation is sparse in Denmark, the Department of Cardiology of H:S Bispebjerg Hospital took a decisive initiative in 1997 to implement comprehensive cardiac rehabilitation. The Cardiac Rehabilitation Unit was founded in autumn 1999, and a 3-year project was designed to broadly evaluate the local comprehensive cardiac rehabilitation; the evaluation included this PhD study on cardiac rehabilitation in Denmark.

The PhD study was initiated at the Unit of Preventive Medicine and Health Promotion at H:S Bispebjerg Hospital and has been carried out at the Department of Cardiology, H:S Bispebjerg Hospital and at the National Institute of Public Health from January 2000 to May 2004. During the study period, health professionals, politicians and health planners have stressed the importance of cardiac rehabilitation, and one aim of this dissertation has been positively received, because cardiac rehabilitation is put on the political and professional agendas (annex A2).

Jørgen Fischer-Hansen (Department Head), Bjarne Sigurd (Chief Physician) and Lars Iversen (Head, Unit of Preventive Medicine and Health Promotion) placed their confidence in me and affiliated me with the idea of comprehensive cardiac rehabilitation back in 1997, when I was a resident physician at the Department of Cardiology.

I have taken on the challenges offered to me of describing the programme, raising money, writing a scientific protocol, establishing the Cardiac Rehabilitation Unit, conducting the randomized clinical trial as the principal investigator, serving as the programme manager, collecting and managing data, writing the local manual and establishing a home page, representing the Cardiac Rehabilitation Unit and finally presenting the results from the project. Facing these challenges has provided precious scientific and personal experience on the nature of implementing cardiac rehabilitation. I hope that this experience will contribute to the development of comprehensive cardiac rehabilitation to benefit patients needing these services.

A large-scale randomized clinical trial was conducted as a part of the programme and described in this dissertation. Results from the trial will be analysed and prepared for publication when the outcome data is available within the coming year.

Acknowledgements

I am deeply indebted to the entire DANREHAB team, who all struggled to adhere to the philosophy of comprehensive cardiac rehabilitation throughout the 3-year project period. The hard work and persistent support of the interprofessional team was a prerequisite for the success of the PhD study and the DANREHAB Trial.

I especially thank my supervisors, Mette Madsen (Deputy Director, National Institute of Public Health), Bjarne Sigurd (Chief Physician, Department of Cardiology, Bispebjerg Hospital), Lars Iversen (Former Head, Unit of Preventive Medicine and Health Promotion) and Henrik Brønnum-Hansen (Statistician, National Institute of Public Health) for providing invaluable supervision and support throughout the study period. I am grateful to Mette Madsen and the National Institute of Public Health for strong support in finalizing the dissertation and unwavering scientific backing for many years. I am greatly indebted to Jørgen Fischer-Hansen, an outstanding clinical mentor of cardiology, and a mentor in the art of conducting high-quality randomized clinical trials. He placed great faith in me by delegating me the responsibility for the project. Thanks to Lars Iversen for providing key knowledge and perspectives on health promotion, the social sciences and policy-making. Bjarne Sigurd provided valuable expertise on the historical perspective of health care. He contributed strongly to fundraising, and taught me the importance of proper diagnosis and risk stratification in cardiac care. In addition, I thank the administrators of H:S Bispebjerg Hospital, who strongly supported the project; and Christian Gluud (Head, Copenhagen Trial Unit, Rigshospitalet (National Hospital)), who participated in initial designing the study, managed the centralized randomization procedure of the trial and emphasized the importance of conducting systematic literature review.

I thank my dear colleagues Anne Merete Boas Soja; Lone Schou; Ulla Ischiel Træden; Lillian Møller; Kirsten Mundt; Annette Kann for inspiring discussions and sharing common interests in health promotion. The members of the following groups have brought me great inspiration with in health promotion, disease prevention and rehabilitation: the Myocardial Infarction Group, National Institute of Public Health; the Working Group on Cardiac Rehabilitation, the Working Group on an Exercise Promoting Hospital and the Interest Group on Diagnosis-related Groups and Disease Prevention, National Network of Health Promoting Hospitals in Denmark; the Working Group on Cardiac Rehabilitation, Danish Society of Cardiology; and the staff of the Unit of Preventive Medicine and Health Promotion, H:S Bispebjerg Hospital.

I express my gratitude to the following for financial support: Copenhagen Hospital Corporation Research Council, Danish Research Academy, Danish Heart Foundation, Apotekerfonden af 1991, Sabbath Programme for Chief Physicians in the Copenhagen Hospital Corporation, Villadsen Family Foundation, Ministry of the Interior and Health, Denmark, development funds from the City of Copenhagen, Eva & Henry Frænkels Mindefond, health technology assessment funds from the National Board of Health, Murermester LP Christensens Fond, Fund for Alternatives for Research Animals of the Danish Animal Protection Society, Bristol-Myers Squibb, Merck Sharp & Dohme Danmark and AstraZeneca A/S.

I dedicate this dissertation to the 770 patients who consented to participate in the trial and to future patients who need comprehensive cardiac rehabilitation.

Abstract (English)

Cardiac rehabilitation (CR) is recommended as part of integrated cardiac care in Denmark to improve the health-related quality of life, slow disease progression and reduce mortality among the large group of patients suffering from ischaemic heart disease.

This PhD dissertation assesses the implementation of hospital-based CR at hospitals in Denmark and presents a local model of comprehensive CR that complies with Denmark's current guidelines. The dissertation is based on two articles, five book chapters and a home page (www.CardiacRehabilitation.dk). The dissertation outlines the current recommendations for CR, reviews the evidence for CR and summarizes the results of a survey on the implementation of CR at hospitals in Denmark. Further, a local model of outpatient comprehensive CR is presented.

Current recommendations. According to Denmark's current guidelines and statements from professionals, politicians and health planners, comprehensive CR should be implemented throughout Denmark's health care system for patients with ischaemic heart disease. In the future, these services might also be aimed at patients with heart failure and patients at high risk of developing ischaemic heart disease. CR is a comprehensive intervention including: individual tailoring, patient education, exercise training, dietary guidance, smoking cessation, psychosocial support and systematic risk factor management and clinical assessment.

Evidence. The international scientific literature on CR has been growing steadily since the late 1960s, and the number of publications has more than doubled within the last 10 years. Systematic meta-analysis has documented that exercise-based CR reduces overall mortality by 20% and cardiac mortality by 26%. Further, CR has been documented to reduce important risk factors. Studies have indicated that CR positively influences the health-related quality of life. The positive influence on the health-related quality of life still remains to be proven, and standardized validated disease-specific instruments for measuring the health-related quality of life are needed.

The evidence for CR has primarily been documented among men younger than 65 years of age who have experienced myocardial infarction. A subgroup analysis indicates that these results can be applied to a broader group of patients. The intervention trials on comprehensive CR vary markedly, and the quality of the trials has been questioned due to lack of allocation concealment, lack of blinding and poor or missing description of intervention.

Implementation in Denmark. A postal questionnaire survey showed that most hospitals in Denmark offer one or more of the CR components. However, not all hospitals offer comprehensive CR that complies with the current guidelines. The survey in 1999 found that 36% of hospitals in Denmark offer comprehensive CR according to Denmark's current guidelines but our survey might overestimate the coverage. Differences in health care systems and the organization of services do not allow the coverage of CR to be directly compared between countries, but Denmark seems to be lagging 5 years or more behind compared to England and Germany. Several CR activities have been initiated in Denmark since the survey in 1999 and may have positively influenced the coverage of CR at hospitals in Denmark.

A local model of comprehensive CR. H:S Bispebjerg Hospital received Denmark's guidelines on CR in 1997 and initiated implementation of comprehensive CR the same year. Since Denmark's guidelines do not describe comprehensive CR in detail, a local programme was developed. The Cardiac Rehabilitation Unit was founded in 1999, and a 3-year study was conducted on implementing a local model of comprehensive CR. The study showed that outpatient comprehensive CR that complies with Denmark's existing guidelines could be organized and implemented at a large urban hospital. Experience from the study indicated some key areas that need special attention in implementing hospital-based comprehensive CR locally: individual tailoring and coordination must be systematically assessed; the quality of each core component must be systematically monitored; continual development of an interprofessional approach and culture must be given priority; profession-specific as well as CR-

specific education are cornerstones in ensuring high-quality CR services. A coherent CR programme across sectors and CR phases must be ensured.

Evaluation of the local model: study design and material. The DANREHAB Trial, a large-scale randomized clinical trial, was designed to clarify whether the local model of comprehensive CR is superior to usual care. The Trial included 770 patients and is the largest single-centre trial conducted so far worldwide on comprehensive CR aimed at a broad target group. The results of the DANREHAB Trial will be prepared for publication within the coming year and will contribute to knowledge on CR in a hospital setting in Denmark. Further, the evaluation will contribute to knowledge on the cost-effectiveness, organizational issues and patients' perspectives.

Conclusion and perspectives. This dissertation shows that Denmark's health care system made marked progress in implementing CR services in the 1990s; nevertheless, the quantity and quality of services vary widely, and the coverage of services still needs to be expanded considerably. The local implementation study showed that outpatient comprehensive CR services that comply with Denmark's current guidelines can be organized and implemented at a full scale. The local study can contribute to the development and implementation of CR in Denmark. Further results from evaluation of the local programme will bring knowledge on hospital-based CR in Denmark.

The overall challenge is to provide high-quality CR services to everyone who can benefit and at a level appropriate to their needs. Several reports and statements have been published in Denmark since 1997; the time has come to prepare practical action plans nationally, regionally and locally. These plans must consider the continuum of care, the quality of CR services, educational needs and future research and development.

Abstract (Danish)

Hjerterehabilitering anbefales i dag som en del af den samlede efterbehandling til patienter, der lever med iskæmisk hjertesygdom med henblik på at forbedre patienternes livskvalitet, standse sygdomsudviklingen og reducere dødeligheden.

Denne PhD-afhandling om hospitalsbaseret hjerterehabilitering undersøger, i hvor høj grad hjerterehabilitering er implementeret på sygehuse i Danmark, og præsenterer en lokal model for integreret hjerterehabilitering, som lever op til de gældende retningslinjer. Afhandlingen er baseret på to videnskabelige artikeludkast, fem bogkapitler og en hjemmeside (www.hjerterehabilitering.dk). I afhandlingen gennemgås de gældende anbefalinger, definitioner og den videnskabelige dokumentation for hjerterehabilitering. Afhandlingen fremlægger resultaterne fra undersøgelsen om hjerterehabilitering på sygehuse i Danmark og beskriver en lokal model for implementering af integreret hjerterehabilitering på et sygehus.

Gældende anbefalinger. Ifølge gældende danske kliniske retningslinjer og anbefalinger fra sundhedsprofessionelle, politikere og planlæggere skal patienter med iskæmisk hjertesygdom efter udskrivelse fra sygehuset i dag tilbydes integreret hjerterehabilitering omfattende: individuel tilrettelæggelse, patient undervisning, fysisk træning, støtte til kostomlægning, støtte til rygeophør, psykosocial støtte samt systematisk risikopfølgning og klinisk kontrol. Nøgleordene i hospitalsbaseret hjerterehabilitering er: integreret behandlingstilgang, individuel tilrettelæggelse, tværfaglig opgaveløsning og en bred målgruppe.

Videnskabelig dokumentation. Mængden af videnskabelige arbejder om hjerterehabilitering har været støt stigende siden 1960'erne, og inden for de sidste 10 år er antallet af offentliggjorte artikler på området mere end fordoblet. En systematisk litteraturgennemgang har vist, at hjerterehabilitering, som omfatter fysisk træning, kan reducere den totale dødelighed med 20% og hjertedødeligheden med 26%. Herudover er det vist, at hjerterehabilitering kan påvirke vigtige risikofaktorer for udvikling af hjertesygdom, herunder blodtryk, kolesterol og rygning. Studier tyder på, at hjerterehabilitering kan påvirke patienternes helbredsrelaterede livskvalitet,

hvilket dog ikke er dokumenteret på grund af manglende ensartede instrumenter til måling af helbredsrelateret livskvalitet blandt hjertepatienter.

Effekten af hjerterehabilitering i øvrigt er overvejende dokumenteret blandt mandlige blodpropssramte patienter under 65 år. Studier tyder på, at effekten fra denne gruppe kan overføres til en bredere målgruppe.

Implementering i Danmark. På baggrund af en postomdelt spørgeskemaundersøgelse gennemført i slutningen af 1999 fandt vi, at de fleste sygehuse i Danmark tilbyder en eller anden form for hjerterehabilitering, men langt fra alle sygehuse har tilbud, der lever op til de gældende retningslinjer. Undersøgelsen viste, at 35% af sygehuse tilbød integreret hjerterehabilitering. Ved sammenligning med andre danske oplysninger fandt vi, at vores undersøgelse er tilbøjelig til at overvurdere udbredelsen. Det er ikke muligt at sammenligne niveauet i Danmark med niveauet i andre lande direkte, da der er store forskelle i sundhedssystemerne verden over. Resultaterne fra undersøgelsen tyder imidlertid på, at Danmark er mindst 5 år bagud sammenlignet med England og Tyskland, når det drejer sig om udbredelsen af hjerterehabilitering. Siden undersøgelsen i 1999 har en række aktiviteter været gennemført indenfor hjerterehabiliteringsområdet; disse har formentlig haft positiv indflydelse på udbredelsen af hjerterehabilitering på landets sygehuse inden for de sidste år.

En lokal model for integreret hjerterehabilitering. H:S Bispebjerg Hospital igangsatte implementeringen af hospitalsbaseret integreret hjerterehabilitering i 1997. På grund af sparsom beskrivelse af selve indsatsen i de nyudgivne retningslinjer blev et lokalt program udviklet. Hjerterehabiliteringsenheden på Bispebjerg Hospital blev etableret i 1999, og et treårigt studie blev igangsat mhp. evaluering af den lokale model. Projektet har vist, at det er muligt at organisere og implementere et lokalt hjerterehabiliteringsprogram, som lever op til de gældende retningslinjer. Projektet har identificeret en række områder, som bør medtænkes i forbindelse med implementering af hjerterehabilitering lokalt: Systematisering af den individuelle tilgang og tilrettelæggelse af det individuelle forløb, kvalitetssikring og monitorering af den samlede indsats samt prioritering og videreudvikling af den tværfaglige arbejdsform og kultur. Erfaringerne fra H:S Bispebjerg Hospital har vist, at omdrejningspunktet for en god hjerterehabiliteringsindsats er høj monofaglig viden samtidig med specifik uddannelse af personale i hjerterehabilitering.

Evalueringsmodel. Som led i evalueringen af hjerterehabiliteringsindsatsen på H:S Bispebjerg Hospital blev der gennemført en omfattende undersøgelse, hvor patienterne ved lodtrækning fik tilbud om behandling i hjerterehabiliteringen eller tilbud om sædvanlig efterbehandling. Undersøgelsen, som omfatter 770 patienter, er et af de største lodtrækningsforsøg om integreret hjerterehabilitering i verden. Resultaterne fra undersøgelsen vil blive analyseret i løbet af det kommende år. Evalueringsresultaterne vil udover oplysninger om effekten af integreret hjerterehabilitering bidrage med viden om "cost-effectiveness", organisatoriske forhold og patientperspektivet.

Konklusion og perspektiv . Resultaterne fra denne PhD-afhandling viser, at udbredelsen af hjerterehabilitering er øget gennem de sidste 10 år. Kvaliteten og kvantiteten af tilbuddene på landets sygehuse varierer meget, og der er behov for at udbygge området. Det lokale studie på Bispebjerg Hospital har vist, at det faktisk er muligt at etablere et hjerterehabiliteringstilbud, der lever op til de gældende retningslinjer, og det lokale studie kan bidrage til udviklingen og implementeringen i Danmark. Samtidig vil fremtidige resultater fra undersøgelsen bidrage til vores viden om hjerterehabilitering i Danmark.

Siden 1997 har der været udarbejdet en række rapporter og aktiviteter, men tiden er nu inde til at implementere hjerterehabilitering og udarbejde praktiske implementeringsplaner nationalt, regionalt og lokalt på sygehuse. Implementeringsplanerne må indtænke sammenhængende hjerterehabiliteringsforløb, kvaliteten i behandlingen, personaleuddannelse og fortsat udvikling og forskning inden for området.

Abbreviations

ACE-inhibitors	Angiotensin converting enzyme inhibitors
CABG	Coronary by pass operation
CCR	Comprehensive cardiac rehabilitation
CHF	Congestive heart failure
CI	Confidence intervals
CR	Cardiac rehabilitation
DRG	Diagnosis related groups
HRQoL	Health related quality of life
ICD10	WHO: International Classification of Diseases Version 10
IHD	Ischemic heart disease. In this context defined as the broad group of patients with angina pectoris, myocardial infarctions and/or patients going through PTCA, CABG. When referring to data from the National Heart Registry the diagnoses of CHD includes the following ICD10 diagnoses codes: I20-I25.
MI	Myocardial infarction
PCI	Percutaneous coronary intervention
PTCA	Percutaneous transluminal coronary angioplasty
RCT	Randomised clinical trial

1. Introduction

Mortality rates from ischaemic heart disease (IHD) have been declining dramatically in recent years (1,2), but IHD is still one of the leading causes of death in Denmark (3). About 16% of adults in Denmark have IHD (4). New and highly effective treatment methods have been introduced and intensified during the 1990s: antiplatelet drugs, beta-blockers, statins, angiotensin-converting enzyme (ACE) inhibitors and acute invasive treatment. Nevertheless, IHD still seems to cause major physical and mental disability (5). IHD is responsible for a large and growing number of hospital admissions in Denmark. The health care expense is also growing rapidly: partly due to the increase in admissions with heart failure, the end-stage of IHD, and increased treatment intensity (invasive and pharmaceutical treatment). The disease pattern of IHD has been changing from a life-threatening disease towards a chronic disease during the last decade, placing new demands on cardiac health care services (6).

Current guidelines in Denmark and elsewhere (7-10) recommend cardiac rehabilitation (CR) as part of comprehensive cardiac care. The aims of CR are to stabilize heart disease, improve physical capacity, limit physical and mental disability, prevent relapse and improve the overall quality of life. The long-term goals of CR are to reduce patients' long-term risk of heart disease and to reduce morbidity and mortality (7-10). According to the guidelines, these goals can be realized through comprehensive CR (CCR) programmes based on patient education, exercise training, dietary guidance, smoking cessation, psychosocial support, risk factor management and clinical follow-up assessment. Initial diagnosis, clinical assessment and acute treatment are prerequisites for CCR and are not included. Guidelines were published throughout Europe in the 1990s (10), and Denmark's clinical guidelines for CR (9) were published in 1997.

1.1 Extent of comprehensive cardiac rehabilitation services at hospitals in Denmark

Studies on CR services carried out during the 1990s (11-15) show poor compliance with national guidelines and great variation in services throughout Europe. The recent Carinex Survey on CR services in European Union countries in which Denmark did not participate (16) showed similar poor results and an especially short supply in countries with the greatest burden of cardiovascular disease. An unpublished small survey in Denmark from 1996 (17) indicated that few hospitals offered CR that complied with the published guidelines, but the extent of hospital-based CR services in Denmark in the late 1990s was not fully known.

1.2 Implementing comprehensive cardiac rehabilitation in local clinical practice

Even though Denmark's national guidelines (9) recommend CCR for a broad group of patients, the guidelines do not describe the clinical CCR intervention in detail. Similarly, most randomized clinical trials (RCTs) on CR do not describe the components of interventions or describe them poorly (18,19). This creates difficulty in reproducing programmes proven to be effective, and detailed descriptions of CR intervention have been requested (18,20). Further lack of documented practical experience in Denmark (17,21,22) raises the need for collecting practical experience on CCR intervention. Describing the reorganization thoroughly was given high priority when a local hospital-based CCR programme was initiated at H:S Bispebjerg Hospital, Denmark's national model for a health-promoting hospital (23).

1.3 Evaluating comprehensive cardiac rehabilitation in a local setting in Denmark

Because scientific experience with CCR is sparse in Denmark, the extent to which international evidence on CCR can be applied to Denmark's health care system within the modern therapeutic era of cardiology is not fully known. The broad model of health technology assessment (24) was chosen to evaluate the local CCR programme at H:S Bispebjerg Hospital to determine the impact of the tested programme on all levels. The health technology assessment will examine the effect of the technology, the economics, the organizational aspects and the perspectives for patients. The main study: The DANREHAB trial, which is outlined as part of this dissertation, was designed as a large-scale RCT comparing CCR with usual care among patients with congestive heart failure (CHF), patients with IHD and patients with a high risk of IHD, the latter defined as patients with three or more classical risk factors for IHD.

1.4 Aims

This PhD dissertation focuses on hospital-based CCR. The aims of this PhD dissertation are:

- to assess the implementation of CCR at hospitals in Denmark;
- to present a local model of CCR; and
- to outline the trial design and study population of the RCT.

When the DANREHAB Trial started in 1999, the results of the trial were planned to form part of this PhD dissertation. However, challenging study logistics only allowed me to review the study design, patient recruitment and baseline data of the DANREHAB population within the fixed time frame of the dissertation of three years. In replacement of the results from the RCT the dissertation includes an extensive description of the implementation of the local CCR programme. The main results from the RCT will be prepared for publication during fall 2004 when outcome data are available.

2. Current recommendations

This chapter briefly presents the international evolution of CR and Denmark's definition of CR. The chapter also describes Denmark's guidelines on CR and provides information on legal and ethical aspects of CR.

2.1 Evolution of cardiac rehabilitation

The definition of CR has evolved considerably since the first programme was announced more than 40 years ago. Historically, patients with IHD were restricted to bed rest for up to 2 months because physical activity was feared to lead to cardiac rupture, heart failure and sudden death. By the late 1930s, many members of the labour force in New York State were on disability pension because of heart problems, and cardiac work-evaluation units and rehabilitation centres were established to evaluate people's physical and mental capacity for work (25).

Eventually, it was noted that ambulation after acute myocardial infarction (AMI) was not associated with an increase in adverse events; it provided benefits, avoiding some of the complications of bed rest (25,26). Saltin et al (27) reported that the functional capacity of normal subjects confined to bed for 3 weeks decreased by about 33%. Equally important was the finding that an equal period of appropriate training was necessary to restore the condition before bed rest. As early ambulation was increasingly applied, it evolved into structured and formalized inpatient CR (25,26).

Pre-discharge exercise testing was introduced to assess the status of patients recovering from AMI (28). As the length of hospital stay declined significantly, formal outpatient programmes primarily consisting of exercise therapy were initiated in the United States in the late 1960s (25,26). The Council on Rehabilitation of the International Society of Cardiology was created in 1966, the WHO Regional Office for Europe arranged first European seminar on CR in 1967, and the First International Congress on Cardiac Rehabilitation was held in September 1977 (29,30). Preventive strategies were emphasized during the late 1970s and 1980s based on the growing evidence of the potential to hinder or reverse the underlying pathological process of atherosclerosis (31). During the same period, behavioural approaches to the treatment of IHD became widely recognized as a significant complement to traditional medical and surgical therapies (30,32). Contemporary CR has since then gradually evolved into complex interventions based on several treatment modalities, including exercise training, patient education, behavioural and psychosocial counselling, risk factor management, pharmaceutical therapy and clinical assessment.

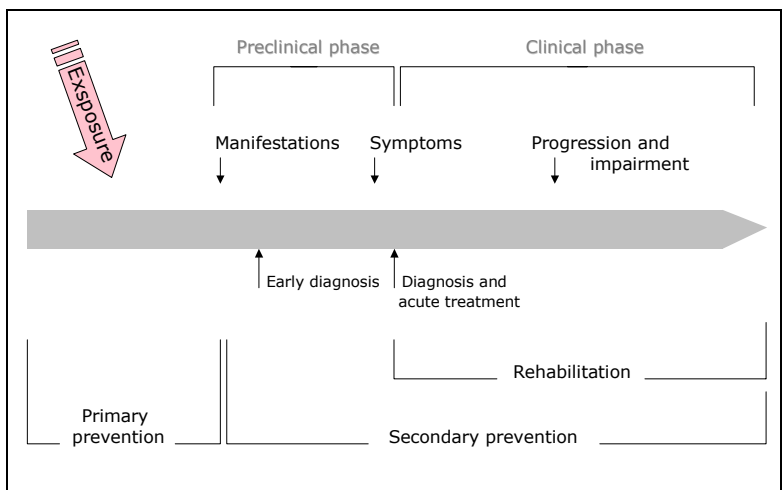
2.2 Definition

Two expert consultations convened by WHO in 1992 defined CR as: "the sum of activity required to influence favourably the underlying cause of the disease, as well as to ensure the patients the best possible physical, mental and social conditions so that they may, by their own efforts, preserve, or resume when lost, as normal a place as possible in the life of the community" (31). The goals of CR are to improve functional capacity, alleviate

or lessen activity-related symptoms, reduce unwarranted disability and enable the patients to return to a useful and personally satisfying role in society (9,33).

CR today strongly emphasizes secondary prevention strategies, defined as initiatives to identify symptoms and disease at early stages to reduce the course of disease and contribute to improving the prognosis, and identifying patients at high risk of developing cardiovascular disease in order to prevent disease progression (Figure 2.1) (9,19,33-36).

Figure 2.1. Development of IHD and strategies for prevention



Adapted from Storm & Olsen (37).

2.3 Current Danish guidelines

In 1997, the Danish Heart Foundation and the Danish Society of Cardiology published clinical guidelines for CR in Denmark (9). The literature on CR was reviewed when the guidelines were prepared in 1997, and this was recently updated in 2003 as part of new practical guidelines on implementing hospital-based CR published by the National Network of Health Promoting Hospitals in Denmark, the Danish Heart Foundation and Danish Society of Cardiology (34). The practical guidelines focus solely on rehabilitation of IHD and were prepared to overcome the lack of detailed description of the CR intervention in the 1997 guidelines. The role of CR in treating people with IHD has subsequently been mentioned among professionals (38,39) and has been emphasized among politicians and administrators (40-44).

The Danish national guidelines (9,34) follow current international recommendations (7,8,10,19), but national guidelines across Europe vary somewhat regarding orientation, the extent to which the guidelines are based on a review of the scientific evidence, the number of professions involved, legal requirements and other aspects (10).

Integrated comprehensive approach

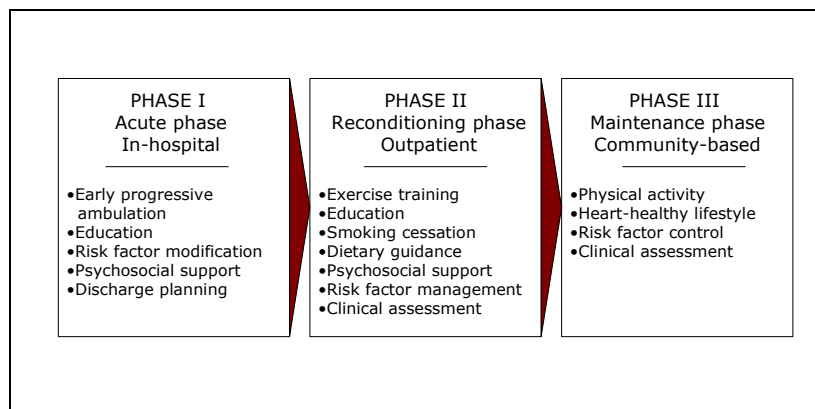
According to current guidelines in Denmark and elsewhere (7-10,19,34), outpatient CR includes comprehensive individually tailored programmes comprising the following treatment modalities, called core components internationally:

- baseline patient assessment;
- exercise training;
- patient education;
- smoking cessation;
- dietary guidance;
- psychosocial support; and
- risk factor management and clinical assessment.

The continuum of care

Rehabilitation of patients with IHD was characterized early as a longitudinal, comprehensive care programme that ends when the patient dies (45). CR can be divided into three phases: I) the acute (in-hospital) phase, II) the reconditioning (outpatient) phase and III) the lifetime maintenance (community-based) phase* (10). Each phase has its own objectives for patient care and progression (Figure 2.2). Successful CR requires optimum clinical assessment, diagnosis and acute treatment.

Figure 2.2. Three phases of cardiac rehabilitation



Knowledge is lacking on how the length of phase II CR and the resulting effects are related (19). The length of phase II programmes varies greatly in Europe: from 1 to 46 weeks (10,16); the programmes included in a meta-analysis of the effects varied in length from 1 week to 30 months (18). A small RCT including 60 patients detected no differences in improved exercise capacity and general health and well-being between groups undergoing a 10-week programme and a 4-week programme (47). Although this aspect has not been sufficiently studied, the most recent position paper in Europe (19) recommends at least 8–12 weeks.

Individual tailoring

One main principle of CR is that treatment should be individually tailored for each patient (7-10,19,34). This principle is considered key in the future organization of CR (48). Further, modern cardiology emphasizes this as the organizational focus of treatment (49). Previous assessments of the extent to which European countries have achieved treatment goals (50,51) have shown that the traditional organization of follow-up services and secondary prevention has been inadequate to achieve the goals set. Recent studies on CR (52,53) have shown that individually tailored programmes achieve goals better and are cost-effective.

According to guidelines in Denmark (9,34), an individual CR programme should be tailored to the needs and resources of each patient based on individual discussions between the patients and health professionals. Involving patients is considered a prerequisite for success.

A multidisciplinary and interprofessional approach

Current guidelines in Denmark and elsewhere (7-10,19,34) unanimously emphasize that hospital-based CR efforts should be based on a multidisciplinary and interprofessional approach. In Europe, the practitioners include a core team of practitioners with whom the patient has daily contact and a peripheral team that can be activated under special circumstances. According to the national guidelines (9,34), the core team comprises physicians specializing in cardiology, nurses, physical therapists and clinical dietitians.

* Literature from the United States often divides CR into four phases (46), with the outpatient phase divided according to whether patients are monitored or not monitored during exercise. Denmark's 1997 guidelines (9) used the four-phase definition.

Involving spouses

The patient's spouse (or cohabitant) plays an important role in CCR (9,34). Studies indicate that patients with good family support are more likely to maintain participation in CR and changes in lifestyle than patients without such support (54). In addition, family members often feel powerless and anxious when close family members are ill and have an independent need for support in coping with this early phase of acute illness (55-58).

Broadening the target group

The effects of CR have especially been documented among middle-aged men experiencing myocardial infarction (18), but the results from small studies and a subgroup analysis (59) indicate that these effects can probably be transferred to a broader target group.

IHD. The national guidelines (9,34) recommend CR for all patients who have manifest IHD: patients with myocardial infarction (MI), patients who have undergone percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) and patients with stable IHD who have not yet been offered CR.

Heart surgery. Guidelines from Denmark (9) say that patients who have undergone heart surgery other than CABG and PCI, such as the implantation of an implantable cardioverter defibrillator (60,61), heart valve surgery (62) and heart transplantation (63-65), could also benefit from CR organized based on the special conditions of the underlying disease and intervention performed (66).

Congestive heart failure. Evidence exists that physical exercise is a well-indicated treatment for patients with congestive heart failure whose symptoms are well controlled (67), and Denmark's guidelines on CR (9) recommend that patients with congestive heart failure be offered comprehensive CR based on the same principles as patients with IHD.

High-risk patients. CR professionals have increasingly focused on the importance of preventing IHD among patients at high risk of developing IHD, and these high-risk patients may be considered a target group for CR that emphasizes lifestyle intervention and risk factor management (9,19,35).

Women, elderly and ethnic minorities. Several studies (68-71) indicate that women obtain the same benefits from CR as men. Evidence (72-74) indicates that elderly patients benefit as much as younger patients from CR. Guidelines (7-10,19,34) emphasize that women and elderly people should participate in CR programmes. Knowledge is limited on the effectiveness of CR among patients with an ethnic minority background (75), and Denmark's guidelines (9,34) have no special recommendations.

2.4 Denmark's legislation

Denmark has no specific legislation on CR, as in Belgium (10) and now Germany (76). The Hospitals Act of 1995, the general legislation on hospitals in Denmark, describes the obligations of hospitals in preventing disease, including CR (77). The Hospital System Act of 2001 strengthened the obligation of hospitals to prepare rehabilitation plans. Patients have the right to have an individual rehabilitation plan prepared upon discharge if a physician considers this necessary. The ethical rules for physicians in Denmark (§ 2 on physicians' precision and conscientiousness) require physicians to contribute to preventing disease and promoting health. In addition, the Hippocratic oath obligates physicians to seek new knowledge to benefit patients, including knowledge on preventing disease and on rehabilitation.

Studies have shown that patients would like knowledge on disease, treatment options and prognosis (78,79) and what they can do to prevent the disease or its progression (80,81). Health personnel in Denmark are legally obligated to inform and advise patients on these matters. The Act on Patients' Legal Rights of 1998 requires health personnel in Denmark to inform patients about their state of health and treatment opportunities, including opportunities to prevent disease and the effect of rehabilitation, and the potential effects of not initiating treatment. Information on rehabilitation opportunities must be provided regardless of whether the hospital that provides the information offers rehabilitation.

2.5 Ethical aspects of cardiac rehabilitation

Medical ethics has four traditional principles: beneficence, non-maleficence, justice and respect for patients' autonomy (82). CR also includes these ethical principles.

Beneficence. To ensure that CR intervention benefits patients, CR professionals strongly emphasize the overall focus on evidence-based treatment, defined as the conscious and judicious use of current best evidence in making decisions about the care of individual patients (83). Clinical guidelines have been developed throughout industrialized countries (7-10,19,34) to support practitioners in composing the best possible evidence-based treatment for patients based on the knowledge in each field. The treatment recommendations in clinical guidelines are not legally mandated but are increasingly included in legal assessments related to patient complaints (84).

Non-maleficence. The risk of adverse events is considered to be low in supervised exercise training for MI patients (85), and guidelines in Denmark (9,34) have no specific safety instructions. Exercise training among CHF patients is considered safe when guidelines for intensity and duration are followed (86), but safety must be given especially high priority in this group of patients because large-scale experience is lacking.

In efforts to prevent disease, health services inadvertently cause people to feel more ill than they are. This applies especially to patients at high risk of IHD, but patients who have been told that they are healthy after an invasive intervention may also experience an inadvertent feeling of illness in connection with CR.

Justice. CR should be delivered equally to patients independently of age, gender and social status (7-10,19,34). Despite these recommendations, studies (87-89) indicate that the participation rate in CR programmes among women is half that of men. One reason could be that fewer women are referred to CR (90,91); another is that women are more often older than men when heart disease becomes manifest (92). Studies also show (90,91) that fewer older than younger patients with IHD are referred to CR programmes, and elderly people are more likely to decline CR services (87,93).

CR also emphasizes that treatment should be tailored according to each patient's needs and resources, causing different distributions of referral in subgroups of patients.

Respect for patients' autonomy. Patients' motivation and own efforts are decisive in achieving treatment goals, and respect for patients' self-determination is very important in CR. In addition, CR activities are based on the obligation of health professionals to disseminate and use knowledge on the relationships between disease, lifestyles, level of functioning and treatment opportunities. CR programmes must strongly emphasize the fact that patients are ultimately responsible for their own health.

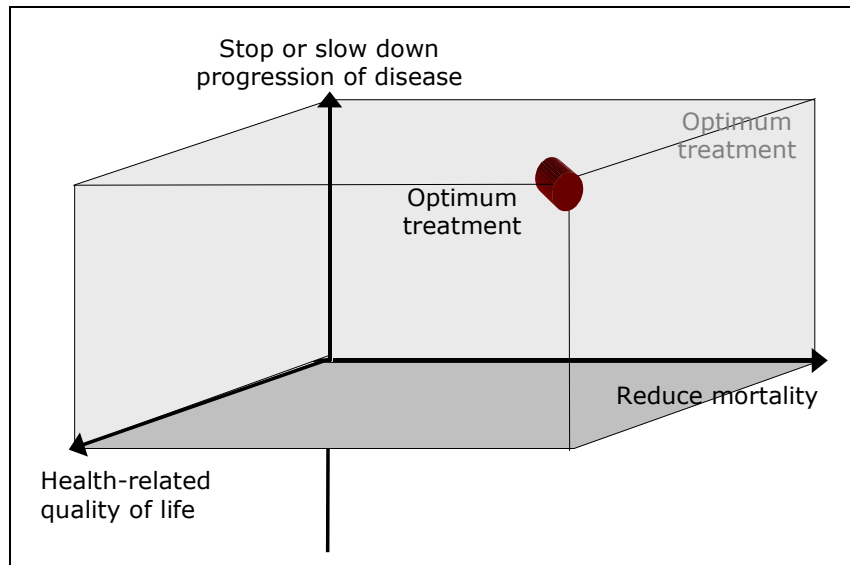
3. The rationale of comprehensive cardiac rehabilitation

This chapter presents general reflections on health benefits and outcome measures. The body of evidence is briefly outlined and followed by a narrative summary of the evidence on CR and each of the core components. This summary is based on existing reviews identified in PubMed, the Cochrane Library, Internet search and literature review.

3.1 Health benefits and outcome measures

The definition and goals of CCR identify three important dimensions of health: a) mortality, b) progression of disease and c) health-related quality of life. Since the three dimensions can be related, the optimum treatment of patients with IHD should ideally positively affect all three dimensions (Figure 3.1). Thus, the effects of CCR cannot be assessed using a single dimension; the outcome measures of CCR should reflect the effect of the intervention on all three dimensions of health.

Figure 3.1. Health dimensions and optimum treatment of IHD patients



Mortality. The hard end-points of total mortality and cardiac mortality have been used as the outcome of CR since the 1960s.

Progression of disease. Together with mortality, the reinfarction rate has also been a historical outcome measure for CR. The focus on modifying risk factors through secondary prevention became an important outcome measure for CR from the 1980s, when the evidence related to slowing down or reversing the underlying pathological process of atherosclerosis grew (26,31). The effects on readmission and invasive procedures such as CABG and PCI is now becoming more and more important because the readmission rate is increasing steadily. In this context, readmission is viewed as resulting from the progression of disease.

Health-related quality of life. The quality of life of IHD patients was indicated as an important outcome measure during the 1980s (26,94) and stressed by WHO in 1991 (31), but quality of life has not yet been precisely defined. Oldridge (94) operationally defined the health-related quality of life as “representing the functional effects of an illness and its consequent therapy upon a patient, as perceived by the patients”. The scientific work on the health-related quality of life generally accepts that it has three domains: physical, mental and social. Two basic approaches have been developed to quantify and assess the health-related quality of life. Generic quality of life instruments are designed to permit comparisons across populations, and disease-specific quality of life instruments are used in specific populations of patients. The disease-specific instruments are claimed to be more responsive, as they are designed to include items relevant to the patient populations. Several different disease-specific and generic quality of life measures have been developed.

3.2 Quality of life among cardiac patients in Denmark

Epidemiological data (95) indicate that the pattern of IHD has shifted from a life-threatening disease towards chronic disease. This emphasizes the necessity of focusing on other outcomes than mortality. The Framingham Disability Study from 1990 demonstrated impaired physical and mental functioning among IHD patients (5). Information on the quality of life among IHD patients in Denmark is sparse. To assess this question, data from the 2000 Danish Health Interview Survey (SUSY 2000) (4,96) have been analysed as part of this PhD dissertation.

Method and study material. SUSY is a nationwide survey of adult Danes carried out in 1987, 1994 and 2000. The purpose of the survey is to describe the status and trends in health and morbidity in the adult population and the factors that influence health status. SUSY 2000 is based on a random sample of 22,500 Danish citizens. Data were collected via personal interview at the respondents’ home and following self-administered questionnaires.

The overall response rate in SUSY 2000 was 74% for the personal interview and 63% for the self-administered questionnaire. A subgroup was selected to complete the SF-36 Health Survey, a generic health-related quality of life instrument.

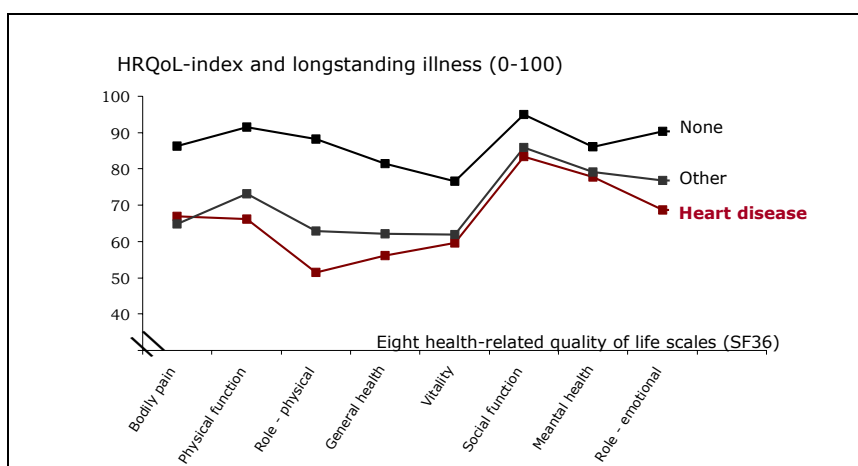
SF-36 is a 36-item questionnaire specifically assessing levels of self-reported quality of life in eight scales (Table 3.1). A lower score indicate poorer health-related quality of life in the specific scale or domain. The SF-36 is a validated instrument (97) that has been translated into Danish (98).

Table 3.1. SF-36 scales and health-related quality of life domains

SF-36 scales	Quality of life domain
Bodily pain	Physical
Physical functioning	Physical
Role – physical	Physical
General health	Physical
Vitality	Social
Social functioning	Social
Mental health	Mental
Role – emotional	Mental

A subpopulation of 5486 people had completed the SF-36 (2675 men; 2811 women). The subpopulation is further characterized in Annex A1 (Tables 1a and 1b). Based on information on longstanding illness defined as illness of more than 6-month duration, 10.6% of the respondents completing the SF-36 were categorized as having heart disease. Another 36.9% were categorized as having other longstanding illness and 52.5% were categorized as having no longstanding illness. The prevalence of heart disease was similar between men (11.1%) and women (10.0%). The prevalence increased with increasing age (45–66 years: 7.7%; 67–79 years: 16.7%; 80+ years: 20.4%).

Figure 3.2. Health-related quality of life among people with heart disease, other longstanding illness and no longstanding illness in a representative sample of the Danish population in 2000



Source: unpublished data (4).

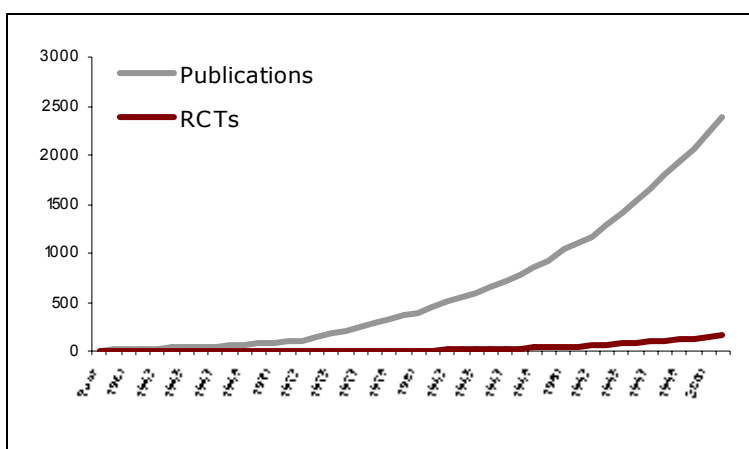
Results. Patients with heart disease scored lower on all eight scales of the SF-36 than patients without longstanding illness (Figure 3.2). The pattern was similar when the results were stratified according to gender and age groups (Annex A1). Patients with IHD further tended to score lower on all scales than patients with other longstanding illness.

Discussion. These preliminary results indicate that major disability still exists among people with heart disease, of which most have IHD (95). These results stress the importance of focusing on treatment modalities aiming at improving the quality of life among patients with IHD.

3.3 Body of evidence

Since the late 1960s, the scientific literature on CR has been growing steadily; the number of publications has more than doubled within the last 10 years (Figure 3.3). A PubMed search retrieved 2498 publications on CR in May 2004; a few originated from Denmark (99-101). Many studies within CR have been observational studies, although during the past 20 years the number of RCTs has increased. Of these 2498 publications, 159 were registered as RCTs. In recent years, the number of studies examining the pathophysiological mechanisms has also grown.

Figure 3.3. Cumulative number of CR publications based on a PubMed search, 1959–2003



PubMed was searched using the keywords cardiac or rehabilitation, limited according to field: title/abstract, and subgroup: randomized controlled trial.

3.4 Evidence on cardiac rehabilitation

The evidence on exercise-based CR has been systematically examined using meta-analysis (18,59,102-105) and systematic reviews (8,106). Further, several systematic reviews have been carried out to examine the evidence on CR primarily based on education and psychosocial interventions (81,107-111). In Denmark, the evidence on CR was reviewed when Denmark’s guidelines were prepared in 1997 (9), and the literature review was recently updated as part of the recently published national practical guidelines on implementing hospital-based CR (112). Examining the evidence on CR is difficult, however, because of variation over time and between studies, explained in part by the evolution of CR intervention and by cultural differences between countries and centres.

Study characteristics

The first meta-analysis carried out by Oldridge et al (105) in 1988 included 19 trials and 4347 patients. A Cochrane meta-analysis published in 2001 includes 36 trials and 8440 IHD patients covering literature to December 1998 (18). The meta-analysis was updated as part of a Canadian systematic clinical and economic review by Brown et al., and 10 new trials were identified (102). The work by the Cochrane group (18) has been further updated and now includes 48 trials and 8940 patients and covers literature until March 2003 (59). The trial sample size varied widely from 37 to 1479 patients, with a median of 112. Table 3.2 summarizes the study characteristics of the meta-analyses on exercise-based CR.

Study population. The earlier RCTs on CR primarily included men and often had a maximum age limit of median 65 years. Further, the earlier meta-analysis only included trials on post-MI patients (103,105). In the most

recently published meta-analysis by Taylor et al (59), the median age of the study population was 55 years and 20% of the study population were women. Of the 48 trials included, 16 (13%) included post-revascularization patients either alone (eight trials) or in combination with post-MI patients (eight trials).

Table 3.2. Study characteristics of meta-analyses on exercise-based CR

Study characteristics	Oldridge (105) CR	O'Connor (103) CR	Brown (102)		Taylor (59) CR
			Exercise-only CCR	CCR	
Median (range)					
Numbers of patients	4347	4554	2984	8677 5693	8940
Age, years median (range)	-		54 (50-70)	56 (47-63)	55 (48-71)
Women (%)	2.9	3	4.9	12.0	20
Numbers of trials	19	22	19	46 27	48

Interventions and follow-up. Trials vary substantially according to the time after the event until randomization, type of intervention, duration of intervention and duration of follow-up. In the most recent meta-analysis (59), the median intervention lasted 3 months (range 0.25–30 months) and follow-up 15 months (range 6–72 months). This heterogeneity between studies poses problems in interpreting the overall effect and makes replicating interventions in other settings difficult. In the Cochrane meta-analysis (18) and the Canadian update (102), the trials were divided into trials on “exercise-only” CR and trials on CCR defined as interventions including exercise and some form of psychological and educational intervention. This division of trials was implemented to try to reduce heterogeneity (113). Further, the division reflects potentially important differences in resource consumption (102) and the change in the definition of CR from exercise only to CCR. Table 3.3 lists the core component included in each of the 27 CCR trials included in the Canadian update (102) according to the type of intervention as noted in the summary of the studies. None of these CCR trials ideally fulfils Denmark’s criteria for CCR, including all the core components.

Quality of trials. The quality of RCTs has been questioned because allocation is not concealed, lack of blinding and poor or missing description of the intervention. The most recent meta-analysis (59) systematically examined the quality of trials and found that only 33% provided details on the method of randomization. Only 17% of the studies reported blinded assessment of outcomes. No evidence of publication bias was found, however. The Cochrane meta-analysis (18) concluded that larger-scale well-designed RCTs are needed to determine whether the effects of CR found in the heterogeneous set of small trials can be confirmed and extended to other patient groups. With these limitations in mind, the following section summarizes the evidence on CR.

Evidence

Mortality. The results from the meta-analyses shows that exercise-only CR as well as CCR reduces cardiac mortality and total mortality, although the trend for CCR on total mortality was not significant (102) (Table 3.4). The reduction in mortality is consistent across the meta-analyses conducted. The subgroup analysis in the most recent meta-analysis (59) indicates that the results are consistent when stratified according to gender, age groups (<60 versus ≥60 years) and diagnostic groups (post-MI, CABG and PCI). Further, the subgroup analysis shows a consistent effect on mortality irrespective of when the study was published (before 1995 versus 1995 and after) (59).

Disease progression. Based on the results from the meta-analysis, CR intervention does not significantly influence the subsequent occurrence of nonfatal MI, CABG or PTCA (Table 3.4). Information on readmissions was not examined systematically in the RCTs included in the meta-analysis. A case-control study in Sweden on the long-term effect of CCR among CABG patients found that the number of cardiac readmissions to hospital (2.1

versus 3.5 per patient) and length of admissions (11 versus 26 days per patient) was significantly lower in the study group (114), indicating that CR may influence readmission rates. More studies are required to make conclusions on the effect on readmission rate.

Table 3.3. Core components of the 27 CCR trials included in the Canadian update meta-analysis (102): x means that the component is included according to the summary of CCR studies in the publication (102)

Trial	Ref.	Number of patients	Duration (weeks) (1 month = 4 weeks ^a)	Exercise training	Education	Dietary guidance	Smoking cessation	Psychosocial support or counselling	Risk factor management or medication	Clinical assessment	Other intervention not categorized
Agren et al	(115)	43	12	x		x					
Bell	(116)	353	6-12	x	x				x		Heart manual
Bengtsson	(117)	85	12	x				x			
Bertie et al	(118)	110	4	x							Standard hospital care
Carlsson et al	(119)	160	10-12	x		x	x	x			
Carlsson	(120)	235	8-12	x		x	x	x			
Engblom et al	(121)	228	120	x		x		x			
Fletcher et al	(122)	88	24	x	x			x			
Fridlund et al	(123)	116	24	x				x			
Heller et al	(124)	450	24	x		x	x				
Higgins et al	(125)	105	8	x	x			x		x	Clinical home visits
Kallio et al	(126)	375	12	x	x			x			
Krachler et al	(127)	59	6	x		x					
Lewin et al	(128)	176	6	x				x			Heart manual
Lisspers et al	(129)	87	48	x	x	x	x	x			
Manchanda et al	(130)	42	48	x		x					
Miller et al	(131)	198	4-32	x				x			
Oldridge et al	(132)	201	8	x				x			
Ornish et al	(133)	93	1	x		x		x			
PRECOR Group	(134)	182	6	x	x			x			
Schuler et al	(135)	113	48	x		x					
Haskell et al	(52)	300	4	x	x	x		x			
Sivarajan et al	(136)	172	12	x	x		x	x			
Taylor et al	(137)	106	24	x	x	x		x	x		
Toobert et al	(138)	38	98	x		x		x			
Vermeulen et al	(139)	98	12	x				x			
WHO (11 centres)	(140)	1479	5-12	x	x			x			
Number of trials including component		116 ^a (43-1479)	12 ^a (1-120)	27	10	13	5	20	2	1	

^aMedian (range).

Risk factor reduction. The most recent meta-analysis (59) found significant greater reductions in total serum cholesterol, serum triglycerides and systolic blood pressure and lower rates of self-reported smoking among patients undergoing CR. Serum high-density lipoprotein and low-density lipoprotein and diastolic blood pressure did not differ significantly. Based on the results from the Canadian update (102), CCR more positively reduces risk, with reductions in total cholesterol, serum low-density lipoprotein, serum triglycerides and systolic blood pressure and smoking than exercise-only CR.

Health-related quality of life. The major problem of examining the effect of CR on health-related quality of life is that the trials use several different measures, making data-pooling inappropriate. Twelve trials included in the most recent meta-analysis (59) assessed the health-related quality of life using either validated measures or measures that covered the three basic domains. The meta-analysis found that, although most studies reported an improvement in quality of life domain scores, only two exceeded the improvement in the usual care groups (136,141). No meta-analysis has yet documented the clinical experience of CR significantly improving patients' perceived quality of life.

3.5 Evidence of core components

Even though the meta-analyses showed that CCR improved mortality and modified risk factors, the effect of CCR is still not fully known. The rationale and recommendations for CCR (9,19,34) are primarily based on the body of evidence of each of the core components summarized in this section.

Table 3.4. Estimated effect of CR based on meta-analysis

Effect	Oldridge (105)	O'Connor (103)	Brown (102)		Taylor (59)
	CR	CR	Exercise-only CCR	CCR	CR
Mortality					
Odds ratio (95% CI)					
All-cause mortality	0.76* (0.62 to 0.92)	0.80* (0.66 to 0.96)	0.76* (0.59 to 0.98)	0.87 (0.74 to 1.02)	0.80* (0.68 to 0.96)
Cardiac mortality	0.75 (0.62 to 0.93)	0.78* (0.63 to 0.96)	0.73* (0.56 to 0.96)	0.80* (0.65 to 0.99)	0.74* (0.61 to 0.96)
Disease progression					
Odds ratio (95% CI)					
Reinfarction	1.15 (0.93 to 1.42)	1.09 (0.88 to 1.34)	0.78 (0.59 to 1.03)	1.07 (0.85 to 1.35)	0.79 (0.59 to 1.09)
CABG	-	-	0.87 (0.58 to 1.29)	0.81 (0.59 to 1.10)	0.87 (0.65 to 1.06)
PCI	-	-	0.57 (0.28 to 1.16)	0.84 (0.59 to 1.19)	0.81 (0.49 to 1.34)
Risk factor reduction					
Mean difference (95% CI)					
Total serum cholesterol	-	-	-0.17 mmol/l (-0.34 to -0.00)	-0.71 mmol/l* (-0.83 to -0.60)	-0.37 mmol/l* (-0.63 to -0.11)
Serum low-density lipoprotein	-	-	-0.27 mmol/l (-0.43 to -1.12)	-0.52 mmol/l* (-0.7 to -0.31)	-0.20 mmol/l* (-0.53 to -0.12)
Serum high-density lipoprotein	-	-	0.04 mmol/l (-0.01 to 0.09)	0.02 mmol/l (-0.01 to 0.16)	-0.05 mmol/l (-0.03 to 0.14)
Serum triglycerides	-	-	-0.18 mmol/l (-0.31 to -0.04)	-0.29 mmol/l* (-0.44 to -0.14)	-0.23 mmol/l* (-0.39 to -0.07)
Blood pressure systolic	-	-	-2.35 mmHg (-6.6 to 2.1)	-3.5 mmHg* (-6.1 to -0.9)	-3.2 mmHg* (-5.4 to -0.9)
Blood pressure diastolic	-	-	-1.0 mmHg (-2.6 to 4.7)	-1.62 mmHg (-3.27 to 0.02)	-1.2 mmHg (-2.7 to 0.3)
Smoking (odds ratio (95% CI))	-	-	0.82 (0.62 to 1.18)	0.76 (0.58 to 1.00)	0.64* (0.50 to 0.83)

* $P \leq 0.05$.

Exercise training

Evidence shows that physical inactivity is an important risk factor for IHD among both men and women (142,143). Evidence (43,144,145) further indicates that increasing physical activity reduces this risk. The meta-analysis on CR documented (102) that exercise training among MI patients reduces cardiac mortality by 31% and all-cause mortality by 27% compared with MI patients not undergoing exercise training. Further, a subgroup analysis indicates that this effect can be extrapolated to other IHD patients (59,102).

Basic research on the effects of exercise training shows that it substantially reduces blood pressure and increases serum high-density lipoprotein. The meta-analysis of the effect of exercise-only CR could not reproduce this effect, however (102). Exercise training improves the regulation of blood sugar among people with non-insulin-dependent diabetes mellitus (NIDDM) (146), and lifestyle intervention including exercise training reduces the risk of developing NIDDM among people with impaired glucose tolerance (147-149). Exercise training alone has limited effects on weight loss (150); adding dietary guidance to exercise training increases the effect.

People with heart disease have poorer physical functioning than people with healthy hearts; this applies to men and women and to young and old people (5). The poorer functioning can be attributed to reduced aerobic capacity and to the anxiety about exercising after an acute cardiac event. Strong evidence (43) indicates that exercise training improves the physical capacity for work among people with healthy hearts and among people with heart

disease. Several studies have documented improvement in aerobic capacity with training: an average of 15–25% increase in maximum oxygen consumption after 3 months of training (151).

Studies indicate that the effect of exercise training supplements the pharmaceutical treatment of mild and moderately severe depression (152). It has not yet been documented that exercise training on its own positively influences the mental and social domains of health-related quality of life.

Patient education

Knowledge comprises an important aspect of lifestyle intervention and risk factor modification (153). Comparative studies on patient education for patients with heart disease (154,155) show that patient education is essential to give patients a qualified basis for making decisions and to increase their knowledge. Two meta-analyses have examined the effect of educating IHD patients. A meta-analysis from 1992 of the effect of patient education including 28 controlled trials indicated that education measurably affects mortality, blood pressure, exercise and diet (111). The effects have been questioned, however, due to difficulty in interpreting the results (106) and the inclusion of non-randomized studies (107). A meta-analysis from 1999 on the effect of psychoeducational programmes for IHD patients included 37 studies (156). The meta-analysis also suggested that these types of programmes reduced cardiac mortality (34%) and the recurrence of MI (29%) and positively affected lifestyle. No effect was found on anxiety or depression. The results of this meta-analysis have also been questioned in a recently published Cochrane meta-analysis on psychological intervention in IHD (107) because non-randomized studies were included and the literature was not fully covered. The meta-analysis (107) identified statistical evidence of publication bias and found no effect on mortality. The meta-analysis (107) is summarized in detail in the section on psychosocial support.

Smoking cessation

Tobacco smoking is the most important modifiable risk factor for IHD (157,158). Several cohort studies from the early 1990s (159-161) have calculated that smoking causes at least 25–30% of cases of AMI in Denmark, and 80% among young people. Among people who have had an AMI, smokers have higher mortality than nonsmokers. A meta-analysis of existing cohort studies (162) estimated a 20% mortality rate among patients who have an AMI and continue to smoke. The mortality benefit of smoking cessation was consistent regardless of gender, duration of follow-up, study site and time period. These findings have never been confirmed in randomized clinical trials. A recent systematic review of 20 prospective cohort studies suggested that smoking cessation among patients with IHD (AMI and angina pectoris) reduced all-cause mortality by 36% (rate ratio 0.64 (95% CI: 0.58–0.71) (163).

Many smokers who have had an AMI stop smoking spontaneously, but most start to smoke again shortly after discharge (164,165). Evidence shows that structured counselling by physicians (166), smoking cessation counsellors (167) and nurses (168) influences the rate of cessation. Support and counselling begun during admission and followed up at least 1 month after admission produces significantly higher cessation rates (169). Intensive counselling during admission without follow-up after admission did not seem to have any additional effect, however (170). Both individual counseling (167) and group education (171) increase the potential for sustaining cessation (172). Clear evidence indicates that nicotine replacement therapy combined with structured counselling is effective for heavy smokers, independent of the intensity of the counselling and the external setting (173). Evidence (174) also shows that bupropion, an antidepressant, positively affects smoking cessation.

Dietary guidance

The Danish Nutrition Council reviewed the evidence on dietary guidance and IHD (175,176) and concluded in 1996 that heart-healthy dietary habits can reduce the risk of MI and reduce mortality among patients with IHD, even though the dietary change may not necessarily be reflected in biological risk factors such as serum cholesterol, blood pressure and weight. The Dean Ornish programme in the United States, a very strict lifestyle intervention programme that restricts dietary fat to less than 10% of energy intake, showed promising results in reducing mortality and the regression of atherosclerosis by changing lifestyle, including dietary changes (133,177,178). A study in India also showed an effect of dietary guidance on mortality and reinfarction (179,180).

The Lyon Diet Heart Study has shown that a Mediterranean-type diet low in saturated fat, high in polyunsaturated fat and high in fruit and vegetables reduces the rate of cardiac death and nonfatal MI for at least 4 years among patients who suffered a first MI (181,182). One study on eating fatty fish at least twice a week suggests that it reduced the risk of reinfarction and death (183). A study on dietary supplementation with omega-3 polyunsaturated fatty acids (1 gram daily) from fish oil (184) was associated with a significant reduction in all-cause mortality and sudden death. Evidence (185,186) indicates that dietary change aimed at reducing serum cholesterol can reduce the risk of MI and reduce mortality from heart disease among patients with IHD.

Although the body of evidence of the cardioprotective effect of dietary guidance is growing, knowledge is still lacking on how to implement this in everyday clinical practice. A meta-analysis on the effects of dietary guidance given by a dietitian compared with another health professional or the use of self-help resources on reducing blood cholesterol (187) indicated that dietitians were better than physicians at lowering blood cholesterol, but there was no evidence that they provided better outcomes than self-help resources or nurses. Since the quality of the trials was low and the number limited, these results should be interpreted with caution.

Psychosocial support

Anxiety and depression. About 11–25% of patients with IHD have depressive disorder. A further 30% develop mild depressive episodes, and 9% of outpatients with heart disease and 10–50% of patients with acute coronary syndrome have anxiety disorder (188-192). A few more recent epidemiological studies (193,194) even indicate that mental factors can increase the risk of IHD, and studies (195,196) have shown that depression and anxiety are underdiagnosed in heart disease. Depression and anxiety complicate the course of heart disease. Developing depression not only influences the patients' subjective health but also adversely affects the results of treatment and reduces survival in some cases. Among patients with IHD, those with untreated depression have 3–4 times higher morbidity and mortality than those without depression (189). Similarly, among patients who have had CABG, those with moderate to severe depression have excess mortality compared with those with no depression (197).

Studies (43,152) indicate that the effect of exercise training supplements the pharmaceutical treatment of mild and moderately severe depression. Exercise training is not recommended as the sole treatment but should be used to supplement pharmaceutical treatment. Knowledge on how to master illness is an important aspect of psychosocial support, but knowledge cannot stand alone (156). Patients with IHD undergoing pharmaceutical treatment for anxiety and depression tolerate treatment well, have less depression and seem to have fewer complications related to heart disease (198-201). A large RCT of 2481 people who had MI (202) showed that treating depression did not influence survival, however. A recent Cochrane meta-analysis on the effectiveness of psychological interventions on mortality, morbidity, mental quality of life and modifiable risk factors for heart disease in patients with IHD (107) showed no effect on mortality. Nonfatal MI declined significantly; this finding was questioned due to considerable heterogeneity and evidence of significant publication bias. The meta-analysis showed a small reduction in anxiety and depression among patients with IHD.

Social network. Studies (203-205) have shown that people who live alone and lack a social network have a higher risk of IHD and death. Other studies (206,207) show that social isolation is associated with reduced survival and health for patients with cardiovascular diseases. No study has shown that intervening in the lives of socially isolated people with heart disease can improve health and survival. Nevertheless, studies have shown that intervening in the lives of socially isolated people with heart disease increases their quality of life (110,208).

Vocational guidance. About 20–25% of patients with MI in Denmark are employed at admission. Many are concerned about whether they can resume employment. A study of employment prospects after MI in Denmark (209) showed that the short-term employment prospects were good: about 90% of the employed patients had resumed working within the first 6 months. Studies (209,210) indicate that patients' age, educational level, socioeconomic status, psychosocial well-being and self-confidence that they could return to work are as important or more important for continuing employment than their physical functioning. The extent to which CR affects return to work is still uncertain, since this area has been little studied (211,212).

Risk factor management and clinical assessment

Structured management. A meta-analysis on the effect of multidisciplinary disease management programmes without exercise training (213) including 12 RCTs and 9803 patients showed that disease management programmes improve processes of care, reduce admissions to hospital (rate ratio 0.84 (95% CI 0.76–0.94) and enhance quality of life or functional status in patients with IHD. The programmes' effects on survival and recurrent infarction, their cost-effectiveness and the optimum mix of components remain uncertain.

Pharmaceutical treatment. The evidence on pharmaceutical treatment has been systematically reviewed in Denmark's guidelines (38,39,214) and is not further reviewed here. The four main prophylactic drug groups for secondary prevention of IHD are antiplatelet drugs, beta-blockers, statins and ACE inhibitors.

3.6 Integration of the core components

Table 3.5 summarizes the rationale and documented health benefits of each CR component. No core component by itself fulfils the idea of optimum treatment by scoring high on all three health dimensions illustrated in Figure 3.1. Denmark's recently published guidelines for hospital-based CR (34) rated the power of the recommendations from A (most powerful) to D (least powerful) (Table 3.5). The recommendations are rated based on the strength of the evidence using SIGNs (215).

Table 3.5. Rationale and documented health benefits of CCR core components and power of the recommendations rated according to national guidelines (34)

Component	Health dimensions			Power of recommendation (34)
	Mortality	Progression of disease	Health-related quality of life domains	
Patient education		+	Physical Mental Social	A
Exercise training	+++	+++	+++	A
Smoking cessation	+++	+++		B
Dietary guidance	+++	+++		A
Psychosocial support				B
Anxiety and depression			+++	
Social network				++
Vocational guidance				+
Risk factor management				A
Systematic assessment	+++	+++		A
Pharmaceutical treatment				
<i>Aspirin</i>	+++	+++		A
<i>Beta-blockers</i>	+++	+++		A
<i>Statins</i>	+++	+++		A
<i>ACE inhibitors</i>	+++	+++		A

+++ : substantial benefits; ++ : moderate benefits; + : slight benefits. Power of recommendation: A (most powerful) to D (least powerful).

The overall philosophy of comprehensive care can be stated as the integration of evidence-based treatment modalities to reach the highest level of positive impact on all dimensions of health. It can reasonably be argued that a higher level of total health benefit is reached when each of these evidence-based components is integrated in an individually tailored comprehensive approach. This remains to be proven in large-scale well-designed CCR trials.

4. Implementation of comprehensive cardiac rehabilitation at hospitals in Denmark

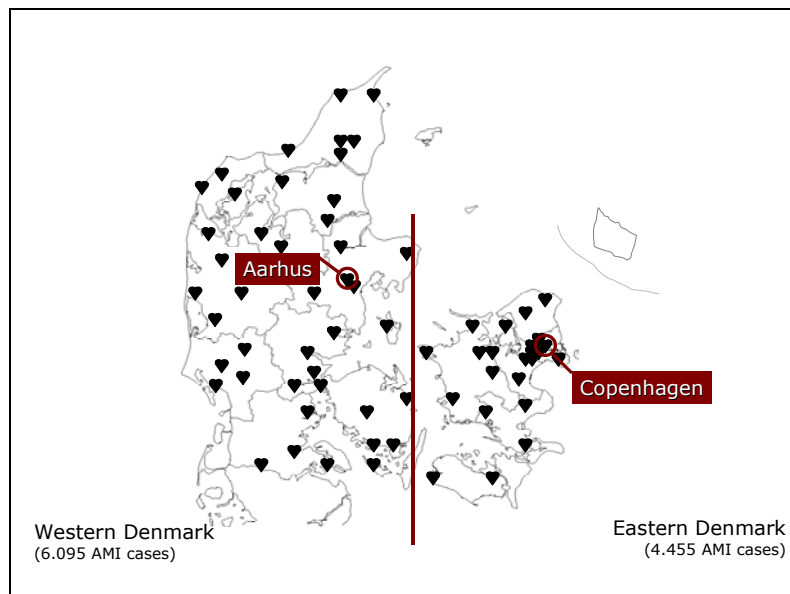
This chapter focuses on the implementation of hospital-based CCR in Denmark based on the results of a study provisionally accepted for publication by the *Scandinavian Journal of Public Health* (Zwisler ADO, Træden UI, Videbæk J, Madsen M. Cardiac rehabilitation in Denmark. Still room for expansion; Annex B). The study has also been presented as part of an extensive report on health promotion and disease prevention at hospitals in Denmark (216) and as papers and posters at international conferences.

4.1 Introduction

Four studies during the 1980s and 1990s investigated the extent of CR in Denmark; only one was published. The studies only covered hospital-based CR, including exercise training, patient education and psychosocial support, and did not cover all the core components of contemporary CR. Nor did the studies systematically cover phase III CR. The Danish Society of Internal Medicine initiated a survey on the overall treatment of AMI at hospitals in Denmark in 1986 (21). The survey showed that 15% of the hospitals offered phase II CR services comprising exercise training. The CR coverage in 1986 was considered low compared with the United States (217-219) and other European countries such as Germany (220). Two years later, recommendations for treatment of AMI were published, including recommendations on CR (221). Subsequent surveys (22,222) showed that CR services were slowly being extended. A telephone survey was conducted in preparation for the IV Nordic Conference on Cardiac Rehabilitation in 1996 (17). The survey demonstrated some further extension of phase II outpatient CR (39% offered exercise training; 51% offered patient education or psychosocial support). The gap between the guidelines and access to services was still wide.

As described earlier the Danish Heart Foundation and the Danish Society of Cardiology published Denmark's guidelines on CR in 1997 (9). As part of the Government Programme on Public Health and Health Promotion (40), the role of CR was re-emphasized in 1999. The National Network of Health Promoting Hospitals in Denmark (www.forebyggendesygehuse.dk), which had designated CR as one of the main focus areas, initiated a national survey on hospital-based health promotion and disease prevention activities (216). The survey also included hospital-based CR. The Danish Heart Foundation was conducting a survey at the same time on the overall treatment of AMI at hospitals in Denmark as part of preparing the national heart statistics for 1999 (223). The two studies were carried out independently.

Figure 4.1. Geographical situation of acute care hospitals in Denmark, 1999



4.2 Acute care hospitals

Public hospital services in Denmark are fully financed by tax revenue. A major reform of hospital services in Denmark is being considered, but these services are currently administered in 15 regions. In 1999, 67 hospitals admitted patients with acute heart disease, with an average catchment area of 80,900 inhabitants (ranging from 4600 to about 200,000). In 1999, the 67 hospitals had 1377 beds (range 0–99) available for cardiac patients and employed 154 cardiologists (range 0–20) (223). The hospitals comprise four groups according to the degree of specialization in cardiology: highly specialized departments offering coronary angiograms (11 hospitals, including 5 departments of surgery); referral centres specializing in cardiology (8 hospitals); departments of internal medicine (43 hospitals) and small departments in rural areas handling a range of diseases within internal medicine and acute surgery (5 hospitals). Geographically, hospital services in Denmark can be divided into eastern Denmark (including the capital) (36%) and western Denmark (64%) (Figure 4.1).

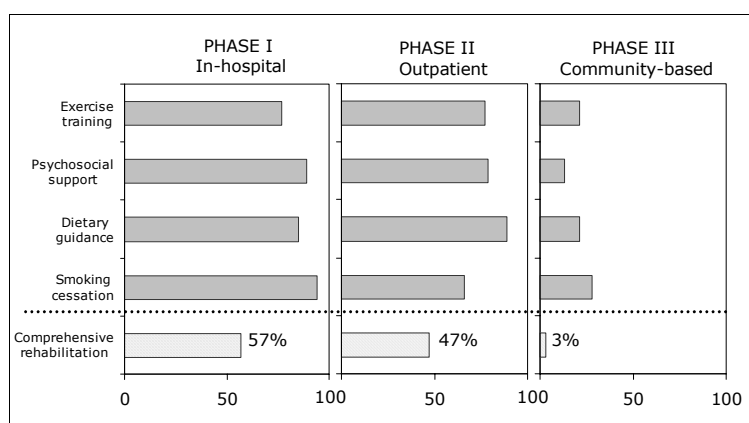
4.3 Methods

Our survey was conducted as a postal questionnaire mailed to the heads of departments at acute care hospitals in Denmark. The questionnaire were developed based on the questionnaires used in the 1990 survey (22) and was further extended by a team of health professionals including a cardiologist to cover all three phases of CR and the secondary prevention activities at the hospital. The questionnaire is available in Danish at www.hjerterehab.dk/uploads/media/KEFS_skema.pdf. The questionnaire was tested in a small pilot study for consistency before being finalized. It was mailed to 67 department heads and 53 responded (79%). The participating hospitals covered 85% of the MI discharges in Denmark during 1999. Participating and nonparticipating departments did not differ significantly according to catchment area, number of beds, number of cardiologists, degree of specialization or geographical location. Participating and nonparticipating hospitals did not differ from information on overall CR services from the national heart statistics survey for 1999 (223).

4.4 Main results

Figure 4.1 summarizes the main results of the survey. In 1999, most hospitals offered one or more of the phase I CR services. Many hospitals also offered one or more of the phase II services, although slightly fewer than the number offering phase I services. According to the department heads, access to one or more of the phase III services was rare and primarily offered by the Danish Heart Foundation. According to Denmark's current guidelines, CR must be an integrated service with a comprehensive approach involving all the components. By 1999, all the components exercise training, psychosocial support, dietary guidance and smoking cessation were offered at 30 hospitals (57% (95% confidence interval (CI): 44–70%)) during phase I, at 25 hospitals (47% (95% CI: 34–60%)) during phase II and at two hospitals (3% (95% CI: 0–8%)) during phase III. Full CR during both phases I and II was offered at 36% (95% CI: 23–49%) of the hospitals. Based on registry data, only 29% of MI patients were discharged from departments that have full CR in both phases.

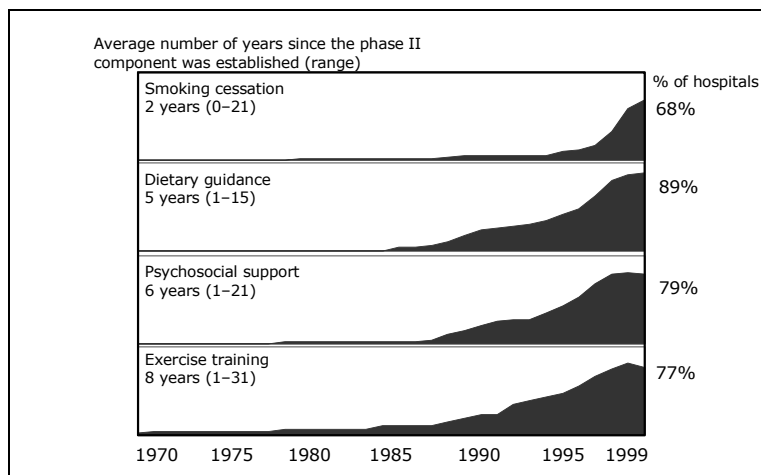
Figure 4.2. Percentage of 53 hospitals in Denmark offering the various components of CR services and comprehensive CR (exercise training, psychosocial support, dietary guidance and smoking cessation) during phases I, II and III



Further, 23% of the departments had a maximum age limit of 75 years, and 68% invited the patients' spouse or cohabitant to participate in the CR services. All programmes were aimed at MI patients, 81% targeted other IHD patients and 76% stated that one or more of the services targeted patients at high risk of IHD. Hospitals and hospital regions varied substantially in the numbers of staff hours spent on the CR components.

Information on the year each component of CR was established allowed us to determine the expansion of all of the core components from 1969 to 1999. The components were primarily established during the 1990s (Figure 4.3). Exercise training was the first component introduced in 1969 by one hospital.

Figure 4.3. Extension of phase II components of CR services at hospitals in Denmark from 1969 until 1999 and average number of years since the component was established (range)



Admissions

To estimate the potential candidates for CCR summary information on IHD and CHF admissions is presented in (Table 4.1). The numbers of admissions due to IHD and CHF can be obtained from the national heart statistics (224), which contains comprehensive information on cardiovascular disease in Denmark from 1978 to 2001. The information mainly originated from the National Patient Registry, which records all hospital admissions, and the Danish Registry of Causes of Death. The validity of the data from the National Patient Registry is high for administrative data on admissions, identification and discharges (97–98%) (225). The validity of data on diagnosis is lower, 66–93% depending on the diagnosis (225,226), with the highest validity for MI (ICD-10: I20–I21) (226). The statistics for 2002 show 48,187 IHD admissions and 11,067 CHF admissions. Among these, more than 10,000 admissions involved PCI and CABG.

Table 4.1. Summary information on IHD and CHF hospital admissions in Denmark, 2002

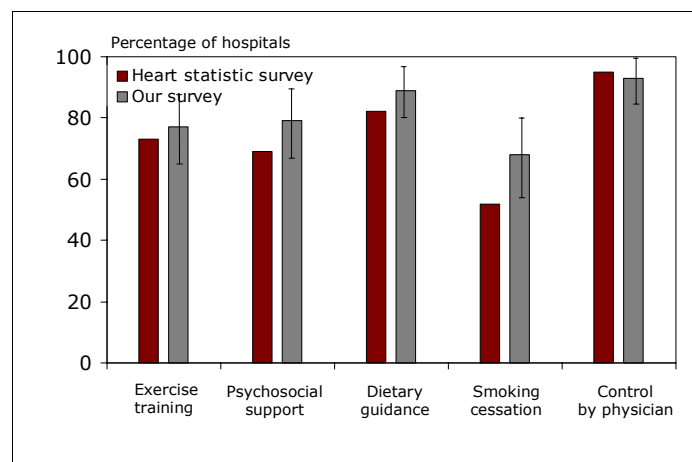
Diagnosis	ICD-10	All admissions and procedures	Admitted individuals	First-time admissions
IHD	I20–I25	48,187	27,536	15,876
MI	I21–I22	15,733	10,994	8,919
Angina pectoris	I20	22,293	15,171	9,736
Other	I23–I25	10,161	7,881	8,809
CHF	I11, I30, I50, P29	11,067	8,307	6,225
Revascularization				
PCI		6,819		
CABG		3,840		
Other heart surgery^a				
Valve surgery isolated		567		
Other adult surgery		303		
Congenital heart diseases		287		
Pacemaker and implantable cardioverter defibrillator^a				
Pacemaker (first implant)		2,328		
Implantable cardioverter defibrillator (first implant)		239		

Source: Videbaek & Madsen (224). ICD-10: International Classification of Diseases, tenth revision. ^aFrom 2000 (223).

4.5 Discussion

State of CR. Based on the nonresponse analysis, which showed no differences between participating and nonparticipating hospitals, we assume that our survey describes the state of hospital-based CR services in Denmark in 1999. This assumption is supported by comparing our results with information on overall phase II CR services from the national heart statistics (223). The national heart statistics survey collected information from all 67 hospitals. The comparison shows that our results are in the same range as the national heart statistics survey, although our prevalence of CR services is slightly higher (Figure 4.4). This finding may indicate that we slightly overestimated the number of hospitals with CR services, especially for smoking cessation, or may reflect differences in the questions asked. The national heart statistics survey limited smoking cessation interventions to certified staff. The first explanation might tend to be true because the overall survey (216) found that the hospitals participating in the National Network of Health Promoting Hospitals in Denmark, which are especially interested in disease prevention and health promotion activities, were overrepresented.

Figure 4.4 Phase II components of CR services at hospitals in Denmark in 1999 according to the present survey (216) compared with the national heart statistics survey (223).



Differences in health care systems and the organization of cardiac care worldwide do not permit the extent of CR in different countries to be compared directly; however, similar findings on overall poor CR coverage were reported from many countries during the late 1990s (11-15,227-232), with Portugal in the far low end (15) and United Kingdom in the high end of the range (228). Denmark's health care system is often compared with those of Sweden or Norway, but no published national surveys on CR could be identified from these countries. The recent Carinex Survey (10,16) showed, similar to Maes in 1992 (233), great variation in CR services and poor compliance with national guidelines across the European Union countries and a consistent pattern of relatively prevalent phase I services, fewer phase II services and almost no phase III services (16,229).

Since our study was part of an extensive survey on hospital-based health promotion activities, we could not obtain detailed information on the content or quality of the CR services offered at the hospitals. A study on CR services in England and Wales (228) found that 199 of 244 centres (81%) admitting patients with cardiac conditions claimed to provide CR. Of the 199 centres, 25 centres were randomly selected for a visit to obtain detailed information on the services. The quantity and quality of services varied widely (228). A study on the practice of outpatient CR in Scotland (234) found similar results. Among 53 programmes including exercise training, only 19 (35%) provided the level providing the most benefits; among 47 programmes including education, only 16 (34%) offered education in a manner that produced benefits in controlled trials. Thus, the CR practices were often more limited than those reporting improving mortality and morbidity.

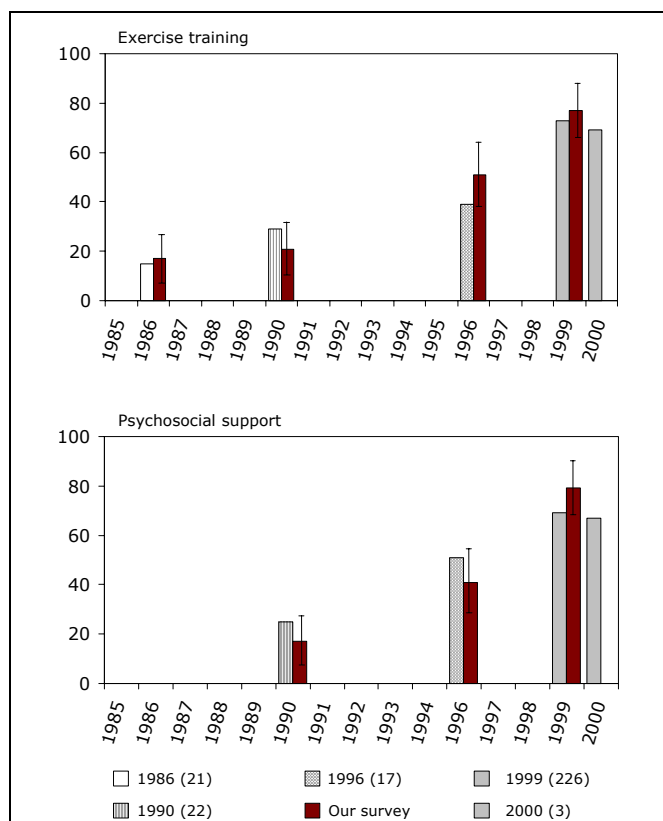
Our survey did not obtain information on the numbers of patients receiving CR and the numbers needing referral. The national heart statistics survey (223) examined this topic, but the department heads were not able to answer this question, because this information is not systematically registered compared with other cardiac procedures

such as PCI and CABG, which are systematically registered in a national registry (www.hjerteregister.dk). Studies have repeatedly shown that patient referral is relatively low even though CR services exist (235), and the estimates of the percentage of patients rehabilitated after acute coronary syndrome vary between 17% and 30% (229,236,237). A recently published national study in France found that 22% of patients with MI and unstable angina received CR (238). In a study in the United States, 9% of eligible patients were referred to CR (239). A study in Queensland, Australia showed that 49% were referred to CR (240). The Carinex Survey (16) estimated that fewer than 50% of patients eligible to participate in CR do so in most European countries. These studies indicate that, although several CR services have been identified at hospitals in Denmark, these services might be reserved for a small group of patients. If one assumes that the hospital departments that have full CR services in both phases, which discharge 29% of all MI patients, refer between one third and one half of these 29% MI patients to full phase II CR, then only 1000 to 1500 of the 10,500 MI discharges (10–15%) were receiving full hospital-based CR in 1999. Very few of these could continue in phase III CR. Thus, our survey indicates that about 36% (95% CI: 23–49%) of hospitals in Denmark offered full CR services in 1999; detailed knowledge on the actual CR services provided and the numbers of patients receiving proper CR is still lacking.

Expansion of CR services. Marked progress was made in the 1990s in implementing CR services in Denmark. Nevertheless, the quantity and quality of services varies widely, and the services are far from fully expanded. The pattern of expansion can be reproduced when comparing our results to the earlier studies on CR from 1986 (21), 1990 (22), 1996 (17), 1999 (223) and a national heart statistics survey from 2000 (3) (figure 4.5).

A study on CR services in England and Wales (228) and a study on CR in Northern Ireland (230) both showed that the CR programmes had developed on an ad hoc basis, largely as a result of the beliefs, dedication and enthusiasm of local staff. This may also reflect the situation in Denmark. The demonstrated shift in onset of the various components partly reflects the evolution of the definition of CR described in Chapter 2. The overall coverage of CR in Denmark seems to be 5 years or more behind the United Kingdom (241), Germany (220) and the United States (242).

Figure 4.5. Expansion of the phase II components at hospitals in Denmark during the 1980s and 1990s



Potential candidates for hospital-based comprehensive cardiac rehabilitation

It is not known how many of the patients admitted for IHD and CHF would actually be eligible for CCR. A study from Australia (240) estimated that 59% of patients discharged with an IHD diagnosis were eligible, and an expert opinion from Canada (102) suggests about 50%. Based on 2002 statistics (224), the assumption could be made that 50% of the patients discharged with the diagnosis of IHD or CHF would be eligible (table 4.1). The need for CCR services in Denmark could then be estimated to between 10,000 and 15,000 patients per year depending on whether all admitted patients or only first-time admissions are included. To this number could be added patients undergoing other heart surgery than CABG and patients with implantable cardioverter defibrillators plus the unknown number of patients at high risk of IHD discharged from hospitals.

5. A local model of comprehensive cardiac rehabilitation

This chapter presents a local model of hospital-based outpatient CCR based on the experience of the Department of Cardiology at H:S Bispebjerg Hospital from 1997 until 2003. To disseminate the local clinical and organizational experience, the CR team published a local manual as a practical example of implementing CCR in Denmark (243); Chapters 1, 2, 13, 14 and 15 have been translated into English as part of this PhD dissertation (Annex C). The manual was distributed to all hospitals and health planners in Denmark and CCR collaborators. To meet the demand for open access to the CCR interventions (6,18,20,244), a web site targeting health professionals in Denmark was also established (www.Hjerterehabilitering.dk) and we are working on an English counterpart (www.CardiacRehabilitation.dk).

5.1 Introduction

H:S Bispebjerg Hospital is a large hospital in the City of Copenhagen with a catchment area of 130,000 people. The Head of the Department of Cardiology received Denmark's guidelines on CCR when they were published in 1997 (9) and appointed a local working group to evaluate the existing outpatient ambulatory follow-up service. The local working group found several areas requiring revision or extension according to Denmark's guidelines on CCR, and a local report on implementation of CCR was prepared in October 1997 (23). Because Denmark's guidelines on CCR (9) did not describe the elements of the CCR intervention in detail, the local report described the core components thoroughly. The hospital administrators widely accepted the proposed local CCR programme. The hospital's regional and national collaborators also focused on the local programme because the hospital was Denmark's national model for a health-promoting hospital. Clinical experience on CCR needs to be collected in Denmark because it has little practical and scientific experience with CCR (17,21,22,216), and describing the reorganization thoroughly was given high priority.

The local CCR programme and the Cardiac Rehabilitation Unit at H:S Bispebjerg Hospital were founded as a project in late 1999. In the following years, the project was carefully adjusted in relation to the prepared scientific protocol, and effort was made to maintain the intervention as described throughout the study period. Despite this effort, the local CCR programme went through several typical development phases (245,246) described in detail elsewhere (247,248). The project was established with a fixed duration of 3 years for organizational and evaluation purposes. When the project ended after the 3 years in March 2003, the local CCR programme described here was implemented as a full CCR service with only minor changes. Thus, the programme is described in the present tense even though this text describes the project period.

5.2 Basic principles

The CCR programme at H:S Bispebjerg Hospital is organized according to Denmark's current guidelines (9,34) and the local report (23). The organization is based on the principles described in Chapter 2: a broad definition of CCR; an integrated comprehensive approach; individual tailoring; a multidisciplinary and interprofessional approach; involvement of partners; broadening of the target group; patient-centred health communication; and systematic risk factor management and clinical assessment.

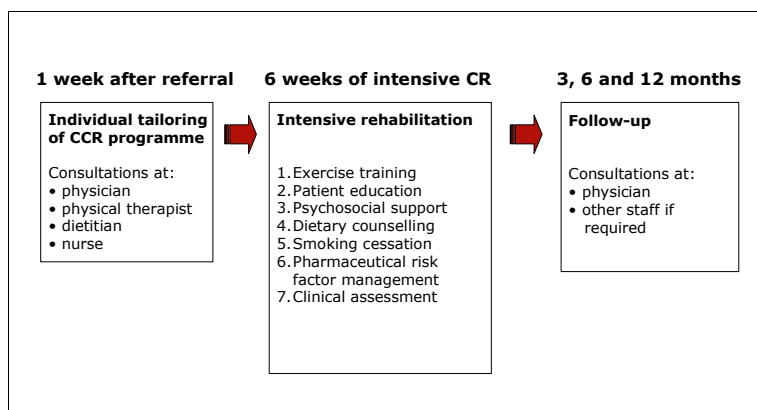
Lifestyle intervention

Lifestyle intervention plays an important role in the secondary prevention strategy of the local CCR programme (249). The local lifestyle intervention is based on knowledge about the links between heart disease and smoking, dietary habits and exercise habits. There are several theories on how health behaviour is established. Nevertheless, none of these theories has been able to explain fully how lifestyle can be changed in the long term (250), and the documented effect of these individual theories is scarce even though these theories are used frequently (153). The local CCR intervention focuses on the stages of change model for lifestyle intervention (251). This model comprises the basis for many disease prevention services at hospitals in Denmark (216), but a systematic review of studies that used the stages of change model (252) could not clearly document any effect. The local CCR programme also uses elements of the health belief model (250), the self-efficacy theory of Albert Bandura (253) and the principles of action competence (254). The lifestyle intervention in the programme is designed as group intervention but includes individual counselling. The composition of the lifestyle intervention is based on the patients' motivation, needs and resources.

Core components

The core components of the local CCR are: individual tailoring (255), patient education (256), exercise training (257), dietary guidance (258), smoking cessation (259), psychosocial support (260) and systematic risk factor management and clinical assessment (261). All treatment components are located in the Cardiac Rehabilitation Unit, which is separate from the Department of Cardiology. All components include theoretical and practical approaches followed by individual follow-up and feedback. The content of each of the components is described thoroughly in the manual (243), presented in an article on study design and methods submitted for publication (Annex D) and summarized in this section.

Figure 5.1. The CCR programme at H:S Bispebjerg Hospital



Individual tailoring. The patients' rehabilitation programmes are individually tailored based on individual consultation with a physician, a clinical dietitian, a physical therapist and a nurse followed by a conference that establishes the final goals of rehabilitation. Based on the patients' individual needs and resources and on the treatment goals, a 6-week individual intensive CR programme is tailored. The treatment goals are selected for each individual and are based on Denmark's current guidelines on pharmaceutical and nonpharmaceutical treatment. Table 5.1 outlines the ideal treatment goals in the local CCR programme.

The motivation and effort of patients is a key element in the local CCR programme. The importance of respecting the individual right of self-determination is emphasized and influences the individual goal-setting strongly. The health professionals are obligated to pass on knowledge about the relationships between lifestyle, disease and the ability to prevent further disease progression. They support patients and their spouses in making decisions on changing lifestyle.

Table 5.1. Ideal treatment goals in the local CCR programme

	CHF (262)	IHD (38)	HR (214)
Symptomatic treatment	No angina NYHA classes I–II		–
Blood pressure (mmHg)	< 140/90		< 140/90
Serum cholesterol			
Total (mmol/l)	< 4.5		< 5.0
LDL (mmol/l)	< 2.6		< 3.0
HDL (mmol/l)	> 1.0		> 1.0
Triglycerides (mmol/l)	< 2.0		< 2.0
Weight			
BMI	< 25 kg/m ²		< 25 kg/m ²
Waist male/female	< 94 cm/< 80 cm		< 102 cm/< 88 cm
Lifestyle			
Physical activity	> 30 minutes per day*		
Dietary habits	Heart-healthy diet		
Smoking	Nonsmoker		
Level of functioning(4)			
Physical	Maximally optimized		
Psychological	Maximally optimized		
Social	Maximally optimized		

NYHA: New York Heart Association classification system. *The recommendation on physical activity changed during the study period from 4 hours of moderate physical activity a week to > 30 minutes per day (144)

Patient education. Patient education is offered as group sessions with six scheduled lectures of 1.0–1.5 hours and individual education when needed. The patient education also includes a 3-hours supplementary course in practical cardiac resuscitation. Practical training as described below supplements the structured lectures. The topics of the six structured heart-health meetings are: 1) heart disease and risk factors, 2) the psychosocial response to heart disease, 3) living with heart disease, including pharmaceutical treatment, 4) a heart-healthy diet, 5) physical activity and 6) continuing to live a normal life.

Exercise training. Exercise training is a cornerstone of the local CCR and comprises the largest portion of time spent in the 6-week programme at H:S Bispebjerg Hospital. Exercise training includes an initial individual consultation with the physical therapist, supervised exercise training, a test of aerobic functioning before and after the 6 weeks, a theoretical lecture during the patient education sessions and individual follow-up with the physical therapist. The supervised exercise training is a 6-week group programme of 90 minutes twice weekly. The intensity, duration and activities are individually tailored according to the initial test results, individual preferences and current guidelines for exercise training (86,263). Each session is structured with 10 minutes of warm-up; 30 minutes of graduated aerobic training; 10 minutes of cooling down. Patients use stationary cycles, stairways and brisk walking in the training supplemented by upper-extremity training using elastics and walking-sticks. Watches with heart-rate monitors are used during training sessions, and at the end of each session the training is individually evaluated by collecting information on perceived exertion using the Borg Scale, angina during exercise using the Borg Angina Scale and subjective exercise experience using a local scale that has not been validated.

Dietary guidance. The component of dietary guidance is based on the three basic heart health principles: less fat, more fish and more vegetables and fruit (175). The dietary counselling is offered as initial individual consultation with the dietitian. Cooking classes are offered as well as individual courses for patients with special dietary conditions: hypercholesterolaemia, NIDDM, obesity or risk of undernutrition. The cooking classes are structured as three sessions of 2.5 hours on practical cooking. The lectures focus on the heart healthy diet and the principles of tasty, recognizable food that is easy to cook. Each session begins with a 30-minute theoretical introduction to the theme of the recipes of the day. Each cooking class ends with everyone sitting down to dinner.

Smoking cessation. The Cardiac Rehabilitation Unit supports smoking cessation through individual counselling with a nurse, smoking cessation counselling in groups and individual cessation programmes. The initial individual consultations with the nurse introduce smoking cessation. Based on the individual consultation and the patient's motivation to stop smoking, an individual programme is put together: individual counselling, group counselling, nicotine replacement therapy and biofeedback using systematic measurement of carbon monoxide concentrations in expired air. The group counselling is set up according to a national smoking cessation programme over 6 weeks with five sessions of 1.5 hours each based on the following topics: 1) patients' smoking history and ambivalence about quitting, 2) nicotine addiction, abstinence and replacement therapy, 3) preventing relapse: high-risk situations, relaxation techniques and distraction, 4) health benefits of quitting and health-related issues such as weight gain and 5) maintenance and evaluation.

Psychosocial support. The psychosocial support the Cardiac Rehabilitation Unit offers is not a delimited component of CCR but is part of the overall services. In addition to the structured, individual counselling, psychosocial support plays a key role in the informal discussions between patients and practitioners and between patients, such as in exercise training, where social interaction is essential. Effective pharmaceutical treatment of symptoms can similarly be considered part of psychosocial support, since this is important in treating any depression or anxiety that may develop in association with heart disease. Patients are screened for depression as part of the individual consultation with the nurse; the interview focuses on psychosocial issues including depression and anxiety, social network and work-related issues. Vocational guidance is offered as individual consultations and support by the hospital social worker. A 24-hour telephone helpline is part of the integrated programme.

Systematic risk factor management and clinical assessment. Risk factor management and clinical assessment are given high priority. At follow-up, the patient's risk profile is systematically assessed, and the lifestyle changes achieved are supported and reinforced. The patient is assigned to follow-up at 3, 6 and 12 months with a physician. If needed, a consultation with the dietitian, physical therapist or nurse can be arranged.

Table 5.2. Ideal prophylactic pharmaceutical treatment in the local CCR programme

	CHF (262)	IHD (38)	HR (214)
Thrombotic inhibition (5) Acetylsalicylic acid 75 [‡] mg Clopidogrel bisulfate 75 mg	+ Optional ^{*,†}	+ Optional ^{*,†}	+ Optional [†]
Beta-blockers	+	+	Optional
Calcium antagonist		Optional when beta-blockers are not tolerated	
ACE inhibitors	+	Optional	Optional
Angiotensin-II	Optional	Optional	Optional
Spironolactone	+	Not used	Not used
Statins	+	+	Optional

*12-month supplement to acetylsalicylic acid following percutaneous coronary intervention. †When allergic to or intolerant of acetylsalicylic acid. ‡150 mg of acetylsalicylic acid for previous stroke. (264)

At each visit, patients are informed of their results, and biofeedback and supervision are given. Pharmaceutical treatment is systematically examined to ensure optimal symptomatic and prophylactic treatment and pharmaceutical compliance (Table 5.2). A stepwise approach is applied; if there are no side effects, the patient is given the maximum dose of one drug before a new one is added, to limit the daily intake of drugs and minimize the potential interactions.

Focus on NIDDM. In the first part of the project period, we found that patients with NIDDM were being inadequately treated in relation to the existing recommendations (265-269). In addition, we suspected that several of the patients had NIDDM without having been diagnosed. To improve the diagnosis and to improve the results of the treatment of patients with both heart disease and NIDDM, we developed a special NIDDM module to supplement the CCR programme. The NIDDM module includes screening for NIDDM, individual counselling on NIDDM, group education, individual education and a meeting on impaired glucose tolerance. The individual counselling with a dietitian on diet and NIDDM is also a part of the CCR service aimed at patients with NIDDM.

Coordination of core intervention. The CR interventions are coordinated by systematic exchange of information using electronic patient records and at a weekly conference with all clinical team members. The weekly conference also discusses the tasks of the coming week, appointments and planned absence with the aim of carrying out tasks optimally. In addition, the conference carries out long-term planning and adaptation.

Multidisciplinary and interprofessional approach

The purpose of the multidisciplinary and interprofessional approach of the local CCR programme is to ensure that the activities within the seven components of treatment are coordinated with the aims of ensuring an optimal rehabilitation programme for each patient and of achieving the treatment goals.

The staff have attended team-building and training courses taught by organizational psychologists to ensure a good foundation for an interprofessional approach. The staff have focused on developing communication skills, profession-based and interprofessional supervision, developing a common culture and giving priority to professional and social interaction. The staff have further participated in the patient services offered by other professions to obtain insight into a interprofessional approach and are regularly updated within the individual components of rehabilitation through extended staff meetings and interprofessional conferences.

The core team. The core team at H:S Bispebjerg Hospital comprises the following positions (numbers relative to full time): 0.8 physicians, 1.0 nurse, 1.0 physical therapist, 0.5 clinical dietitians, 1.0 secretary and 1.0 receptionist. Further, a social worker and a liaison psychiatrist can be involved when needed. The team members were recruited from the local Department of Cardiology.

All core team members were trained in motivational interviewing before the programme started. The nurses were trained in smoking cessation counselling. None of the team members had prior specific experience with CCR. The functions of all positions in the Unit have been detailed in writing, including the qualifications required, job functions and areas of responsibility.

5.3 Experience

During the project period, the CR staff obtained considerable experience in clinical practice (270,271) (Annex C). This section summarizes our experience and reflections on individual tailoring, quality assurance, a multidisciplinary and interprofessional approach, educational needs and the importance of systematic assessment and referral procedures.

Individual tailoring. The principle of individual tailoring is considered to be a key element in CCR, but how this should be delivered in everyday clinical practice has not been fully described. In the beginning of the study, individual tailoring solely included a consultation with a physician. However, this did not provide the staff with adequate knowledge of the patients' motivation, resources and barriers, and the individual treatment goals were not clear to the interprofessional team of practitioners. The CCR programme was extended to include individual counselling with a physical therapist, clinical dietitian and nurse. The focus for the interprofessional conference was changed to emphasize the individually tailored rehabilitation programmes and establishing goals and planning clinical assessment. We found that the model in which all professions counsel the patients strengthens both the individual professions and the interprofessional approach and thereby improves the overall patient programmes.

Quality assurance. Coordinating the multifactorial intervention and assuring the quality of care has been very challenging. We experienced that systematic and clear assessment of the CCR intervention for each patient is essential in CCR. In the programme we used joint electronic patient records to overcome this need. Standardized interview guides were prepared to ensure uniform information content for the individual counselling. A joint information base developed through common systematic information collection turned out to be decisive for coordinating the interprofessional programme and an important prerequisite for assuring a high-quality coherent programme for each patient. We experienced that the fact that the Unit is in one location is decisive for treatment and gives patients the sense that the individual components are coordinated. Since CCR is developing rapidly, the staff must be given the opportunity for further education and continual updating within science.

Multidisciplinary and interprofessional approach. The clinical practice in the Cardiac Rehabilitation Unit is organized based on the fundamental principles of a multidisciplinary and interprofessional approach as stressed by guidelines. However, how to implement this important key issue of CCR in clinical practice is not fully described. The interprofessional approach in the CCR programme at H:S Bispebjerg Hospital is based on the premise that decisions on the goals of treatment should be influenced by the insight of several professions and a common framework. We emphasize the term interprofessional instead of multidisciplinary to reflect this premise. We are convinced that CCR is optimized when the various professional approaches and competencies are used in a coherent programme in which the tasks performed are coordinated. Nevertheless, we found practising interprofessional cooperation to be extremely difficult. We found, as detailed by others (272), that challenges in cooperation especially arise in the following situations: uncertainty about carrying out tasks, disagreement on the division of tasks and responsibility, disagreement on goals and assessment criteria, differences in how involved the staff are in the programme and differences in the forms of management and cooperation desired by staff. In the future organization of CR, the management should take positions on and involve staff actively in these challenges and establish a structure for these. One prerequisite is common definitions within the interprofessional team. Interprofessional CCR also places very high demands on profession-specific competence. If a high level of profession-specific competence is not ensured by hiring and training highly qualified staff, the interprofessional group risks acquiring an approach in which everyone is merely superficially familiar with the other professions and the advantages of a strong profession-specific approach thus disappear. The daily formal and informal contact between the various professions because the Unit is in one location is very important for interprofessional cooperation.

Educational needs. This project has emphasized the importance of continual further education and training for each profession together with further education and special training within CR with the aim of ensuring professional excellence within all components of rehabilitation.

In the future, the CCR staff are required to have specialized education within their profession. The staff are required to have specialized knowledge within cardiology and experience in treating heart patients since the patients in rehabilitation have complicated cases of heart disease. Educating patients and their families is a component of rehabilitation, and we found that the ability of each practitioner to communicate knowledge on heart disease, influence attitudes and promote changes in lifestyle is decisive for the success of each patient's rehabilitation programme. The future CCR staff must therefore have experience in adult education and motivational counselling techniques and be motivated to take further education or training on the theoretical aspects of adult education and behavioural change, communication and lifestyle intervention. The staff must preferably have experience with interprofessional cooperation and problem-solving. The approach with an interprofessional organization places great demands on the staff to be oriented towards and committed to development and change. Finally, the staff should fundamentally respect the work of all professions.

Systematic referral. Well-functioning CCR services require that all patients be assessed systematically for referral. In the study period, a nurse, as part of the study, systematically assessed all patients' need for CR independently of the discharge process in the Department of Cardiology. In an operational situation, the patients' suitability for CCR would most appropriately be assessed as part of the discharge process. We found that patients are more motivated to participate in CCR if they are asked to attend an outpatient assessment interview than if

they are asked to participate while inpatients. Patients are more clarified about their illness and have determined their need for support after the acute illness period when they attend an outpatient interview. We therefore recommend that patients in the future be referred to outpatient discharge counselling for CCR after the acute treatment has been fully instituted and their situation has been fully assessed. The patients were referred to the CCR programme one week after discharge, which is equivalent to the referral interval for CCR for a typical patient after AMI. We find a general need for clear referral procedures that indicate the optimum time for referral to CCR of the broad and heterogeneous group of patients targeted by CCR in our programme. In the future, effective routines should be implemented that ensure that all patients undergo uniform systematic assessment and referral.

6. Evaluation of the local comprehensive cardiac rehabilitation programme

This chapter outlines the evaluation of the local CCR programme with a focus on the RCT. The trial design is presented in a manuscript submitted for publication (Zwisler ADO, Schou L, Soja AMB, Brønnum-Hansen H, Gluud C, Iversen L, Sigurd B, Madsen M, Fischer-Hansen J. A randomized clinical trial of hospital-based, comprehensive cardiac rehabilitation versus usual care for patients with congestive heart failure, ischemic heart disease or high risk of ischemic heart disease (the DANREHAB Trial) – design, intervention and population; Annex D). The trial design has also been presented as papers and posters at international conferences.

6.1 Introduction

According to the current Danish guidelines described in Chapter 2, CCR is broadly indicated and targets patients with CHF and IHD. Patients with a high risk of developing IHD are also pointed out as a future target group (9,19,35). Nevertheless, CR trials have mostly included men below 65 years of age with MI (18), and the effects of CR among more broadly defined patients are not fully known. Studies indicate that women benefit as much as men (273) and that patients older than 75 years benefit (74,273), but these patients have been underrepresented so far.

As described in Chapter 3, the quality of the RCTs on CR has been questioned. Of the studies included in the Cochrane meta-analysis (18), 82% did not describe the randomization clearly, and few reported assessing outcome blindly. Methodological problems in RCTs risk exaggerating the estimated intervention benefits (18,274), which stresses the importance of conducting high-quality trials.

Many RCTs on CCR do not describe the interventions or describe them poorly (18,20). This creates difficulty in reproducing programmes proven to be effective. Further, in complex, multidisciplinary interventions, poorly described studies and heterogeneous trials pose problems in analysing and interpreting any overall effects. To overcome these problems, detailed descriptions of evidence-based CR interventions have been sought (6,18,20).

Many CR studies were carried out before 1995, and their effects may today be outstripped by new and highly effective treatment methods: statins, ACE inhibitors and acute invasive treatment. The incremental benefit of CR with most patients receiving thrombolysis, acetylsalicylic acid, statins, beta-blockers and ACE inhibitors has not been studied adequately, and no CCR trial has fully described medication at baseline and follow-up among the study groups.

As described earlier, Denmark has sparse scientific and practical experience with CCR, and it is not fully known whether international evidence on CCR can be applied to a national health care system within the modern therapeutic era of cardiology.

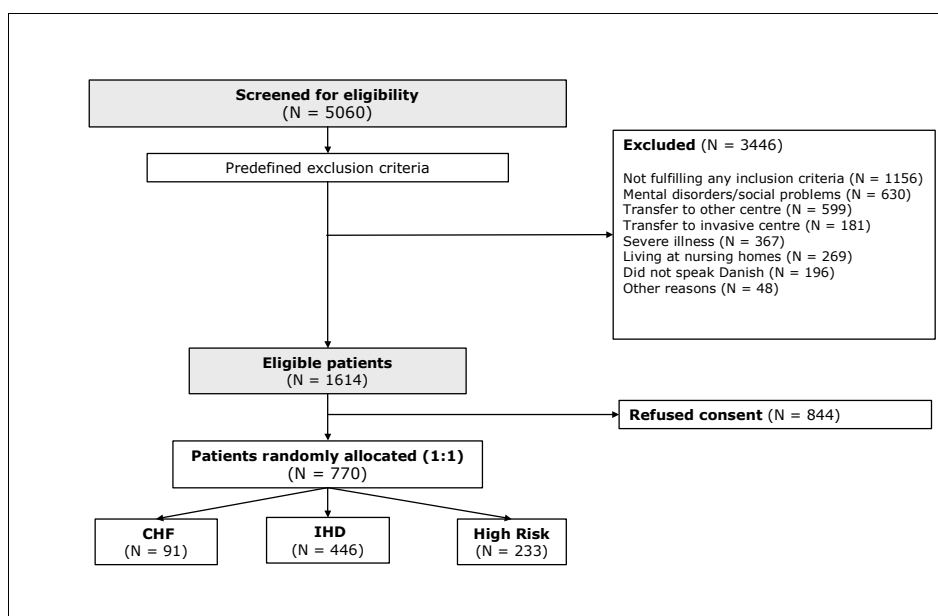
To ascertain whether hospital-based CCR is superior to usual care treatment on broad indications, a large-scale RCT was designed: the DANREHAB Trial.

6.2 Trial design

The DANREHAB Trial was designed as a two-armed centrally randomized clinical trial comparing hospital-based CCR to usual care for patients with CHF, IHD or a high risk of IHD. Based on results from a pre-intervention study (275), the population size required was calculated as 1810 patients with a follow-up period of 1 year, a power of 0.80 and two-sided $P < 0.05$. The duration was fixed at maximum 3 years to minimize the influence of changes in treatment trends over time. The pilot study indicated that 900 patients would be eligible annually, enabling the 1810 patients to be achieved within 3 years at the expected participation rate of about 70%.

Figure 6.1 outlines the patient flow of the DANREHAB Trial. All patients discharged from the Department of Cardiology at H:S Bispebjerg Hospital were screened according to the inclusion and exclusion criteria. Patients who gave informed consent were randomized 1:1 to the CCR and usual care groups using a centralized randomization procedure with stratification according to diagnosis group, age, gender and known NIDDM. The usual care group was offered standard follow-up treatment prescribed by the discharging physician. The CCR group was offered treatment in the Cardiac Rehabilitation Unit as described in Chapter 5.

Figure 6.1. Patient flow through the DANREHAB Trial



The primary composite outcome measure for the trial includes overall mortality, MI or readmission due to heart disease. Investigator-independent outcome data from registries were chosen to ensure blinded assessment and outcome analysis. Several secondary outcomes have been defined and reflect the multifactorial nature of the intervention (Table 6.1).

6.3 Study population

Of the 5060 patients screened in the study period from March 2000 to February 2003, 68% were excluded due to predefined exclusion criteria, leaving 32% of the patients eligible. Among the eligible patients, 770 patients (47%) consented to enrol in the trial. Among the patients included, 91 were stratified to the CHF group, 446 to the IHD group and 233 to the group at high risk of IHD (Figure 6.1). Patients who consented were younger ($P < 0.001$) and had a lower comorbidity score than patients who did not consent ($P = 0.03$) (Figure 6.2). Univariate analysis showed that men were more likely to consent than women. This gender difference disappeared when corrected for age and comorbidity in a multivariate logistic regression analysis.

Table 6.1. Baseline data and outcome measures collected in the DANREHAB Trial

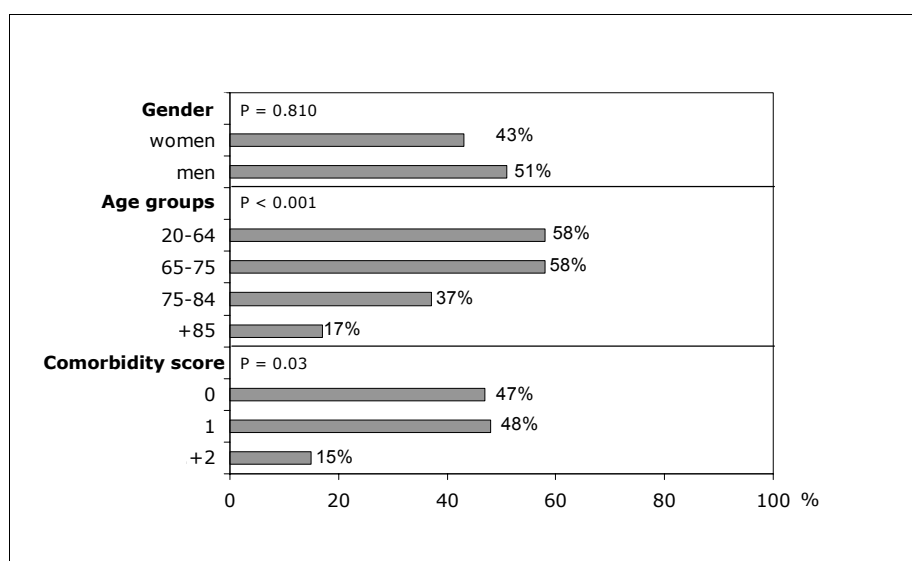
	Baseline (all patients)	3 and 6 months (CR group)	12 months (all patients)	Registry (all patients)
Background				
Age, gender	x		x	
Education, socioeconomics ^b	x		x	x
Working situation, sick leave ^b	x	x	x	x
Medical history				
Family history of IHD ^b	x			
IHD ^{b,d}	x			x
Intermittent claudication, stroke ^b	x			x
NIDDM ^{b,d}				x
Comorbidity ^d				
Lifestyle				
Smoking ^b	x	x	x	
Carbon monoxide measurements ^c	x		x	
Leisure activity ^b	x		x	
6-minute walking test ^c	x		x	
Diet ^{a,b}	x	x	x	
Weight, height ^c				
Waist and hip circumference ^c				
Risk factors				
Resting blood pressure ^c	x	x	x	
Fasting lipids ^c	x	x	x	
Fasting glucose ^c	x	x	x	
Health-related quality of life, anxiety and depression				
SF-36 Health Survey ^b	x	x	x	
Hospital Anxiety and Depression Scale ^b	x	x	x	
Antidepressants ^{b,d}	x	x	x	x
All medication				
ATC codes, dosages ^{b,d}	x	x	x	x
Readmissions				
Total number ^d				x
CHF as primary diagnosis ^d				x
IHD as primary diagnosis ^d				x
MI as primary diagnosis ^d				x
Deaths				
Total mortality ^d				x
IHD mortality ^d				x

^aValidated self-administrated questionnaire. ^bInterview. ^cClinical examination. ^dAdministrative information.

Table 6.2 outlines the baseline characteristics of the study population. The mean age of the population was 64.6 years, and 36% were women. Of the population, 42% had previous MI, 17% CABG and 26% PCI. Twenty per cent of the population had known NIDDM at baseline, 30% had systolic blood pressure above 140 mmHg and 61% total cholesterol above the target goal for the group (Table 5.1). More than half the patients were physically inactive at baseline (53%), 29% were current smokers and 27% were obese (body mass index (BMI) \geq 30). Summarizing the modifiable risk factors, 62% of the patients had three or more modifiable risk factors above the treatment goal for the specific patient group.

A total of 381 patients were randomized to the CCR group and 389 to the usual care group. Among the CCR group, 86% completed the CCR intervention. The CCR group and the usual care group did not differ in demographics and baseline risk factors, showing that the randomization procedure worked.

Figure 6.2. Participation-rate in subgroups of consenting patients in the DANREHAB Trial tested by logistic regression with adjustment of other covariates



6.4 Discussion

The current Danish guidelines (9) recommend CCR broadly. The evidence on CCR, however, is still limited because the trials have primarily included MI patients younger than 65 years of age (18). The DANREHAB Trial included a broad spectrum of patients, but older patients and patients with high comorbidity were underrepresented. This may limit the external validity. The DANREHAB Trial, however, included more elderly people and more women than previous trials on CCR (Table 3.2).

The quality of the CR trials has been questioned due to poorly described randomization, lack of blinded outcome measures and insufficient programme description (18). In the DANREHAB Trial we randomized each patient by using a centralized randomization procedure to avoid selection bias (276).

Blinded outcome assessment is especially relevant in CR trials in which blinded allocation is not possible due to the nature of the intervention. The existence of a national system of unique person identification and a national registry recording data on all somatic hospital admissions in a population with relative demographic stability makes blinded primary outcome assessment possible in the DANREHAB Trial. The data on somatic hospital are highly valid for administrative data concerning admissions, identification and discharges (97–98%) but have lower validity for diagnosis: 66–88% depending on diagnosis (225). A recent study (226) indicates that the information on the MI diagnosis from the registry is highly valid (93%).

We stipulated a sample size of 1810 patients but only 770 patients were enrolled. Many patients, especially elderly people, were reluctant to participate, and the participation rate reached 47% versus the expected 70%. Patients who did not speak Danish were excluded because money was lacking for interpretation; this was not planned initially. Other reasonable explanations for not reaching the stipulated sample size of 1800 patients were unpredictable logistical events such as change in patient record procedures and leave among scientific staff. However, with 770 patients, the DANREHAB Trial is the largest single-centre RCT on CCR (Table 3.3).

Not reaching the stipulated population size of 1810 patients increases the risk of not finding a statistically significant difference even though it may exist (a type II error). To decrease this risk, the follow-up period for the primary outcome will be extended, as stated in the initial protocol. The follow-up can be extended due to the registry-based capture of the primary outcome measure. This extension, however, raises the risk of crossover from usual care to CCR, since CCR was implemented as a full service for all IHD patients at H:S Bispebjerg Hospital in April 2003. This will be taken into account in the long-term follow-up analysis using late entry.

Table 6.2. Demographics, history of disease and risk factors at baseline in the DANREHAB Trial Percentages unless otherwise stated

	CHF	IHD	HR	All
	N = 91	N = 446	N = 233	N = 770
Demographics				
Age (years) (mean)	70.3	65.9	60.1	64.6
Women	37.4	33.4	41.6	63.6
Living alone	62.6	45.5	44.6	47.3
Working	7.7	24.9	35.6	26.1
History of disease				
IHD presentation				
MI	51.7	62.6	-	42.3
CABG	19.8	25.6	-	17.1
PTCA	22.0	41.6	-	26.1
Diabetes	30.8	18.4	18.9	20.0
Modifiable risk factors				
Blood pressure				
High systolic [†]	13.2	27.6	39.9	29.6
High diastolic [†]	5.5	9.6	22.8	13.1
Cholesterol				
High total cholesterol [†]	41.8	45.7	47.2	45.7
High LDL cholesterol [†]	40.7	41.9	45.9	43.0
Low HDL cholesterol [†]	55.0	50.0	55.4	52.2
High triglycerides [†]	6.6	17.5	23.2	17.9
Lifestyle				
BMI ≥ 30 kg/m ²	31.9	20.2	38.2	27.0
Moderate physical activity [*]	69.2	48.2	52.8	52.1
Current smoking	20.9	24.9	40.4	29.1

* < 4 hours of leisure activity per week.

The intervention of the DANREHAB Trial was described thoroughly (243) to facilitate the implementation of CCR in daily clinical routine. The CCR-intervention in the DANREHAB Trial can be characterized as a complex intervention based on several components including behaviour and methods of organizing and delivering (20). As indicated in the definition of CCR, all components seem essential to the proper functioning of the intervention, although the components of the intervention that are effective are difficult to specify. Each component may act both independently and interdependently (20). In the DANREHAB Trial, precisely defining the “active ingredients” is not possible. A large amount of information, including information on medication at baseline and follow-up, has been collected to approach the nature of the complex intervention (Table 6.1).

Effort has been made to maintain the intervention as originally described. Given that interventions normally evolve over time, as providers become more experienced and individualize the intervention to meet their own styles and the perceived needs of participants, analysis will be carried out to determine whether the DANREHAB Trial has a learning-curve effect.

6.5 Publication plan

Within the coming year, the results from the DANREHAB Trial will be analysed and prepared for submission to peer-reviewed journals. The primary and secondary outcome data will be analysed; registry data are expected to be available from the central registries in June 2004. Further, the publication plan includes studies on safety, cost-effectiveness and NIDDM. The impact on organization and the patients’ perspectives will further be presented as part of the comprehensive health technology assessment.

7. Conclusion and perspectives

7.1 Introduction

This dissertation has focused on CR, outlining the contemporary definition of CR and reviewing the current evidence. This chapter summarizes and concludes the dissertation. The future perspectives of CR in Denmark are discussed to close the chapter.

7.2 Definition

The definition of CR has evolved considerably since the first programme was announced more than 40 years ago. Contemporary CR has evolved from early ambulation to complex comprehensive interventions based on several components.

Two expert consultations convened by WHO in 1992 defined CR as: "the sum of activity required to influence favourably the underlying cause of the disease, as well as to ensure the patients the best possible physical, mental and social conditions so that they may, by their own efforts, preserve, or resume when lost, as normal a place as possible in the life of the community". The goals of CR are to improve functional capacity, alleviate or lessen activity-related symptoms, reduce unwarranted disability and enable patients with heart disease to return to a useful and personally satisfying role in society. Secondary prevention strategies are today strongly emphasized as part of CR. CR is divided into three phases: I) the in-hospital phase, II) the reconditioning outpatient phase and III) the lifetime maintenance phase. Each phase has its own goals for patient care and progression.

According to Denmark's current guidelines published in 1997, the keywords of hospital-based CR today are: an integrated comprehensive approach, individual tailoring, a multidisciplinary and interprofessional approach and broadening of the target group. The core components of outpatient CCR are: individual tailoring, patient education, exercise training, dietary guidance, smoking cessation, psychosocial support and systematic risk factor management and clinical assessment.

7.3 Evidence of comprehensive cardiac rehabilitation

The scientific literature on CR has been growing steadily since the late 1960s, and the number of publications has more than doubled within the last 10 years. Systematic meta-analysis has documented that exercise-based CR reduces overall mortality by 20% and cardiac mortality by 26% compared with usual care. Further, exercise-based CR has been documented to reduce risk factors (systolic blood pressure, total cholesterol, low-density lipoprotein cholesterol, triglycerides and smoking). Studies have indicated that CR positively influences the health-related quality of life; although most studies reported an improvement, only two studies included in a recent meta-analysis showed an improvement exceeding that in the usual care group. The positive influence on the health-related quality of life still remains to be proven, and standardized validated instruments for measuring the disease-specific health-related quality of life are needed.

The systematic review on the evidence of CR covers numerous trials and patients, but these trials primarily include male post-MI patients younger than 65 years of age. A subgroup analysis in the most recent meta-analysis indicates that the results are consistent when stratified according to gender, age groups and diagnostic groups. The effects on a more broadly defined group of patients are still not fully known.

Trials vary considerably according to the time between the acute cardiac event and randomization, the type of intervention and the duration of intervention and follow-up. The quality of the trials has been questioned due to lack of allocation concealment and blinding and poor or missing description of intervention. Further, no trial included in the meta-analysis ideally fulfils Denmark's definition of contemporary CR. Thus, the rationale and recommendations of CCR are primarily based on the body of evidence of each of the core components, but the aggregate effect of CCR still remains to be proven.

7.4 Implementation in Denmark

Based on the results of a postal questionnaire survey, we found that most hospitals in Denmark offer one or more of the CR components: exercise training, patient education and psychosocial support, smoking cessation and dietary guidance during in-hospital stay and as outpatient hospital services. However, not all hospitals offer CCR, defined as hospitals offering all these CR components. Community-based maintenance CR services were especially lacking: 57% offered in-hospital CCR; 47% offered outpatient CCR; 36% offered CCR in-hospital and outpatient. According to the heads of departments of cardiology, only two hospitals facilitated access to all components of community-based maintenance CR services. Our survey probably overestimated the coverage of CCR in hospitals in Denmark in 1999 based on comparison with other studies.

Each year an estimated 10,000 to 15,000 patients with IHD and CHF need CCR services in Denmark. To this number should further be added patients undergoing other heart surgery than CABG and patients at high risk of developing IHD discharged from hospitals. It is not known how many of the eligible patients actually participate in CR activities in Denmark, because this information is not registered.

Differences in health care systems and the organization of services do not allow the coverage of CR to be directly compared between countries, but based on Denmark's coverage, Denmark seems to be 5 years or more behind the United Kingdom, Germany and the United States. Several CR activities have been initiated in Denmark since the survey was conducted in 1999 (Annex A2); these activities may have positively influenced the coverage of CR at hospitals in Denmark.

7.5 A local model of comprehensive cardiac rehabilitation

H:S Bispebjerg Hospital received Denmark's guidelines on CR in 1997 and initiated implementation of CCR the same year. Since Denmark's guidelines do not describe CCR in detail, a local programme was developed as an example of a CCR model. The programme was designed according to the current guidelines and contemporary definition of CR. The Cardiac Rehabilitation Unit was founded in 1999, and a 3-year study was conducted on implementing a local model of CCR.

The local implementation study showed that outpatient CCR that complies with Denmark's existing guidelines for CR could be organized and implemented at a large urban hospital. Experience from the study indicated four key areas that need special attention in implementing hospital-based CCR locally.

- Individual tailoring and coordination must be systematically assessed.
- The quality of the content within each core component must be systematically monitored.
- Continual development of an interprofessional approach and culture must be given priority.
- Profession-specific as well as CR-specific education are cornerstones in ensuring high-quality CR services.
- Coherent CR should be ensured through systematic clinical assessment and referral procedures from one phase of CCR to another and access to well-functioning phase III services.

7.6 Evaluation of the local model: study design and material

A large-scale RCT, the DANREHAB Trial, was designed to clarify whether the local model of CCR is superior to usual care for patients with CHF or IHD or patients with a high risk of IHD. Patients were centrally randomized to CCR or usual care, and a 12-month blinded primary outcome measure based on public registries was chosen.

During the study period, 5060 patients discharged alive were screened; 1614 (32%) were eligible for the trial. Of these, 770 (47%) consented to randomization. The study included a relatively high percentage of women (37%) and patients older than 75 years of age (23%). Randomized patients were younger ($P < 0.001$) and had less comorbidity ($P < 0.03$) than nonrandomized patients. Among the 770 patients included, 91 patients were stratified to the CHF group, 446 to the IHD group and 233 to the HR group. Many modifiable risk factors were present at baseline (62% of patients had three or more modifiable risk factors).

This trial shows that a large-scale randomized clinical trial on CCR can be conducted among a broad group of patients with centralized randomization and blinded outcome assessment, although recruiting elderly patients with comorbidity was difficult.

Delay in patient recruitment and challenging study logistics only allowed the study design, patient recruitment and baseline data to be presented in this dissertation. Within the next year, the primary and secondary outcome data will be analysed and prepared for submission to peer-reviewed journals. Further, the publication plan includes studies on safety, cost-effectiveness and NIDDM. The impact on the organization of services and the patients' perspectives will further be presented as part of the comprehensive health technology assessment.

7.7 Future challenges of cardiac rehabilitation in Denmark

CCR should be implemented throughout Denmark's health care system for all patients with heart disease who need it. This is a prudent activity that can provide substantial benefits in reducing mortality, slowing down disease progression and improving health-related quality of life. We found that Denmark's health care system made marked progress in implementing CR services in the 1990s; nevertheless, the quantity and quality of services vary widely, and the coverage of services still needs to be expanded considerably. The local implementation study showed that outpatient CCR that complies with Denmark's current guidelines can be organized and implemented at a full scale.

Ensuring full access to CCR services requires initiatives to fully expand these services, which are widely accepted among professionals, politicians and health planners. Several reports and statements have been published in Denmark since 1997 (Annex A2); the time has come to prepare practical action plans nationally, regionally and locally. These plans must consider the continuum of CCR, the quality of CCR services, educational needs and future research and development.

Continuum of comprehensive cardiac rehabilitation

The continuum of CCR comprises not only the efforts of the outpatient programme but must include efforts during each of the three phases of CCR that must succeed one another in a continuous, chronological order. The comprehensive intervention is often based on activities by several actors in various sectors, and it is decisive that the patients consider cardiac care to be logical and coherent.

Phase I. Optimum CR in phase I and subsequent systematic clinical assessment and referral to phase II are prerequisites for a successful phase II hospital-based CR programme. Experience from the CCR programme at Bispebjerg Hospital shows that systematic assessment identifies many patients with heart disease or at high risk of heart disease who need systematic CCR. Nevertheless, our experiences also show that not all patients want or are well suited for a hospital-based outpatient CR programme. Elderly patients and patients with CHF especially have difficulty in deciding to participate in a long programme requiring many visits to the hospital. Denmark offers very few alternatives to hospital-based outpatient treatment, such as home-based CR or, as in other countries, phase II inpatient CR.

Phase II. The CCR programme at Bispebjerg Hospital has shown that outpatient CCR that complies with Denmark's current guidelines can be organized. The experience from Bispebjerg Hospital showed that an interprofessional approach requires a different organizational structure than the traditional hierarchical structure of hospitals and hospital departments, which tends to support the specialized profession-specific culture. One future challenge is therefore to develop an organizational design and a form of management for rehabilitation that better supports interprofessional methods of performing tasks and continuity in patient care across traditional professions and professional cultures while ensuring profession-specific excellence.

One alternative to hospital-based phase II CR is home-based CR, which may turn out to be just as effective as hospital-based programmes. Nevertheless, home-based CR requires well-functioning outpatient programmes at which staff are based or from which staff can obtain experience and expertise. Experience with home-based CR in

Denmark needs to be developed and assessed so that CR in the future can reach out to a broader target group than merely the relatively well-functioning patients who can manage to participate in the outpatient programmes.

Phase III. At the end of phase II, it is very important that the patients can be referred to well-functioning phase III services with the aim of maintaining the effects achieved. The practical experience from Bispebjerg Hospital and from our survey of CR in Denmark showed that few phase III CR services are available. Similar to other countries, Denmark urgently needs to scale up phase III CR. Local health centres, which are currently being debated in Denmark, have been proposed as a vehicle for expanding phase III CR to local areas in other European countries.

Intersectoral cooperation. Attention has increased in recent years to the fact that patients are especially vulnerable during the transition between phases because coordination may be lacking between actors and activities. The problem is not solely that the intersectoral cooperation or lack thereof does not support the programme optimally. The most important problem is that poorly functioning intersectoral cooperation adversely affects the otherwise positive activities within the individual phases and sectors.

Ensuring coherent and optimum patient care turned out to be difficult in the programme at Bispebjerg Hospital. This task becomes even more difficult when a coherent programme has to be coordinated across the various sectors. Clinical assessment and referral are an important aspect of ensuring intersectoral cooperation. Ensuring clear guidelines for assessment and referral procedures is key as well as establishing joint responsibility for implementing assessment and referral across sectors. The experience from Bispebjerg Hospital inspires conviction that intersectoral cooperation can be improved considerably in the future.

Quality of comprehensive cardiac rehabilitation services

The quantity and quality of CCR offered at hospitals in Denmark varies substantially, which stresses the importance of assuring the quality of the future services. A joint clinical CR database should be established to monitor CCR activities and referral rates. This database should be coordinated with the ongoing European activities: the European Cardiology Audit and Registration Data Standards (CARDS), a European CR database. The practitioners of CCR must agree on common outcome measures for CR and define data standards. One of the central outcomes of CCR is improving the health-related quality of life, but Denmark still has not valid instrument to measure this outcome.

The Interest Group on Diagnosis-related Groups and Disease Prevention supported by the National Board of Health is working on making CR activities part of the official system of public financing of hospital services; maintaining high standards and quality in CCR requires that only interventions proven to be effective be supported and reimbursed.

Educational needs

No formal training programmes or education related to CR are available in Denmark today. Creating formal educational programmes is a decisive aspect of realizing the goals of CCR in the future. One of the most important lessons learned from Bispebjerg Hospital is that an interprofessional approach must be based on profession-specific excellence and on fundamental mutual respect among the professions involved. Education of the future, including educational programmes for specialists in cardiology, should require knowledge of and ability to manage CCR. Ensuring professional excellence requires that the basic education and further education support this through well-documented methods, types of activities, documentation and evaluation within each profession. Successfully implementing CCR in the future requires that basic assumptions on coherent CR programmes and on the necessity of interprofessional cooperation be shaped and profiled in connection with basic education as well as further education.

Future research and development

Denmark has been lagging far behind in CR research. Denmark is one of the countries that urgently needs to expand CCR services and has little previous culture in this field and therefore has a great opportunity to conduct research and to closely monitor and develop evidence-based services.

The main scientific question related to CCR today is how to best deliver services and to whom. Research must therefore examine how each of the core components should be delivered to reach the predefined goals. Further research must explore how to ensure systematic referral, adherence to programmes, optimal risk-factor reduction, maintenance of lifestyle changes and pharmaceutical compliance. This research must also investigate organizational and cultural barriers to CCR and how to overcome these to ensure well-functioning interprofessional CCR services.

The results from the DANREHAB Trial will contribute to knowledge on CCR aimed at a broad group of patients. Further, the evaluation of the local CCR programme at Bispebjerg Hospital will contribute to knowledge on the cost-effectiveness of hospital-based CCR in Denmark, organizational issues and the patients' perspectives on CCR.

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CARDIAC REHABILITATION

a survey on implementation in Denmark
and presentation of a local model

Current guidelines recommend cardiac rehabilitation as part of the comprehensive cardiac care aimed at stabilizing ischaemic heart disease, improving physical capacity, limiting physical and mental disability and improving the overall quality of life. The long-term goals of cardiac rehabilitation are to reduce patients' long-term risk of heart disease and to reduce morbidity and mortality. According to the guidelines, these goals can be realized through comprehensive cardiac rehabilitation programmes.

Denmark's clinical guidelines on cardiac rehabilitation were published in 1997. The role of cardiac rehabilitation has subsequently been emphasized in Denmark among professionals, politicians and administrators. This PhD dissertation:

- describes the implementation of comprehensive cardiac rehabilitation at hospitals in Denmark by 1999;
- presents a local model of comprehensive cardiac rehabilitation; and
- outlines the trial design and characteristics of the study population of a randomized clinical trial on comprehensive cardiac rehabilitation in Denmark.

The main results from the randomized clinical trial will be prepared for publication during autumn 2004.