UNIVERSITY OF KWA ZULU-NATAL

A SURVEY TO DETERMINE THE NEED AND SCOPE FOR A CARDIAC REHABILITATION PROGRAMME AT GREY'S HOSPITAL IN KWA ZULU-NATAL - A MULTI DISCIPLINARY PERSPECTIVE

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DECLARATION

“I declare that a survey to determine the need and scope for a cardiac rehabilitation programme at Grey’s Hospital, Kwa Zulu-Natal – a multi-disciplinary perspective – is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references".

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Melisha Rabilal

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DEFINITIONS OF TERMINOLOGY USED

Angina

Angina is chest pain or discomfort that occurs when the heart muscle does not get enough blood. When plaque builds up in the arteries of the heart insufficient blood reaches the heart muscle. These changes that occur in the arteries of the heart are known as atherosclerosis.

Atherosclerosis

Atherosclerosis is a slow progressive disease that may start in childhood and eventually impede the blood flow through the arteries of the brain, heart, kidneys, and the arms and legs. In a severe case scenario the blood flow to these organs can be blocked off.

Blood Pressure (BP)

Blood pressure is the force of the blood pushing against the walls of the arteries and is expressed as two numbers, the systolic blood pressure and diastolic blood pressure. Usually they are written as SBP/DBP e.g. 120/80 mmHg. Blood pressure is measured with a variety of equipment, such as mercury baumanometers or electronic BP monitors.

Cardiomyopathy

Cardiomyopathy refers to diseases of the heart muscle. In cardiomyopathy, the heart muscle becomes enlarged or abnormally thick or rigid resulting in the inability of the heart to function as an effective pump for blood to the different areas of the body.

Cardiovascular disease (CVD)

Cardiovascular disease refers to any disease of the heart and blood vessels. The most common are diseases of the heart muscle, strokes, heart attacks, heart failure and heart disease caused by high blood pressure.

Coronary artery disease

Coronary artery disease occurs when the coronary arteries that supply blood to the heart muscle become hardened and narrowed. This is due to the build up of fatty deposits (artheroma). Eventually, blood flow to the heart muscle is reduced and the heart muscle is not able to receive the amount of oxygen it needs. This process leads to ischaemic heart disease, which causes damage to the heart muscle.

Diabetes mellitus

Is a condition where the body stops making the hormone insulin. Insulin carries the sugar, glucose from the blood into the cells where it is used for energy. As a result the glucose levels in the blood rises and can cause organ damage if not treated.

Hypercholesterolaemia

Hypercholesterolaemia is a high level of cholesterol in the blood and a major risk factor for heart disease, which leads to atherosclerosis, heart attacks and strokes. The cholesterol is in different forms in the blood. The most important ones are low-density lipoprotein (LDL) known as the 'bad' cholesterol and high-density lipoprotein (HDL), which is the 'good' blood cholesterol. A high level of LDL cholesterol increases the risk of heart disease. Therefore, the lower the LDL cholesterol level, the lower the risk of heart attack and stroke. Higher HDL levels are better and give some protection against heart disease whereas a low HDL cholesterol; puts one at higher risk for heart disease.

Heart attack

A heart attack is also known as a myocardial infarction (MI). When the diseased roughened arteries of the heart become too narrow or a clot forms, blood flow to the heart muscle is restricted. The heart muscle is left without oxygen, causing death of segment of the muscle and leaving the heart unable to pump sufficient blood to the rest of the body. This is characterized by a sudden severe chest pain that may spread down one or both arms to the neck.

Heart failure

Heart failure is caused by the inability of the heart to pump blood efficiently around the body. This occurs because of damage to the heart muscle as a result of various diseases. The circulation becomes slow causing excess fluid to be retained in the body.

Hypertension (High BP)

High blood pressure known as hypertension is a BP reading of 140/90 mmHg or higher. A person has hypertension if either of the numbers is above the "normal" point. Once high BP develops it usually lasts a lifetime. It can be controlled by following a healthy lifestyle and using appropriate medication. Hypertension is controlled when treatment reduces the BP to below 140/90 mm Hg. If hypertension is not treated it may cause:

1. The heart muscle to weaken, which may lead to heart failure;
2. Small bulges (aneurysms) to form in arteries. Common locations are the main artery from the heart (aorta); arteries in the brain, legs and intestines; and the artery leading to the spleen;
3. Arteries to the kidney to narrow which may cause kidney failure;
4. Arteries throughout the body develop atherosclerosis or they can weaken, especially those in the heart, brain, kidneys and legs. This can cause a heart attack, stroke, or kidney failure.
5. Blood vessels in the eyes to burst or bleed, which may cause changes in vision and result in blindness.

Hypotension (Low BP)

Abnormally low blood pressure especially in the arteries of the systemic circulation is known as hypotension. Hypotension is the opposite of hypertension. Hypotension is generally considered as systolic blood pressure of less than 90 mm Hg or diastolic less than 60 mm Hg. However in practice, blood pressure is considered as too low only if noticeable symptoms are present.

Morbidity

Morbidity refers to people who have a disease or condition whilst they are still alive.

Prevalence

Prevalence refers to the percentage of people in the population who have a condition at any point in time.

Rheumatic heart disease

Rheumatic heart disease is a condition in which permanent damage to heart valves between the chambers of the heart occurs. The heart valve is damaged by a disease process called rheumatic fever that begins with a throat infection caused by streptococcus bacteria. These malfunctioning heart valves eventually place stress on the heart muscle and a person may require an operation to replace the diseased heart valve.

Stroke

A stroke also referred to as a cerebrovascular accident (CVA) occurs when the blood flow to the brain is interrupted. This could either happen when a blood vessel to the brain ruptures, causing bleeding, or becomes blocked by a blood clot. The affected brain cells then start to die because of a lack of oxygen and other nutrients. The severity of a stroke varies from a passing weakness or tingling in a limb to a profound paralysis, coma or death.

Abstract

Aim : The study was explored within the context of a survey to determine the need and scope for a cardiac rehabilitation programme at Grey's Hospital in Kwa Zulu-Natal. A multi-disciplinary perspective was sought as a cardiac rehabilitation programme with a multi-disciplinary approach is holistic. Also it is an effective intervention as secondary prevention in the care of the cardiac patient.

Design : Exploratory survey in a "case-study".

Setting : a provincial, tertiary hospital in Kwa-Zulu Natal

Participants : Permanent healthcare workers employed by the Department of health and working in the various units at Grey's Hospital with more than 3 years experience. Staff included nurses and doctors in the coronary care unit, medical ward D1, catheterization unit and the cardiac clinic. Allied staff such as occupational therapists, dieticians, psychologists and physiotherapists also participated in this study. Staff not satisfying the above criteria and those not consenting to be part of the study were excluded. 58 questionnaires were distributed and 35 were returned completed.

Intervention : A self developed questionnaire was used and information was obtained about the demographics of the healthcare workers, relevant interaction with cardiac patients and aspects of training related to cardiac conditions. Questions were directed to professionals as pertained to their respective scope of practice. Some questions were "open" ended and required responses with descriptions and/ or explanations. Admission records were perused in various cardiac units to determine the number of cardiac patients accessing services at Grey's Hospital.

Results : The total number of cardiac patients that attended Grey's Hospital from January 2007 to December 2011 was 19983. The cardiac clinic showed an increase annually in the number of patients each year from 2495 in 2007 to 3569 in 2011 with a total number of 15928 over 5 years. All professionals assisted patients with achieving cardiac rehabilitation goals. There was a need demonstrated for the implementation of written resources for patient education; and training of staff in cardiac rehabilitation according to international guidelines. Basic life support (CPR) training is present among

some professionals. A structured referral of patients for cardiac rehabilitation is not present and a phase I-IV cardiac rehabilitation programme with updated protocols is not present at Grey's Hospital. Health professionals listed the scope of practice for current and potential interventions with cardiac patients. Healthcare workers also expressed their views on the value of a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital. Benefits for a multi-disciplinary cardiac rehabilitation programme at referral hospitals were listed by the multi-disciplinary healthcare workers. It was found there is a strong agreement to have a cardiac rehabilitation programme at Grey's Hospital across all disciplines. An overall agreement of 32/35 for rehabilitation programme is statistically significant with $p < 0.001$.

Conclusion : There is a need for a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital.

CHAPTER ONE

1.1 Introduction

Cardiovascular disease (CVD) is a worldwide problem with an increased prevalence in sub-Saharan Africa. Rheumatic heart disease, hypertension, and cardiomyopathy are already prevalent, and coronary heart disease is assuming growing significance. It is vital that in developing countries, rehabilitative care be incorporated into the existing health care system (Mathes 2007).

Cardiac rehabilitation is a complex intervention that requires the input of a multi-disciplinary team of qualified and competent professionals to encompass and deliver the recommended core components. It not only provides advice and support for patients to make healthier lifestyle choices but also supports them to return to work and develop important self-management skills for long term adherence (British Association for Cardiac Rehabilitation (BACR) 2012)

The efficacy of comprehensive exercise-based cardiac rehabilitation has been demonstrated in the literature and is considered a fundamental intervention in CVD management and prevention (National institute in clinical excellence 2007 and 2012). It has been shown to significantly reduce cardiac, cardiovascular and all-cause mortality (Taylor et al 2004; Lawlor et al 2011; Heran et al 2011). Cardiac rehabilitation has also been shown to improve the patient quality of life, physical activity status and anxiety and depression levels (Yohannes et al 2010). Furthermore, cardiac rehabilitation supports early return to work and the development of self-management skills. Recent evidence now suggests that exercise-based cardiac rehabilitation is also associated with a reduction in myocardial infarction (Lawler et al 2011) and a reduction in early post discharge hospital readmission rates (Lam et al 2011). Altogether it is one of the most cost-effective treatments available – second to only asprin and beta blockers (Fidan et al 2007)

Secondary prevention and rehabilitation are part of the World Health Organization strategy for controlling cardiovascular diseases. The quality of each individual's life, of which health is an essential determinant, should be a primary goal. Rehabilitation goals are not only to train patients disabled by cardiovascular disease to adapt to their environment but also to intervene in their immediate milieu and in society as a whole in order to facilitate their social integration (WHO 1993).

Enormous changes in the rehabilitative approach to the care of patients with cardiovascular disease have occurred since the World Health Organization (WHO) Expert Committee on the Rehabilitation of Patients with Cardiovascular Diseases was organized by WHO in 1963. At that time, rehabilitation was concerned predominantly with individuals recovering from acute, essentially uncomplicated, myocardial infarction; the several rehabilitative interventions recommended for such patients were considered to encompass "the sum of activities required to ensure them the best possible physical, mental and social conditions so that the patients may, by their own efforts, resume and maintain as normal a place as possible in the community". Now, however, rehabilitation is considered to be an essential part of the care that should be available to all cardiac patients with its goals to improve functional capacity, alleviate or lessen activity-related symptoms, reduce unwarranted invalidism, and enable the cardiac patient to return to a useful and personally satisfying role in society (Mathes 2007).

The American association for cardiovascular and pulmonary rehabilitation (AACVPR 2004) has published guidelines for cardiac rehabilitation and secondary prevention programmes. A cardiac rehabilitation resource manual is also in circulation (AACVPR 2006). Together with the American heart association the AACVPR has issued a scientific statement outlining the core components of cardiac rehabilitation/secondary prevention programmes (AHA/AACVPR scientific statement 2007).

With reference to developing countries, it was the task of the WHO Expert Committee to identify the current status of rehabilitative care for cardiac diseases, highlighting and interrelating four aspects (WHO 1993):

- implementation of cardiac rehabilitation in developing countries;
- exercise testing and training in the rehabilitation of children and young adults with cardiovascular disease;
- rehabilitation of severely disabled cardiac patients with medically complex problems;
- current and future approaches to education in the rehabilitation of patients with cardiovascular disease.

During its deliberations the Committee has assumed that a medical diagnosis of cardiovascular illness must be made if rehabilitative care is to be initiated. In this, the Committee's recommendations differ from those concerned with primary prevention of cardiovascular disease. The recommendations for rehabilitative care have been formulated for cardiac patients characterized as being at high, intermediate, and low risk of early recurrence of cardiovascular events and thus at high, intermediate and low risk for exercise training. Additionally the recommendations for functional assessment of patients and for physical activity components of care are divided into those feasible and appropriate at facilities equipped for basic, intermediate, and advanced levels of care.

The WHO in its technical report presents recommendations particularly to medical practitioners involved in a variety of fields, including primary care, cardiovascular medicine and surgery, paediatric cardiology, rehabilitation medicine, sports medicine, occupational medicine, geriatrics, and medical insurance, as well as to non-physician health professionals working in rehabilitative care. Some are also aimed governmental and voluntary health organizations and agencies and professional medical societies that are instrumental in the areas of public health policy, regulation and legislation, as

well as at educational institutions responsible for the professional training and postgraduate education of health personnel involved in cardiovascular care.

Some of the World Health Organization committee's recommendations are concerned with the results that cardiac patients, their families, teachers, and employers can reasonably expect from rehabilitative care. The Committee finally suggests a variety of roles that can be played by international bodies, including WHO and the International Society and Federation of Cardiology, in supporting or implementing studies, projects, training programmes etc., designed to enhance the availability and efficacy of rehabilitative care and thus to improve the outcome of cardiovascular disease for patients of all ages.

1.2 Problem Statement

In 2011 Kwa Zulu-Natal province had an estimated population of about 10.8 million and 1,017,763 people reside in the Umgugundlovu District. The majority of the people in these districts are unemployed and will thus rely on the public health system for their cardiac rehabilitation services. The staff of a cardiac rehabilitation programme usually include a medical doctor, physician, cardiologist trained in cardiac rehabilitation, physiotherapist, exercise physiologist/biokinetist, dietician, psychologist, and a cardiac trained sister. Occupational therapists and social workers may also be involved with the programme. Patient counselling and spouse education forms an important part of cardiac rehabilitation programmes (Levy 1993). Some programmes also have religious counselling as part of the programme. It is obviously not always possible to have the above mentioned staff at all programmes throughout South Africa as South Africa is a country in socio-economic transition.
The Umgungundlovu district in Kwa Zulu-Natal is surrounded by 3 districts which currently employ physiotherapists.

A preliminary review of the districts reveals that :

- Umgungundlovu District has 9 hospitals

- eThekwini District has 13 hospitals
- iLembe District has 4 hospitals
- Ugu District has 5 hospitals

Community service physiotherapists render outreach services in rural community hospitals and clinics identified by the department of Health. Physiotherapists are mostly involved in the treatment of cardiac patients in the acute and sub-acute settings when patients are hospitalised. Currently in Kwa Zulu-Natal there are two hospitals in the public sector which offer outpatient cardiac rehabilitation programmes. The Department of Physiotherapy at Inkosi Albert Luthuli Hospital in Durban and the R.K.Khan Hospital in Durban have established phase III programmes.

This study at Grey's Hospital identified that a cardiac rehabilitation programme as secondary prevention is lacking in the Umgungundlovu district. Within the different professional scopes of practice the study probes practitioners as to their view on the intervention of cardiac rehabilitation and the possible benefits cardiac rehabilitation may offer patients.

As a multi-disciplinary intervention, a cardiac rehabilitation programme addresses the goals as outlined by the WHO expert committee. There is thus a need to establish the scope for a cardiac rehabilitation programme at the hospital.

1.3 Motivation for the Study

Physiotherapists internationally are involved in the care of patients with coronary artery disease from the acute stage (Phase 1) until Phase III (structured rehabilitation programme) is completed. In Kwa Zulu-Natal rehabilitation workers mainly physiotherapists are employed in the public and private sectors. Within the physiotherapy profession in South Africa there is limited research and participation in multi-disciplinary cardiac rehabilitation programmes as outlined by the World Health Organization.

The British Association for Cardiac Rehabilitation (BACR) and the Association for Chartered Physiotherapists interested in Cardiac Rehabilitation (ACPICR) offer postgraduate instructor training in this field.
The guidelines for cardiac rehabilitation are outlined in courses offered by the cardiopulmonary group which is a special interest group of the South African Society of Physiotherapy. Physiotherapists in public hospitals and the private sector are invited to attend these courses. However, formal post-graduate training in cardiac rehabilitation according to BACR, ACPICR and AACVPR guidelines are not conducted with Physiotherapists in South Africa. Grey's Hospital is a tertiary hospital and it would be beneficial to introduce a cardiac rehabilitation programme at this institution as it deals with a large number of patients presenting with cardiac conditions and complications.

Statistics extracted from hospital records show that from the period 2007 to 2011 there was a total of 15928 cardiac patients seen at the Grey's Hospital cardiac clinic which is an outpatient clinic. The total number of cardiac patients including in-patients for the same period was 19983 with an increase from 3437 patients per annum in 2007 to 4489 patients per annum in 2011.
However no studies have been conducted in this institution although cardiac rehabilitation occurs on a daily basis.

Grey's Hospital is a tertiary Hospital in the Umgungundlovu district serving the midlands and the western half of the province of Kwa Zulu-Natal. The area serviced by Grey's Hospital is known as zone 2.

Since cardiac rehabilitation is a multi-disciplinary model, a multi-disciplinary perspective was sought and the perspectives of health professionals were examined to determine whether there is scope for multi-disciplinary practice at Grey's Hospital.

1.4 Aim of the Study

The study is conducted within the context of an exploratory survey to determine the need and scope for a cardiac rehabilitation programme at Grey's Hospital – Kwa Zulu-Natal. A multi-disciplinary perspective was sought as a cardiac rehabilitation programme with a multi-disciplinary approach is holistic. Also it is an effective intervention as secondary prevention in the care of the cardiac patient.

1.5 The Study Objectives

The following study objectives have been formulated:

1.5.1 To establish the need and scope for cardiac rehabilitation programme at Grey's Hospital

1.5.2 To establish current practice among health workers at Grey's Hospital

1.5.3 To establish the current number of patients accessing the cardiac units at Grey's Hospital

1.5.4 To establish whether there exists the potential for a cardiac rehabilitation programme at Grey's Hospital

1.6 Significance of the Study

The study indicated that due to the large number of patients accessing the hospital services, there is a need for cardiac rehabilitation as secondary prevention. The respondents from the different professional groups will give insight as to their respective practices when interacting with cardiac patients. This information will be presented to the department of Health as it will serve as a starting point for cardiac research at the institution. The hospital management will also be able to refer to the results of the study to support cardiac rehabilitation at the institution. Grey's Hospital will be increasing its bed status and the results support an existing recommendation for the establishment of a well resourced cardiac rehabilitation programme.

1.7 Summary of Chapters

- **Chapter 1: Introduction**

  This chapter introduces the topic under investigation and outlines the purpose of the study. The flow of information in the thesis is clarified.

- **Chapter 2: Literature Review**

  Aspects of cardiac rehabilitation are presented here. The aim is to bring clarity and research related to the topic.

- **Chapter 3: Methodology**

  The methodology used to determine the need and scope for a cardiac rehabilitation programme at Grey's Hospital – a multi-disciplinary perspective is presented in this chapter. This section thus includes the sampling technique, instrumentation used to collect data, the procedures employed and the strategies used to analyse data.

- **Chapter 4: Results**

  The results of the study are presented in the form of graphs (cylinder, pyramid, column and cone), tables and pie charts and include the statistical analysis.

- **Chapter 5: Discussion**

  The results are discussed and references made to studies which relate to this topic.

- **Chapter 6: Conclusion**

  Conclusions are drawn related to the study. Recommendations and limitations are presented. This section is followed by the related references used.

Chapter 2

2. Literature Review

In this chapter cardiac disease will be explored and cardiac rehabilitation described. The recommendations of the AHA, AACVPR, American college of sports medicine and the WHO technical report series will be outlined. Literature on research in cardiac rehabilitation will be discussed and current practice of physiotherapists in South Africa reviewed. An overview of Grey's Hospital and its facilities will be presented.

2.1 Burden of disease

The burden of cardiovascular disease (CVD) in the world is enormous and growing and the majority of those affected are in developing countries (Beaglehole et al 2003; Mbewu 1998). In 2002 it was estimated that 29 percent of deaths worldwide (16.7 million deaths) were due to CVD and that 43 percent of global morbidity and mortality, measured in disability-adjusted life years (DALYs), was caused by CVD (WHO 2002). Furthermore, 78 percent of global mortality and 86 percent of mortality and morbidity from CVD occurs in developing countries. By 2020 it is estimated CVD will become the leading cause of the global health burden, accounting for 73 percent of total global mortality and 56 percent of total morbidity (Murray et al 1996; Reddy et al 1998).

Africa has not been spared this global tide of CVD. In most African countries CVD is now the second most common cause of death after infectious disease, accounting for 11 percent of total deaths (WHO 1999); and CVD is a major cause of chronic illness and disability. Projections from the global burden of disease project suggest that from 1990 to 2020, the burden of CVD faced by African countries will double. A large proportion of the victims of CVD will be

middle-aged people. The poor will suffer disproportionately as a consequence of their higher disease risk and limited access to health care (Mbewu 2006).

The financial and social costs of this CVD epidemic are likely to have a negative impact on development and the alleviation of poverty (http:/www.ichealth.org). African countries therefore face a double burden as they struggle to cope with the burden of communicable diseases and diseases associated with lack of socioeconomic development. Furthermore, their predicament is only likely to worsen, because the majority of their populations are under 35 years of age, and the determinants and risk factors for CVD are already prevalent and increasing within this age group.

The population of South Africa totals approximately 52 million people and is ethnically and economically diverse. The diversity is reflected in the patterns of urbanisation with nearly 50% of the black population residing primarily in rural or per-urban areas compared to fewer than 20% of white South Africans or those of mixed ancestral or asian origin (South African National Census 2011). However, urbanization of the black population has been increasing rapidly, particularly since 1994. Furthermore, this rapid urbanization combined with globalization has been accompanied by large shifts in the health patterns of South Africans, increasing the prevalence of non-communicable disease (Bradshaw 2003). The South African National Burden of Disease study for the year 2000 estimated that 17% of all deaths were due to cardiovascular diseases (Bradshaw 2005). Of these deaths, ischaemic heart disease and stroke each accounted for 35% of cardiovascular deaths, hypertensive heart disease 15%, inflammatory heart disease 6% and other causes including rheumatic heart disease accounted for 9%. It is of interest to note that in South Africa HIV/AIDS is the leading cause of death and accounts for 30% of all deaths.

Cardiovascular disease contributes much to the burden of morbidity and mortality from chronic diseases in industrialised countries, including South Africa (Steyn et al 1992). In the period between 1997 and 2004, 195 people died per day because of some form of heart and blood vessel disease (CVD) in South Africa. About 33 people die per day because of a heart attack, while

about 60 die per day due to a CVA. It is reported that the ratio of death from a heart attack is 1 female for every 2 males. As a result of heart failure about 37 people die per day (Bradshaw 2005). Despite the high death rates caused by AIDS in South Africa, acturial projections suggest that the rate of chronic diseases, including heart disease, would also increase. The model suggested that chronic disease death would increase from 565 deaths per day in the year 2000 to 666 deaths per day in 2010. More than half the deaths caused by chronic diseases occur before the age of 65 years. These are premature deaths which affect the workforce and have a major impact on the economy of the country (Bradshaw 2003; Pestana 1996). Premature deaths caused by heart and blood vessel diseases (CVD) in people of working age (35-64 years) are expected to increase by 41 percent between 2000 and 2030. The negative economic impact of this will be enormous (Leeder 2004).

The highest death rates for heart and blood vessel disease in South Africa are found in Indian people, followed by coloured people, while the white and black people have the lowest rates (Norman 2006). Although white and black African people have similar rates for these diseases, their patterns differ considerably. White people mainly reflect a pattern of death caused by heart attacks while the black African people reflect that of death caused by CVA and diseases of the heart muscle and high blood pressure.

Available data suggests that common heart conditions such as ischaemic heart disease, heart failure, rheumatic heart disease and diseases of the heart muscle, the heart valves and heart disease caused by high blood pressure; are poorly managed (Commerford 2006; Mayosi 2006; Silwa 2005; Commerford 2005).

The potential costs of this CVD epidemic for African countries are staggering. Cardiovascular disease (direct and indirect) is estimated to cost the United States about US$300 billion annually, equal to the entire gross domestic product of the African continent. Clearly, even a fraction of such cost has the potential to cause enormous damage to the economies and developing trajectories of African countries. In this way, the growing CVD epidemic in Africa will increase already unacceptable levels of inequity in access to health care services. The overall health of African nations will not improve, nor will

their level of development, unless they deal with this epidemic of CVD. Furthermore, in an increasingly integrated global economy the CVD epidemic in developing countries will divert economic goods to CVD care, resulting in a reversal of developmental efforts; productivity will decline because of the loss of more productive citizens; and consumer markets will shrink as a result of loss of the purchasing power of these citizens.

Prevalence of Risk Factors for Heart Disease

Along with increased burden of non-communicable diseases, there has been as associated increase in the prevalence of a number of known risk factors associated with heart disease including smoking, sedentary lifestyle, and increased intake of dietary fat (Bourne 1993; Yach 1988; Reddy 2003). Furthermore, South Africans have a high prevalence of overweight and obesity, with over 50% of women and more than 20% of men considered overweight by World Health Organization (WHO) standards (body mass index kg/m^2>25). Indeed, the World Health Survey 2003 published by the WHO, suggests that the prevalence of physical inactivity in South African adults is greater than 60% for both males and females. In fact, nearly 60% of all South African adults have at least one major reversible factor. Thus, the need for both secondary and indeed primary intervention initiatives including cardiac rehabilitation is large.

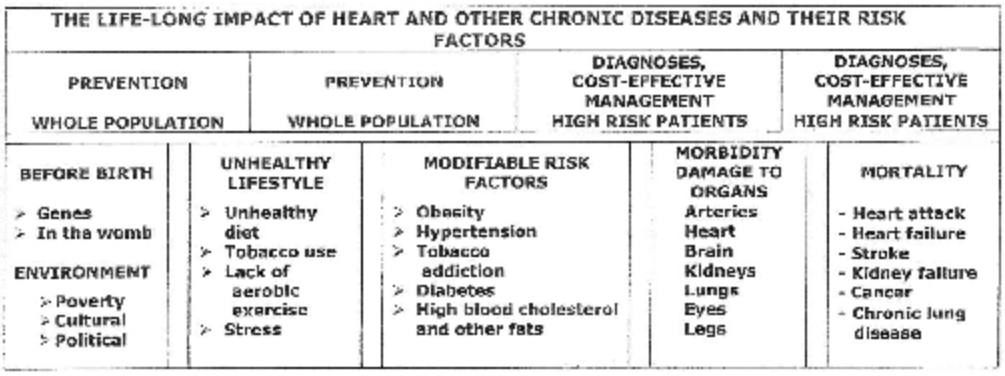
A life-course perspective on heart disease and absolute risk assessment for heart disease is presented in the media data document (Steyn 2007) describing heart disease in South Africa. It is postulated that although most heart attacks occur in middle-aged and older people, the influences of risk factors can start before birth and will have an impact throughout life. Therefore, the process for prevention and management of heart disease must start early and be present throughout life. With reference to the impact of many risk factors on the magnitude of risk for heart disease, in people who have many risk factors the chance of suffering a heart attack grows exponentially with each additional risk factor. This principle can be illustrated by considering a person with three risk factors. The chance of suffering a

heart attack does not increase by 3+3+3 equalling 9, but increases by 3*3*3 equalling 27, thus the risk increases exponentially with multiple risk factors.

In determining the absolute risk for heart disease in the presence of more than one risk factor, and to assess the true level of risk for a heart attack in any person, the impact of all the risk factors present in that person needs to be assessed. Such absolute risk assessment considers the multiplication effect of risk factors to identify those who are at highest risk for getting a heart attack. This implies that the risk for a heart attack in a person with modest levels of many risk factors can be higher than in a person who has only one risk factor at a very high level.

The prevalence and treatment statement status of common heart conditions such as ischaemic heart disease, heart failure, rheumatic heart disease, and diseases of the heart muscle, the heart valves and heart disease caused by high blood pressure is unknown in South Africa (Steyn 2007). However, the available data suggest that these conditions are poorly managed (Commerford 2006; Mayosi 2006; Silwa 2005; Commerford 2005). No data exists on the number of heart attacks or strokes that South Africans suffer from daily. However, there is a rule of thumb suggesting that for one death caused by a heart attack or stroke three persons will survive such an event. This suggest that about 130 heart attacks and approximately 240 strokes occur daily in South Africa (Steyn 2007).

Figure 1 – Scheme to illustrate the life course perspective on heart disease and other chronic diseases (Steyn 2007).



2.2 Cardiac Rehabilitation: South Africa

South Africa is divided into nine provinces. Formal cardiac rehabilitation programmes exist in most of these provinces associated with government hospitals, academic universities or private hospitals.

Outpatient cardiac rehabilitation programmes are conducted from government hospitals, private gymnasia or biokinetic practices associated with private hospitals or private practices under the auspices of universities or sports science/sports medicine departments. Services can vary from provision of exercise rehabilitation only to exercise rehabilitation, patient education, dietary and psychological intervention. The programmes which provide medical monitoring and comprehensive services as listed above tend to be costly and quite exclusive. Most of the patients in the Umgungundlovu district who access services at Grey's Hospital live in impoverished circumstances. It would thus be beneficial to implement a cardiac rehabilitation programme at Grey's Hospital as the hospital is a government public health facility.

However, despite an increasing worldwide trend for cardiac rehabilitation to be considered an important part of patient care, it is estimated that only 15-20% of eligible private cardiac patients are referred to rehabilitation services. This figure is even less in the public sector.

Although cardiac rehabilitation services are underutilized in South Africa, the increasing demand for these services has come to the attention of the health insurance industry and medical insurance schemes. In general most schemes recognize patient claims for reimbursement for cardiac rehabilitation. However, a few still refuse to assist their members in paying for cardiac rehabilitation. The economic diversity in South Africa makes the provision of cardiac rehabilitation services very challenging, particularly at the state or provincial hospitals where budget and staff shortages have made exercise rehabilitation programmes seem a less important priority (Derman 2007).

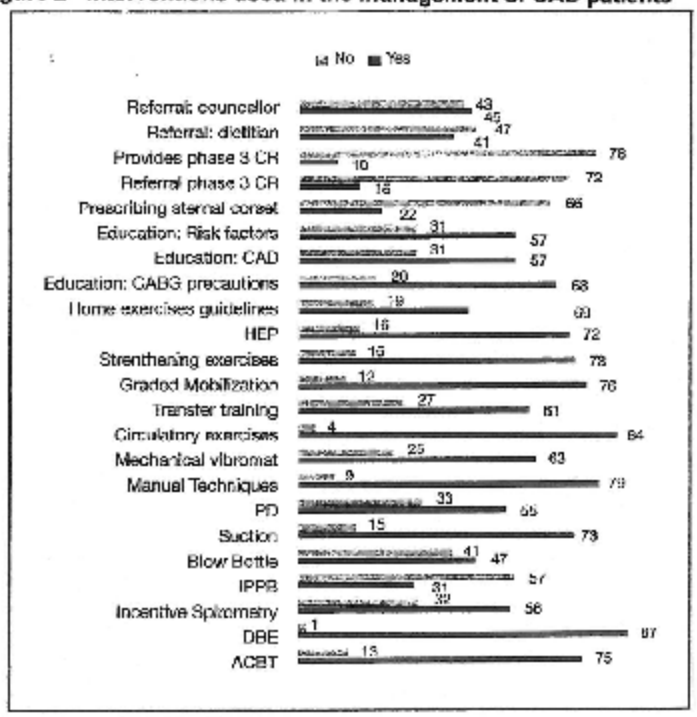
Physiotherapy management of patients with Coronary Artery Disease : Current practice in South Africa

The Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR) and the British Association for Cardiac Rehabilitation (BACR) describe the phases of cardiac rehabilitation as follows :
Phase I – hospital in-patient period
Phase II – convalescent stage following discharge
Phase III – structured rehabilitation programme
Phase IV – long-term maintenance
According to the ACPICR and BACR physiotherapists have a role in the physical activity component of all phases of cardiac rehabilitation (many Phase IV programmes however, are delivered by appropriately trained BACR exercise instructors). Internationally, physiotherapists treat patients with CAD in the acute stage following a coronary event and/or following coronary artery bypass (CABG) surgery. These patients are then subsequently followed up as out-patients during cardiac rehabilitation in order to improve function and quality of life and to delay the occurrence of subsequent coronary events (Piotrowicz et al 2008; Martin 2007; Tucker et al 1996).

A study conducted recently in South Africa (Roos and Van Aswegen 2011) aimed at establishing the number of physiotherapists working in the cardiopulmonary field of physiotherapy and involved in the care and rehabilitation of patients with CAD. The current physiotherapy interventions that are used in the management of patients with CAD were examined. The clinical settings (acute or outpatient care) in which patients with CAD regularly receive physiotherapy interventions was determined. The study revealed the frequency of physiotherapy interventions and follow-up of patients with CAD. Also explanations were presented as to the reasons for non-involvement of physiotherapists who work in a cardiopulmonary setting in rehabilitation of patients with CAD in certain instances.

An observational cross-sectional study was conducted with questionnaires mailed to 50 regional and tertiary government institutions and 137 electronic questionnaires were circulated. A total of 187 questionnaires were sent out and 142 were returned (76%). Results showed that 62% of the physiotherapists provided care to patients with CAD (50 government physiotherapists and 38 private practitioners). Of the 38% who did not treat patients with CAD, 38 were government physiotherapists and 16 private practitioners. Care was mostly provided in a hospital setting (81%) and out-patient phase III cardiac rehabilitation was lacking (11%).

Figure 2 - Interventions used in the management of CAD patients



Data in figure 2 - expressed as number of physiotherapists using interventions. CR, cardiac rehabilitation; CAD, coronary artery disease; CABG, coronary artery bypass graft; HEP, home exercise programme; PD, postural drainage; IPPB, intermittent positive pressure breathing; DBE, deep breathing exercises; ACBT, active cycle of breathing technique.

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Deep breathing exercises (99%), circulatory exercises (95%) and manual chest clearance techniques (88%) were mostly used during physiotherapy. Postural drainage, graded mobilisation and education components (home exercise programme, exercise guidelines and CABG precautions) were commonly included as treatment modalities. Intermittent positive pressure breathing was not commonly used as a chest clearance technique.

Only 16 physiotherapists referred patients to a phase III out-patient cardiac rehabilitation programme and ten cardiopulmonary physiotherapists offered such a programme at the hospital or private practice where they worked.

Most patients received treatment in hospital once or twice daily. Physiotherapists who provide physiotherapy interventions to patients in an outpatient capacity did so once a week (Table1).

Table 1 – Frequency of physiotherapy interventions

In hospital	**Number**
Once daily	52
Twice daily	42
Three times daily	6
Do not provide PT in hospital	4
Outpatient setting	
Two/three times weekly	3
Once weekly	17
Once in two weeks	6
Once in a month	5
Do not provide PT in outpatient setting	56
Depends on patient	1

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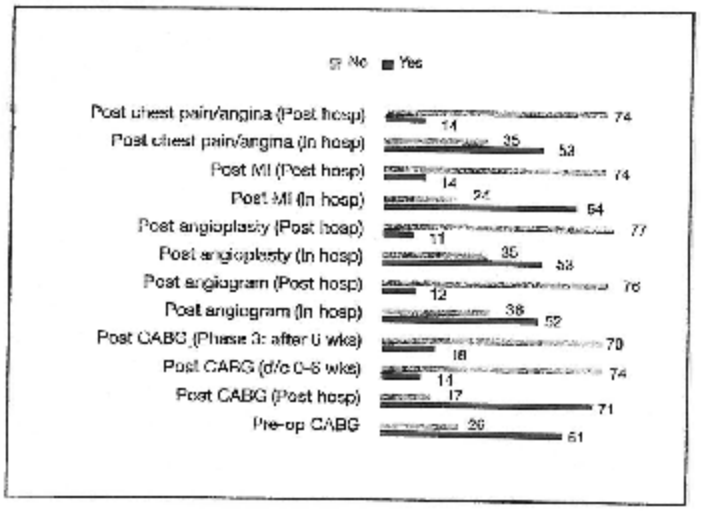
Figure 3 illustrates that patients were most commonly seen in hospital prior to following CABG surgery and after myocardial infarction (MI). Fewer physiotherapists treated patients following admission for chest pain/angina or angioplasty intervention (Figure 3). The reason for referral of these patients to physiotherapy is unknown. Few physiotherapists continued with patient care following discharge from the hospital.

Figure 3 – Clinical settings and scenarios



Data in figure 3 - expressed as number of physiotherapists working in clinical settings/scenarios. MI, myocardial infarction; CABG, coronary artery bypass graft

The most common reasons listed for not providing rehabilitation care to patients with CAD in the private sector included a lack of equipment, space and time. It was mentioned that patients often received information from nursing staff members concerning living a healthy lifestyle and from dieticians concerning an appropriate diet. Some private practitioners did provide out-patient rehabilitation but this was discontinued mostly due to poor patient adherence or changes in doctors' referral patterns. It was also noted that

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patients often lived far away from the specialized centre where their coronary event was managed. Follow-up of these patients was therefore not possible. In the public sector these patients were often not referred to the physiotherapy department or they were transferred to a more specialized hospital. It was also noted that intervention in these patients depended on the patient's clinical condition e.g. the presence of post-operative complications or if they were medically stable.

Primary prevention strategies such as education concerning living a healthy lifestyle and secondary management for re-occurrence of a cardiac event such as cardiac rehabilitation are important components in a attempting to decrease the burden of CAD (Mensah 2008; Piotrowicz and Wolszakiewicz 2008).

Education consisting of post-operative precautions of CABG (wound care and temporary restrictions in physical activity), exercise guidelines (including frequency, intensity, time and type of exercises and red flags), general CAD pathophysiology and risk factor modification was done by physiotherapists in the acute care setting. The motivation of patients with CAD to be active appears to be greatest in the early post-discharge period (Reid et al, 2006). Interventions to assist with increasing physical activity levels during this period, such as phase III cardiac rehabilitation, should be encouraged (Reid et al, 2006). The small number of physiotherapists involved with phase III cardiac rehabilitation is also a cause for concern (Roos and Van Aswegen 2011). It was unclear if patients received cardiac rehabilitation from other health care professionals such as nursing staff or biokinetists.

The questionnaire revealed that deep breathing exercises (DBE) (87) were the most common chest clearance technique used by physiotherapists when treating patients with CAD. The use of DBE is supported by Tucker et al (1996) and Martin (2007) as techniques commonly used by physiotherapists in the management of patients undergoing CABG surgery in Australia and the United Kingdom. There is however conflicting evidence in the literature concerning the effectiveness of DBE following CABG. Treatment techniques

may be divided into positive pressure related and non-pressure related deep breathing exercises.
Westerdahl et al (2005) conducted a randomised control trial (level 1b) in patients following CABG and found that implementing DBE with a fluctuating positive pressure device e.g. blow-bottle improved the patient's pulmonary function. C-T scans of these patient's chests revealed less areas of atelectasis in the intervention group.

It is important to note that the DBE in this study was performed in a sitting position.
It is well known that an upright position is more adventitious compared to the supine position when attempting to improve lung volumes in a cardiopulmonary patient (Pryor and Prasad 2008; Frownfelter and Dean 2006). Intermittent positive pressure breathing (IPPB) was used by 31 physiotherapists in the current study. Romanini et al (2007) reported that IPPB was effective in managing hypoxia in CABG patients in the first few days following surgery. However, Westerdahl et al (2001) reported that DBE performed with a blow bottle device was more effective in preventing a decline in lung function in patients after CABG than DBE alone or IPPB. Brasher et al (2003) on the other hand showed that if DBE was removed from an early mobilisation programme for patients after CABG there was no significant difference between the control and intervention groups relating to the patient's lung function results. In this and Westerdahl's studies the patients were mobilised out of bed on day one post surgery but the positioning and repititions during DBE were different. In Westerdahl's study (2005) all DBE were done in sitting and the repititions of DBE per hour were greater than the latter study where participants were positioned in supine or sitting during DBE and performed fewer repetitions.
With reference to non-pressure related DBE, the effect of IS was compared to other prophylactic physiotherapy techniques on postoperative pulmonary complications (PPC) following CABG in a Cochrane review (Freitas et al 2007) (level 1a evidence). A total of four randomised control trials met the inclusion criteria for this review. The reviewers found no differences in PPC when using IS or a pressure device such as IPPB for patients after CABG

surgery. Worse pulmonary function and arterial oxygen levels were reported with the use of IS when compared to pressure devices (Freitas et al, 2007). Even though the evidence is contradictory in nature regarding the use of chest clearance techniques such as DBE, IS, blow-bottle and IPPB post-operatively, patients who undergo CABG surgery have significant pulmonary dysfunction four days post-operatively which can persist up to four months, following surgery (Westerdahl et al, 2003).

Intervention strategies used by physiotherapists for the improvement of pulmonary function following CABG is therefore still justified.
Manual techniques were frequently used by physiotherapists in the study by Roos and Van Aswegen (2011). A literature search in Pubmed, Cochrane Database for Systematic Reviews however found no studies to support the use of this treatment modality in the care of patients with CAD. Postural drainage (PD) was also commonly used. Head-down PD is considered a relative contraindication in patients with severe cardiovascular disease (Hough 1997). A short-term 30 degree head-down PD session in healthy adults resulted in decreased heart rate, mean arterial blood pressure and diastolic duration (Naylor 2005). In healthy adults these changes may have no serious consequences but in individuals with known CAD and reduced cardiac reserve it could result in significant side effects. Naylor et al (2006) conducted a quasi-experimental study to evaluate the cardiovascular (CVS) and respiratory responses to modified and head-down PD positioning in patients with severe heart disease (mean ejection fraction 23% SD 7). The researchers found no significant differences in respiratory responses in participants when positioned in a modified or head-down PD position. There was a significant difference in CVS responses when the two positions were compared and modified PD was better tolerated. It is therefore advisable to use a modified PD position in patients with CAD if indicated. Close monitoring of the patient's response while in the specific position should be maintained.

Activity based interventions such as circulatory exercises and/or graded mobilisation are commonly used by physiotherapists. These interventions are supported by evidence in the literature. Early mobilisation in hospital is

encouraged following CABG surgery and acute coronary events if patients are medically stable (Hirschhorn et al 2008; Pryor and Prasad 2008). In the majority of articles mentioned thus far the patients were mobilised out of bed on day one post surgery and mobilisation progressed gradually. Hirschhorn et al (2008) illustrated with a randomised controlled trial (level 1b) that a moderate intensity (3-4 on modified Borg scale) walking program following CABG was safe and effective in increasing walking distance at discharge.

In the study by Roos and Van Aswegen (2011), patients with CAD were most commonly seen by physiotherapists once or twice daily while in hospital. This finding is similar to the frequency of treatment provided by physiotherapists working in the United Kingdom when treating patients post cardiac surgery (Martin 2007). When reviewing treatment frequency Van der Peijl et al (2004) reported no difference in hospital length of stay or postoperative complications between patients seen once or twice daily by physiotherapists after cardiac surgery. They did note that the twice daily group reached functional milestones sooner and was more satisfied with the physiotherapy service.
A group of patients that was not so frequently managed by physiotherapists was the group undergoing angiogram and angioplasty interventions. It is well known that these patients are less physically active than patients who have had CABG (Reid et al 2006). The role of education in the form of risk factor modification and the importance of exercise is essential for such patients as the rate of angiography interventions is increasing (Reid et al 2006).

According to Piotrowicz (2008) management goals in stage one rehabilitation (early in-hospital rehabilitation for myocardial infarct) include the optimization of pharmacotherapy of the underlying cardiac disease, prevention of sequelae of immobilization and the improvement of exercise capacity. An evaluation of the mental state of the patients, anxiety reduction, and mental support is also necessary. Patient education should include basic information regarding the disease itself, treatment modalities, and organization of care. Information pertaining to coronary heart disease, risk factors and the possible strategies to reduce them should be imparted to the patient. Piotrowicz (2008) continues that clinical status of the patient must be evaluated (as per risk groups) and

appropriate stage II rehabilitation schedule assigned. Active physical rehabilitation, depending on the severity of the infarction (complicated versus uncomplicated) and possible contraindications is initiated after 12-48 hours of bed rest. After the clinical condition of the patient is stabilized (usually within 2-3 days in case of uncomplicated infarction), exercise of gradually increased intensity is initiated under physiotherapist supervision:
Initial phase – breathing exercise, relaxation exercise, dynamic exercise involving small muscle groups
Continuation phase – dynamic exercise involving large muscle groups, sitting and standing up, walking;
At 4-6 days, the patient assisted by the physiotherapist is allowed to try climbing stairs. Dynamic exercise is recommended throughout stage I rehabilitation. In contrast, exercise resulting in Valsalva manoeuvre-like conditions is not advised. Piotrowicz (2008) continues to describe rehabilitation of the patient in each stage of recovery as well as the patient post myocardial infarct who has been treated with PCI (angioplasty).

The results of the study to determine current practice of physiotherapists in South Africa in the management of patients with coronary artery disease by Roos and van Aswegen (2011) confirmed that most physiotherapists are involved during hospitalisation of the patient. However, the use of evidence based interventions in the clinical care of patients with CAD was inconsistent. There is currently limited involvement of physiotherapists in out-patient cardiac rehabilitation in South Africa. Roos and Van Aswegen (2011) recommend that considering the potential burden of this disease on the economy of South Africa the focus of physiotherapists should be on prevention of risk factors. Implementation of programmes which address hypertension through education and exercise as well as cardiac rehabilitation would be suitable for the long-term management of individuals diagnosed with CAD. Physiotherapy practice in this arena could be enhanced by evidence-based workshops to clinicians, improved communication between professionals (referrals), creating a data base of healthcare professionals providing phase III cardiac rehabilitation and outpatient follow-up of patients to enhance patient care.

2.3 Physiological Benefits of Cardiac Rehabilitation

The benefit of keeping physically active has been advocated for thousands of years. The ancient philosophers recommended exercise as a means of living long, healthy lives (Thompson 2004), and in the 17th century Heberden recorded that one of his patient's angina was cured through regular sawing of wood (Jay 2000). Physical inactivity is linked to low levels of physical fitness and is considered a major independent risk factor in both the development and progression of CHD (Blair et al 1989; Blair et al 1996; Paffenbarger et al 2001). The more physically active an individual is, the greater their degree of fitness and the lower their risk for developing CHD (Blair et al 1989; Berlin et al 1990). The importance of the relationship between physical activity, physical fitness, cardiovascular health and survival has been well established from epidemiological research. Workers who were less physically active in their job suffered more heart attacks compared to workers who were more active. Men who had a more active lifestyle and participated in vigorous leisure-time exercise at least twice a week reduced their risk of developing CHD by up to a third (Paffenbarger 1972; Morris et al 1953). The importance of exercise in the secondary prevention of CHD was developed through these findings.

Structured exercise as a therapeutic intervention is central to comprehensive CR as it enhances levels of physical activity, improves fitness and may also beneficially modify other coronary risk factors such as blood pressure and helping with weight loss (Bethell et al 1990; Miller et al 1997). In addition, it has been shown to help regain self-confidence (Marra et al 1985; Monpere 1988) and increase survival rates (Pashkow 1993; Ades et al 2000). Even small improvements in fitness appear to reduce mortality (Erikssen et al 1998) but more vigorous exercise regimes have a greater effect in populations with or without CVD (Blair 1996; Vanhees et al 1994). In both primary and secondary prevention of CVD, with every one metabolic equivalent increase in aerobic fitness there is a reduction of 8-17% in mortality (Kavanagh et al 2002). It is recommended that patients with CVD perform moderate intensity aerobic exercise for 20-30 minutes at least two to three times a week

(Association of chartered physiotherapists interested in cardiac rehabilitation 2009).
Outcomes relating to cardiorespiratory fitness in the majority of cardiac rehabilitation programmes have been shown to improve significantly in trained groups when compared to the controls (Bethell et al 1990; Bethell 1987; Dugmore et al 1999; Hedback et al 1993; Wilhelmson et al 1975). This improvement in fitness has been reported up to 20% more than that which can occur spontaneously (Bethell 1992; Greenland 1988; Lipkin 1991; Sleight 1992).

A systematic review and meta-analysis found that trials of cardiac rehabilitation which included an exercise component showed a significant reduction in all cause mortality (20%) and cardiac mortality (26%) (Taylor et al 2004). These mortality effects of exercise therapy were found to be consistent across a number of CHD groups, including a post myocardial infarction, post revascularisation and angina

The physiological benefits of cardiac rehabilitation have been reviewed (Squires et al 1990; Naughton 1992; Pashkow 1993; Bittner et al 1993).
The physiological benefits of cardiac rehabilitation can be divided into (a) benefits of early rehabilitation and (b) benefits of ongoing rehabilitation. This is as follows :

(a) Benefits of early rehabilitation
These include the prevention of the detrimental effects of prolonged bed rest. Strict bed rest has been shown to have a significant effect on physiological function. After a few days the patient has significantly decreased cardiorespiratory fitness, decreased blood volume, decreased red blood cell count and a negative nitrogen and protein balance. Also there is decreased strength and flexibility, increased orthostatic hypotension and an increase in the risk of thromboembolism. Early physical activity decreases post-surgical stiffness and prevents complications of post-surgical atelectasis in patients who have undergone coronary artery bypass grafting. Other benefits include the prevention of general deconditioning, increased awareness of cardiac

disease information and the modes available for life-style alteration. There is a decrease in length of hospital stay, the promotion of psychological well being and a decrease in the incidence and severity of depression and anxiety; and the provision of spiritual comfort.

(b) The benefits of ongoing rehabilitation

Regular physical exercise reduces the myocardial oxygen requirement at a given level of exercise and raises the angina threshold (Trap-Jensen 1971). Myocardial oxygen requirement is directly related to the cardiac rate-pressure product (heart rate x systolic blood pressure). Exercise training reduces the rate-pressure product at any given level of exercise, thus reducing the overall myocardial oxygen demand. Therefore, angina pectoris will occur at a higher workload after exercise training than before exercise training.

Regular physical exercise improves myocardial oxygen supply. This is possibly due to formation of collateral vessel formation. This has been shown in animal models but no evidence exists in humans (Franklin 1991).

Blood platelet aggregability is decreased by regular physical activity Rauramaa 1986) and the body's natural thrombolytic capacity is enhanced. Exercise had been shown to be an important stimulus for the release of endothelial tissue-plasminogen activator into the blood (Eichner 1986). With regular physical activity the chance of developing ventricular fibrillation is reduced. This has been shown in the rat model (Noakes 1983). It has also been shown from the physically active subjects in Paffenberger's study (1986) and from the civil servants in Morris's study (1990) that this group (of physically active subjects) had less chance of dying suddenly from heart disease. Regular physical exercise has had a positive influence on other CVD risk factors. Recent studies have shown that regular exercise increases high density lipoprotein (HDL) concentrations and decreases the total cholesterol:HDL ratio. Serum triglyceride concentrations decrease and in hypertensive patients, systolic and diastolic blood pressure is lowered. The risk of developing hypertension is decreased and carbohydrate metabolism is enhanced therefore regular exercise helps to prevent and control diabetes mellitus and reduces stress.

Regular physical exercise in the form of formal cardiac rehabilitation programme enhances the psychological well- being in these patients (Schomer 1983) and enhances the patient's quality of life (Sparks et al 1993; Oldridge et al 1991; Blumenthal et al 1993).

2.4 Cost-benefit relationship of Cardiac Rehabilitation

In the past cardiac rehabilitation programmes have been criticised for not being cost-effective however little data are available. Ades et al. (1992) studied hospitalisation and medical costs in patients who participated in a structured cardiac rehabilitation programme and the compared the costs to those patients who did not participate in regular cardiac rehabilitation. Medical charges for patients participating in cardiac rehabilitation were on average $739 lower than charges for patients not participating in cardiac rehabilitation. This was due to both a lower incidence of hospitalisation and lower charges per hospitalisation. Results of this and other studies indicate an association between participation in cardiac rehabilitation programmes and lower cardiac rehospitalisation costs in the years after an acute coronary event (Oldridge 1991; Ades 1992; Levin 1991; Oldridge 1990).

For patients who develop chronic disease and will require some form of treatment, exercise offers an attractive option for both secondary and tertiary prevention, particularly if programmes have low facility and opportunity costs, and attention is directed to high-risk patients.

2.5 AHA/AACVPR Scientific Statement (2007)

Core components of cardiac rehabilitation/secondary prevention programmes – A scientific statement from the American heart association exercise, cardiac rehabilitation, and prevention committee, the council on clinical cardiology; and the councils on cardiovascular nursing, epidemiology and prevention, and nutrition, physical activity, and metabolism; and the American association of cardiovascular and pulmonary rehabilitation.

This update to the previous statement (Balady et al 2002) aims to present current information on the evaluation, interventions, and expected outcomes in each of the core components of cardiac rehabilitation/secondary prevention programmes in agreement with the 2006 update of the AHA/American college of cardiology (ACC) secondary prevention guidelines (Smith et al 2006), including baseline patient assessment, nutritional counselling; risk factor management (lipids, hypertension, weight, diabetes, and smoking); psychosocial management; physical activity counselling; and exercise training. The most notable updates in the present statement are the changes in lipid goals and strategies to attain them and a new emphasis on ensuring that patients are taking the appropriate medications that have been shown to be of substantial benefit in reducing subsequent adverse cardiovascular events. Inherent to these recommendations is the understanding that successful risk factor modification and the maintenance of a physically active lifestyle is a lifelong process. Hence, the incorporation of strategies to optimize patient adherence to lifestyle and pharmacological therapies is integral to the attainment of sustained benefits. It is essential to the success of any programme that each of these interventions is performed in concert with the patient's primary care provider and/or cardiologist, who will subsequently supervise and refine these interventions over the long term. These recommendations are intended to assist cardiac rehabilitation staff in the design and development of their programmes and to assist healthcare providers, insurers and policy makers, and consumers in the recognition of the comprehensive nature of such programmes. In turn, insurance providers and

third-party payers should provide adequate reimbursement for cardiac rehabilitation/secondary prevention programmes such that comprehensive interventions delivered by a mult-disciplinary team of professionals can be sustained. It is not the intent of this statement to promote a rote approach or homogeneity among programmes, but rather to foster a foundation of services upon which each programme can establish its own specific strength and identify and effectively attain outcome goals for its target population. Presently, these core components are an integral part of the national programme certification process established by the AACVPR (http://www.aaacvpr.org/certfication). As such, programmes certified by the AACVPR are recognized as meeting essential standards of care in keeping with the contemporary definition of cardiac rehabilitation as a secondary prevention programme. The AHA and AACVPR encourage all cardiac rehabilitation/secondary prevention programmes to meet the standards for AACVPR programme certification.

Core components of cardiac rehabilitation/secondary prevention programmes

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Patient Assessment (AACVPR 2004; Smith et al 2006; King et al 2005; Sanderson et al 2004)

Evaluation

- Medical history: review current and prior cardiovascular medical and surgical diagnosis and procedures (including assessment of left ventricular function); co-morbidities (including peripheral artery disease, cerebral vascular disease, pulmonary disease, kidney disease, diabetes mellitus, musculoskeletal and neuromuscular disorders, depression, and other pertinent diseases); symptoms of cardiovascular disease; medications (including dose, frequency, and compliance); date of most recent influenza vaccination; cardiovascular risk profile; and educational barriers and preferences. Refer to each core component of care for relevant assessment measures.
- Physical examination: Assess cardiopulmonary systems (including pulse rate and regularity, blood pressure, auscultation of heart and lungs,

Patient assessment (continued)

palpation and inspection of lower extremities for oedema and presence of arterial pulses); post-cardiovascular procedure wound sites: orthopaedic and neuromuscular status; and cognitive function. Refer to each core component for respective additional physical measures.

- Testing: obtain resting 12 – lead ECG; assess patient's perceived health-related quality of life or health status. Refer to each core component for additional specified tests.

Interventions

- Document the patient assessment information that reflects the patient's current status and guides the development and implementation of
  (1) a patient treatment plan that prioritizes goals and outlines intervention strategies for risk reduction, and
  (2) a discharge/follow-up plan that reflects progress toward goals and guides long-term secondary prevention plans.
- Interactively, communicate the treatment and follow-up plans with the patient and appropriate family members/domestic partners in collaboration with the primary healthcare provider.
- In concert with the primary care provider and/or cardiologist, ensure that the patient is taking appropriate doses of asprin, clopidogrel, beta-blockers, lipid-lowering agents, and ACE inhibitors or angiotensin receptor blockers as per the ACC/AHA, and that the patient has had an annual influenza vaccination.

Expected Outcomes

- Patient treatment plan: Documented evidence of patient assessment and priority short-term (i.e weeks-months) goals within the core components of care that guide intervention strategies. Discussion and provision of the initial and follow-up plans to the patient in collaboration with the primary healthcare provider.
- Outcome report: Documented evidence of patient outcomes within the core-components of care that reflects progress toward goals, including whether the patient is taking appropriate doses of asprin, clopidogrel, beta-blockers, and ACE inhibitors or angiotensin receptor blockers as

Patient assessment (continued)

per the ACC/AHA, and whether the patient has had an annual influenza vaccination (and if not, documented evidence for why not) and identifies specific areas that require further intervention and monitoring.

- Discharge plan: Documented discharge plan summarizing long-term goals and strategies for success.

Nutritional Counselling (NCEP 2002)

Evaluation

- Obtain estimates of total daily caloric intake and dietary content of saturated fat, trans fat, cholesterol, sodium, and nutrients
- Assess eating habits, including fruit and vegetable, whole grain, and fish consumption; number of meals and snacks; frequency of dining out; and alcohol consumption.
- Determine target areas for nutrition intervention as outlined in the core components of weight, hypertension, diabetes, as well as heart failure, kidney disease, and other comorbidities.

Interventions

- Prescribe specific dietary modifications aimed to at least attain the saturated fat and cholesterol content limits of the Therapeutic Lifestyle Change diet (NCEP 2002). Individualize diet plan according to specific target areas as outlined in the core components of weight, hypertension, and diabetes (as outlined in this hereunder), as well as heart failure and other comorbidities. Recommendations should be sensitive and relevant to cultural preferences.
- Educate and counsel patient (and appropriate family members/domestic partners) on dietary goals and how to attain them.
- Incorporate behaviour change models and compliance strategies into counselling sessions.

Expected Outcomes

- Patient adherence to prescribed diet
- Patient understands basic principles of dietary content, such as calories, fat, cholesterol, and nutrients.

Nutritional counselling (continued)

- A plan has been provided to address eating behaviour problems.

Weight Management (Smith et al 2006; Expert panel 1998; Poirier et al 2006)

Evaluation

- Measure weight, height, and waist circumference. Calculate body mass index (BMI).

Interventions

- In patients with BMI > 25 kg/$m^2$and/or waist > 40 inches in men (102 cm) and > 35 inches (88 cm) in women:
  - Establish reasonable short-term and long-term weight goals individualized to the patient and his/her associated risk factors (e.g. reduce body weight by at least 5% and preferably by > 10% at a rate of 1-2 lb/wk over a period of time up to 6 months).
  - Develop a combined diet, physical activity/exercise, and behavioural programme designed to reduce total caloric intake, maintain appropriate intake of nutrients and fibre, and increase energy expenditure. The exercise component should strive to include daily, longer distance/duration walking (e.g 60-90 minutes).
  - Aim for an energy deficit tailored to achieve weight goals (e.g. 500-1000 kcal/day).

Expected Outcomes

- Short-term: Continue to assess and modify interventions until progressive weight loss is achieved. Provide referral to specialized, validated nutrition weight loss programmes if weight goals are not achieved.
- Long-term: Patient adheres to diet and physical activity/exercise programme aimed toward attainment of established weight goal.
  (* BMI definitions for overweight and obesity may differ by race/ethnicity and region of the world. Relevant definitions, when available, should be respectively applied.)

Blood Pressure Management (Smith et al 2006; Chohanian et al 2003)

Evaluation

- Measure seated resting blood pressure on ≥ 2 visits.
- Measure blood pressure in both arms at programme entry.
- To rule out orthostatic hypotension, measure lying, seated, and standing blood pressure at programme entry and after adjustments in antihypertensive drug therapy.
- Assess current treatment and compliance.
- Assess use of non-prescription drugs that may adversely affect blood pressure.

Interventions

- Provide and/or monitor drug therapy in concert with primary healthcare provider as follows:
- If blood pressure is 120-139 mm Hg systolic or 80-89 mm Hg diastolic:
  - Provide lifestyle modifications, including regular physical activity/exercise; weight management; moderate sodium restriction and increased consumption of fresh fruits, vegetables, and low-fat dairy products; alcohol moderation; and smoking cessation.
  - Provide drug therapy for patients with chronic kidney disease, heart failure, or diabetes if blood pressure is ≥ 130/≥80 mmHg after lifestyle modification.
- If blood pressure is ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic:
  - Provide lifestyle modification and drug therapy

Expected Outcomes

- Short-term: Continue to assess and modify intervention until normalization of blood pressure in prehypertensive patients; < 140 mmHg systolic and < 90 mmHg diastolic in hypertensive patients; < 130 mmHg systolic and < 80 mmHg diastolic in hypertensive patients with diabetes, heart failure, or chronic kidney disease.
- Long term: Maintain blood pressure at goal levels.

Lipid Management (Smith et al 2006; NCEP 2002; Grundy 2004)

Evaluation

- Obtain fasting measures of total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides. In those patients with abnormal levels, obtain a detailed history to determine whether diet, drug and/or other conditions that may affect lipid levels can be altered.
- Assess current treatment and compliance
- Repeat lipid profiles at 4-6 weeks after hospitalization and at 2 months after initiation or change in lipid-lowering medications.
- Assess creatine kinase levels and liver function in patients taking lipid-lowering medications as recommended by NCEP (2002).

Interventions

- Provide nutritional counselling consistent with the Therapeutic Lifestyle Change diet, such as the recommendation to add plant stanol/sterols and viscous fibre and the encouragement to consume more omega-3 fatty acids (Smith et al 2006), as well as weight management counselling, as needed, in all patients. Add or intensify drug treatment in those with low-density lipoprotein > 100mg/dL; consider adding drug treatment in those with low-density lipoprotein > 70 mg.dL.
- Provide interventions directed toward management of triglycerides to attain non-high-density lipoprotein cholesterol < 130 mg/dL. These include nutritional counselling and weight management, exercise, smoking cessation, alcohol moderation, and drug therapy as per NCEP and AHA/ACC (Smith et al 2006).
- Provide and/or monitor drug treatment in concert with primary healthcare provider

Expected Outcomes

- Short term: Continue to assess and modify intervention until low-density lipoprotein is < 100 mg/dL (further reduction to a goal < 70 mg/dL is considered reasonable) and non-high-density lipoprotein cholesterol < 130 mg/dL (further reduction to a goal of < 100 mg/dL is considered reasonable).

Lipid management (continued)

- Long term: Low-density lipoprotein cholesterol < 100 mg/.dL (further reduction to a goal < 70 mg/dL is considered reasonable). Non-high-density lipoprotein cholesterol < 130 mg/dL (further reduction to a goal of < 100 mg/dL is considered reasonable).

Diabetes Management (Smith et al 2006; American Diabetes Association 2003; Sigal et al 2006)

Evaluation

- From medical record review:
  - Confirm presence or absence of diabetes is all patients
  - If a patient is known to be a diabetic, identify history of complications such as findings related to heart disease; vascular disease; problems with eyes, kidneys, or feet; or autonomic or peripheral neuropathy.
- From initial patient interview:
  - Obtain history of signs/symptoms related to above complications and/or reports of episodes of hypoglycaemia or hyperglycaemia
  - Identify physician managing diabetic condition and prescribed treatment regimen, including:
  - Medications and extent of compliance
  - Diet and extent of compliance
  - Blood sugar monitoring method and extent of compliance
- Before starting exercise:
  - Obtain latest fasting plasma glucose (FPG) and glycosylated haemoglobin (HbA1c).
  - Consider stratifying patient to high-risk category because of the greater likelihood of exercise-induced complications.

Interventions

- Educate patient and staff to be alert for signs/symptoms of hypoglycaemia or hyperglycaemia and provide appropriate assessment and interventions as per the Diabetes Association
- In those taking insulin or insulin secretogogues:
  - Avoid exercise at peak insulin times.

Diabetes management (continued)

- Advise that insulin be injected in abdomen, not muscle to be exercised.
- Test blood sugar levels pre- and postexercise at each session: if blood sugar value < 100mg/dL, delay exercise and provide patient 15g of carbohydrate; retest in 15 minutes; proceed if blood sugar value is > 100mg/dL; if blood sugar value is > 300 mg/dL, patient may exercise if he or she feels well, is adequately hydrated, and blood and/or urine ketones are negative; otherwise, contact patient's physician for further treatment.
- Encourage adequate hydration to avoid effects of fluid shifts on blood sugar levels.
- Caution patient that blood sugar may continue to drop for 24-48 hours after exercise.

- In those treated with diet, metformin, alpha glucosidase inhibitors, and/or thiozolidinediones, without insulin or insulin secretogogues, test blood sugar levels prior to exercise for first 6-10 sessions to assess glycaemic control; exercise is generally unlikely to cause hypoglycaemia
- Education Recommendations:
  - Teach and practice self-monitoring skills for use during unsupervised exercise.
  - Refer to registered dietician for medical nutrition therapy.
  - Consider referral to certified diabetic educator for skill training, medication instruction, and support groups.

Expected Outcomes

- Short-term:
  - Communicate with primary physician or endocrinologist about signs/symptoms, self-monitor blood sugar status, and self-manage activities.
- Long-term:
  - Attain FPG levels of 90-130 mg/dL and HbA1c < 79
  - Minimize complications and reduce episodes and hypoglycaemia and hyperglycaemia at rest and/or with exercise.
  - Maintain blood pressure < 130/ <80 mm Hg.

Tobacco cessation (Smith et al 2006; Eigre et al 2000)

Evaluation

- Initial encounter:
  - Ask the patient about his or her smoking status and use of other tobacco products. Document status as never smoked, former smoker, current smoker (includes those who have quit in the last 12 months because of the high probability of relapse). Specify both amount of smoking (cigarettes per day) and duration of smoking (number of years). Quantify use and type of other tobacco products. Question exposure to second-hand smoke at home and at work.
  - Determine readiness to change by asking every smoker/tobacco user if he or she is now ready to quit.
  - Assess for psychological factors that may impede success.
  - Ongoing contact: Update status at each visit during first 2 weeks of cessation, periodically thereafter.

Interventions

- When readiness to change is not expressed, provide a brief motivational message containing the "5 Rs": Relevance, Risks, Rewards, Roadblocks, and Repetition.
- When readiness to change is confirmed, continue with the "5 As": Ask, Advise, Assess, Assist, and Arrange. Assist the smoker/tobacco user to set a quit date, and select appropriate treatment strategies (preparation):

  Minimal (brief)
  - Individual education and counselling by programme staff supplemented by self-teaching materials.
  - Social support provided by physician, programme staff, family and/ or domestic partner: identify other smokers in the house; discuss how to engage them in the patient's cessation efforts.
  - Relapse prevention: problem solving, anticipated threat, practise scenarios

  Optimal (intense)
  - Longer individual counselling or group involvement.
  - Pharmacological support (in concert with primary physician): nicotine replacement therapy, bupropion hydrochloride.

Tobacco cessation (continued)

- Supplemental strategies if desired (e.g. acupuncture, hypnosis).

- If patient has recently quit, emphasize relapse prevention skills.
- Urge avoidance of exposure to second-hand smoke at work and home.

Expected Outcomes

- Note: Patients who continue to smoke upon enrolment are subsequently more likely to drop out of cardiac rehabilitation/secondary prevention programmes
- Short term: Patient will demonstrate readiness to change by initially expressing decision to quit and selecting a quit date. Subsequently, patient will quit smoking and all tobacco use and adhere to pharmacological therapy (if prescribed) while practising relapse prevention strategies; patient will resume cessation plan as quickly as possible when temporary relapse occurs.
- Long term: Complete abstinence from smoking and use of all tobacco products for at least 12 months (maintenance) from quit date. No exposure to environmental tobacco smoke at work and home.

Psychosocial Management (Wenger et al 1995; AACVPR 2004)

Evaluation

- Identify psychological distress as indicated by clinically significant levels of depression, anxiety, anger or hostility, social isolation, marital/family distress, sexual dysfunction/adjustment, and substance abuse (alcohol or other psychotropic agents), using interview and/or standardized measurement tools.
- Identify use of psychotropic medications.

Interventions

- Offer individual and/ or small group education and counselling on adjustment to heart disease, stress management, and health-related lifestyle change. When possible, include family members, domestic partners, and/or significant others in such sessions.

Psychosocial management (continued)

- Develop supportive rehabilitation environment and community resources to enhance the patient's and the family's level of social support.
- Teach and support self-help strategies.
- In concert with primary healthcare provider, refer patients experiencing clinically significant psychosocial distress to appropriate mental health specialists for further evaluation and treatment.

Expected Outcomes

- Emotional well-being is indicated by the absence of clinically significant psychological distress, social isolation, or drug dependency.
- Patient demonstrates responsibility for health-related behaviour change, relaxation, and other stress management skills: ability to obtain effective social support; compliance with psychotropic medications if prescribed; and reduction or elimination of alcohol, tobacco, caffeine, or other non-prescription psychoactive drugs.
- Arrange for ongoing management if important psychosocial issues are present.

Physical Activity Counselling (AACVPR 2004; Smith et al 2006; Thompson et al 2003; ACSM 2006; Pina et al 2003)

Evaluation

- Assess current physical activity level (e.g questionnaire, pedometer) and determine domestic, occupational, and recreational needs.
- Evaluate activities relevant to age, gender, and daily life, such a driving, sexual activity, sports, gardening, and household tasks.
- Assess readiness to change behaviour, self-confidence, barriers to increased physical activity, and social support in making positive changes.

Interventions

- Provide advice, support, and counselling about physical activity needs on initial evaluation and follow-up. Target exercise programme to meet individual needs (see exercise training section). Provide educational

Physical activity counselling (continued)

materials as part of counselling efforts. Consider exercise tolerance or simulated work testing for patients with heavy labour jobs.

- Consistently encourage patients to accumulate 30-60 minutes per day of moderate-intensity physical activity on $\geq$ 5 (preferably most) days of the week. Explore daily schedules to suggest how to incorporate increased activity into usual routine (e.g, parking away from entrances, walking $\geq$ 2 flights of stairs, and walking during lunch break).
- Advise low-impact aerobic activity to minimize risk of musculoskeletal injury. Recommend gradual increases in the volume of physical activity over time.
- Caution patients to avoid performing unaccustomed vigorous physical activity (e.g. racquet sports and manual snow removal). Reassess the patient's ability to perform such activities as exercise training progresses.

Expected outcomes

- Patient shows increased participation in domestic, occupational, and recreational activities
- Patient shows improved psychosocial well-being, reduction in stress, facilitation of functional independence, prevention of disability, and enhancement of opportunities for independent self-care to achieve recommended goals.
- Patient shows improved aerobic fitness and body composition and lessens coronary risk factors (particularly for the sedentary patient who has adopted a lifestyle approach to regular physical activity).

Exercise Training (AACVPR 2004; Thompson et al 2003; Grundy et al 1999; ACSM 2006; Pina et al 2003)

Evaluation

- Symptom-limited exercise testing prior to participation in an exercise-based cardiac rehabilitation programme is strongly recommended. The evaluation may be repeated as change in clinical condition warrant. Test parameters should include assessment of heart rate and rhythm, signs,

Exercise training (continued)

symptoms, ST-segment changes, haemodynamics, perceived exertion, and exercise capacity.

- On the basis of patient assessment and the exercise test if performed, risk stratify the patient to determine the level of supervision and monitoring required during exercise training. Use risk stratification schema as recommended by the AHA and AACVPR.

Interventions

- Develop an individualized exercise prescription for aerobic and resistance training that is based on evaluation findings, risk stratification, comorbidities (e.g. peripheral arterial disease and musculoskeletal conditions), and patient programme goals. The exercise regimen should be reviewed by the programme medical director or referring physician, modified if necessary, and approved. Exercise prescription should specify frequency (F), intensity (I), duration (D), modalities (M), and progression (P).
  - For aerobic exercise: F =3-5 days/wk; I= 50-80% of exercise capacity; D =20-60 minutes; and M =walking, treadmill, cycling, rowing, stair climbing, arm/leg ergometry, and other using continuous or interval training as appropriate.
  - For resistance exercise: F=2-3 days/wk; I=10-15 repetitions per set to moderate fatigue; D=1-3 sets of 8-10 different upper and lower body exercises; and M=calisthenics, elastic bands, cuff/hand weights, dumbells, free weights, wall pulleys, or weight machines.
- Include warm-up, cool-down, and flexibility exercises in each exercise session
- Provide progressive updates to the exercise prescription and modify further if clinical status changes.
- Supplement the formal exercise regimen with activity guidelines outlines in the physical activity counselling section

Expected Outcomes

- Patient understands safety issues during exercise, including warning signs/symptoms.

Exercise training (continued)

- Patient achieves increased cardiorespiratory fitness and enhanced flexibility, muscular endurance, and strength
- Patient achieves reduced symptoms, attenuated physiologic responses to physical challenges, and improved psychosocial well-being.
- Patient achieves reduced global cardiovascular risk and mortality resulting from an overall programme of cardiac rehabilitation/secondary prevention that includes exercise training (Taylor et al 2004).

2.6 Exercise Prescription for patients with cardiac disease (ACSM – Guidelines 2010)

The ACSM describes the process for developing an exercise prescription for people with cardiovascular disease. This information is contained in the ACSM's guidelines for exercise testing and prescription (ACSM 2010). The manifestation of artherosclerotic cardiovascular disease may be outlined as follows :

- Acute coronary syndromes (ACS) – the manifestation of coronary artery disease (CAD) as angina pectoris, myocardial infarction (MI), or sudden death.
- Cardiovascular disease (CVD) – artherosclerotic disease of the arteries of the heart, brain (i.e., stroke), and peripheral vasculature (i.e., peripheral artery disease – PAD)
- Coronary artery disease (CAD) –artherosclerotic disease of the arteries of the heart
- Myocardial ischaemia – lack of coronary blood flow with resultant lack of oxygen supply often manifested as angina pectoris
- Myocardial infarction (MI) – death of the muscular tissue of the heart

Exercise prescription for patients with cardiac disease focusses on (a) the structure of inpatient and outpatient cardiac rehabilitation programmes; (b) procedures to design a safe and effective exercise prescription for those who have not had an exercise test; (c) resistance-training guidelines; and (d) procedures to prepare for returning to work.

Inpatient rehabilitation programmes

Following a documented physician referral, patients hospitalized after a cardiac event or a procedure associated with coronary artery disease (CAD), cardiac valve replacement, or myocardial infarction (MI) should be provided with a programme consisting of early assessment and mobilization, identification of and education regarding CVD risk factors, assessment of the

patient's level of readiness for physical activity, and comprehensive discharge planning (AACVPR 2004).

The goals for inpatient rehabilitation programmes are as follows:

- Offset the deleterious physiologic and psychological effects of bed rest.
- Provide additional medical surveillance of patients.
- Identify patients with significant cardiovascular, physical, or cognitive impairments that may influence prognosis
- Enable patients to safely return to activities of daily living within limits imposed by their CVD
- Prepare the patient and support system at home or in a transitional setting to optimize recovery following acute-care hospital discharge.
- Facilitate patient entry, including physician referral into an outpatient cardiac rehabilitation programme

Before beginning formal activity in the in the inpatient setting, a baseline assessment should be conducted by a healthcare provider who possesses the skills and competencies necessary to assess and document heart and lung sounds, peripheral pulses, and musculoskeletal strength and flexibility (AACVPR 2004).

Initiation and progression of physical activity depends on the findings of the initial assessment and varies with the level of risk. Thus, inpatients should be risk stratified as early as possible following their acute cardiac event. The American College of Sports Medicine (ACSM) has found that the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) risk stratification of patients with known CVD is useful because it is based on overall prognosis of the patient potential for rehabilitation (AACVPR 2004). The ACSM has adopted this risk stratification for patients with CVD.

American Association of Cardiovascular and Pulmonary Rehabilitation Risk stratification criteria for cardiac patients

LOWEST RISK

Characteristics of patients at lowest risk for exercise prescription (all characteristics listed must be present for patients to remain at lowest risk)

- Absence of complex ventricular dysrhythmias during exercise testing and recovery
- Absence of angina or other significant symptoms (e.g., unusual shortness of breath, light-headedness, or dizziness, during exercise testing and recovery)
- Presence of normal haemodynamics during exercise testing and recovery (i.e., appropriate increases and decreases in heart rate and systolic blood pressure with increasing workloads and recovery(
- Functional capacity ≥ 7 METs

Nonexercise Test Findings

- Resting ejection fraction ≥ 50%
- Uncomplicated myocardial infarction or revascularization procedure
- Absence of complicated ventricular dysrhythmias at rest
- Absence of congestive heart failure
- Absence of signs or symptoms of postevent/postprocedure ischaemia
- Absence of clinical depression

MODERATE RISK

Characteristics of patients at moderate risk for exercise prescription (any one or combination of these findings places a patient at moderate risk)

- Presence of angina or other significant symptoms (e.g., unusual shortness of breath, light-headedness, or dizziness occurring only at high levels of exertion [≥ 7METs]

- Mild to moderate level of silent ischaemia during exercise testing or recovery (ST-segment depression < 2mm from baseline)
- Functional capacity < 5 METs

Nonexercise Testing Findings

- Rest ejection fraction = 40%-49%

HIGHEST RISK

Characteristics of patients at high risk for exercise participation (any one or combination of these findings places a patient at high risk)

- Presence of complex ventricular dysrhythmias during exercise testing or recovery
- Presence of angina or other significant symptoms (e.g., unusual shortness of breath, light-headedness, or dizziness at low levels of exertion [< 5METs] or during recovery)
- High level of silent ischaemia (ST-segment depression ≥ 2 mm from baseline) during exercise testing or recovery
- Presence of abnormal haemodynamics with exercise testing (i.e., chronotropic incompetence or flat or decreasing systolic BP with increasing workloads) or recovery (i.e., severe postexercise hypotension)

Nonexercise Testing Findings

- Rest ejection fraction < 40%
- History of cardiac arrest or sudden death
- Complex dysrhythmias at rest
- Complicated myocardial infarction or revascularization procedure
- Presence of congestive heart failure
- Presence of signs or symptoms of postevent/postprocedure ischaemia
- Presence of clinical depression

Clinical indications and contraindications for inpatient and outpatient cardiac rehabilitation

INDICATIONS

- Medically stable post-myocardial infarction (MI)
- Stable angina
- Coronary artety bypass graft (CABG)
- Percutaneous transluminal coronary angioplasty (PTCA) or other transcatheter procedure
- Compensated congestive heart failure (CHF)
- Cardiomyopathy
- Heart or other organ transplantation
- Other cardiac surgery, including valvular and pacemaker insertion (including implantable cardioverter defibrillator [ICD])
- Peripheral arterial disease (PAD)
- High-risk cardiovascular disease (CVD) ineligible for surgical intervention
- Sudden cardiac death syndrome
- End-stage renal disease
- At risk for coronary artery disease (CAD) with diagnoses of diabetes mellitus, dyslipidaemia, hypertension, obesity, or other diseases and conditions
- Other patients who may benefit from structured exercise and/or patient education based on physician referral and consensus of the rehabilitation team

CONTRAINDICATIONS

- Unstable angina
- Resting systolic BP (SBP) > 200 mmHg or resting diastolic BP (DBP) > 110 mmHg that should be evaluated on a case-by-case basis
- Orthostatic BP drop of > 20 mm Hg with symptoms
- Critical aortic stenosis (i.e., peak SBP gradient of > 50 mm Hg with an aortic valve orifice area of < 0.75cm^2 in an average-sized adult)
- Acute systemic illness or fever
- Uncontrolled atrial or ventricular dysrhythmias

- Uncontrolled sinus tachycardia (> 120 beats.min^{-1})
- Uncompensated CHF
- Third-degree atrioventricular (AV block) without pacemaker
- Active pericarditis or myocarditis
- Recent embolism
- Thrombophlebitis
- Resting ST-segment depression or elevation (> 2mm)
- Uncontrolled diabetes mellitus
- Severe orthopaedic conditions that would prohibit exercise
- Other metabolic conditions, such as acute thyroiditis, hypokalaemia, hyperkalaemia or hypovolaemia

Exceptions should be considered based on the clinical judgement of the physician and the rehabilitation team. Decreasing length of hospital stay after the acute event or intervention has made the traditional programme of multiple rehabilitation steps obsolete, as many uncomplicated patients are seen for 3 to 4 days before discharge. Activities during the first 48 hours after MI or cardiac surgery should be restricted to self-care activities, arm and leg range of motion, and postural change (AACVPR 2004). Simple exposure to orthostatic or gravitational stress, such as intermittent sitting, or standing during hospital convalescence, reduces much of the deterioration in exercise performance that generally follows an acute cardiac event (Convertino 1983; Franklin 2003). Patient may progress from self-care activities, to walking short distances to moderate distances of 50 to 500 feet (15-152 m) with minimal or no assistance 3-4 times.d^{-1}, to independent ambulation on the hospital unit. The optimal dosage of exercise for inpatients depends in part on their medical history, clinical status, and symptoms. The rating of perceived exertion (RPE) provides a useful and complementary guide to heart rate (HR) to guage exercise intensity. In general, the criteria for termination an inpatient exercise session are similar to or slightly more conservative than those for terminating a low-level exercise test. (AAVCPR 2004).

Adverse responses to inpatient exercise leading to exercise discontinuation are as follows (ACSM 2010)

- Diastolic blood pressure (DBP) ≥ 110 mm Hg
- Decrease in systolic blood pressure (SBP) > 10 mm Hg during exercise
- Significant ventricular or atrial dysrhythmias with or without associated signs/symptoms
- Second or third degree heart block
- Signs/symptoms of exercise intolerance, including angina, marked dyspnoea and electrocardiogram (ECG) changes suggestive of ischaemia.

Recommendations for inpatient exercise programming include the Frequency, Intensity, Time, and Type of Exercise (FITT) framework as well as progression. Activity goals should be built into the overall plan of care (AACVPR 2004). The exercise programme components for patients with CVD are essentially that same as for people who are apparently healthy (ACSM 2010) or are in the low-risk category.

ACSM Risk stratification categories for artherosclerotic cardiovascular disease

Low Risk – Asymptomatic men and women who have ≤ 1 CVD risk factor

Moderate Risk – Asymptomatic men and women who have ≥ 2 risk factors

High Risk – Individuals who have known cardiovascular, (cardiac, peripheral vascular, or cerebrovascular disease) pulmonary, (chronic obstructive pulmonary disease, asthma, interstitial lung disease, or cystic fibrosis) or metabolic disease (diabetes mellitus-type 1 or type 2, thyroid disorders, renal or liver disease) or one or more signs and symptoms listed in the guideline (ACSM 2010)

FREQUENCY

- Early mobilization: 2-4 times.day^{-1} for the first 3 days of hospital stay

- Later mobilization: 2 times.day^{-1} beginning on day 4 of the hospital stay with exercise bouts of increased duration

INTENSITY

The intensity recommendations that follow reflect the advised upper intensity limits (Joo et al 2004).

- To tolerance if asymptomatic
- RPE $\leq$ 13 on scale of 6 -20
- Post – MI/congestive heart failure (CHF) : HR $\leq$ 120 beats.min^{-1} or HR $_{rest}$ + 20 beats.min^{-1} as the arbitrary upper limit
- Post-surgery: HR_{rest} + 30 beats.min^{-1} as the arbitrary upper limit

TIME (DURATION)

- Begin with intermittent bouts lasting 3-5 minutes as tolerated
- Rest period may be a slower walk (or complete rest, at the patient's discretion) that is shorter than the duration of the exercise bout. Attempt to achieve a 2:1 exercise rest ratio.

PROGRESSION

- When continuous exercise duration reaches 10 to 15 minutes, increase intensity as tolerated.

By hospital discharge, the patient should demonstrate an understanding of physical activities that may be inappropriate or excessive. Moreover, a safe, progressive plan of exercise should be formulated before leaving the hospital. Until evaluated with a submaximal or maximal exercise test or entry into a clinically supervised outpatient cardiac rehabilitation programme, the upper limit of exercise should not exceed levels observed during the inpatient programme while closely monitoring for signs and symptoms of exercise intolerance. All patients also should be educated and encouraged to investigate outpatient exercise programme options and be provided with information regarding the use of home exercise equipment. All patients, especially moderate- to high-risk patients should be encouraged to participate in a clinically supervised outpatient rehabilitation programme. Patients should be counselled to identify abnormal signs and symptoms suggesting exercise

intolerance and the need for medical evaluation. Although not all patients may be suitable candidates for inpatient exercise, virtually all benefit from some level of inpatient intervention, including risk factor assessment, activity counselling, and patient and family education.

Outpatient rehabilitation programmes

Outpatient cardiac rehabilitation programmes may begin as soon as hospital discharge. Most patients are capable of beginning a supervised exercise programme within 1 to 2 weeks of leaving the hospital (AACVPR 2004). The goals for the outpatient rehabilitation are to:

- Develop and assist the patient to implement a safe and effective formal exercise and lifestyle physical activity programme.
- Provide appropriate supervision and monitoring to detect deterioration in clinical status and provide ongoing surveillance data to the patient's healthcare providers to enhance medical management.
- Return the patient to vocational and recreational activities or modify these activities contingent on the patient's clinical status.
- Provide patient and family education to maximize secondary prevention (e.g., risk-factor modification) through aggressive lifestyle management and judicious use of cardioprotective medications.

At programme entry, the following assessments should be performed:

- Medical and surgical history, including the most recent cardiovascular event, comorbidities, and other pertinent history
- Physical examination, with an emphasis on the cardiopulmonary and musculoskeletal systems
- Review of recent cardiovascular tests and procedures, including 12-lead electrocardiogram (ECG), coronary angiogram, echocardiogram, stress test (exercise imaging studies),

revascularization, and pacemaker/implantable defibrillator implantation

- Current medications, including dose, route of administration, and frequency
- CVD risk factors

Although exercise training is safe and effective for cardiac patients, all patients should be stratified for risk of occurrence of cardiac events during exercise training (AACVPR 2004). Routine pre-exercise assessment of risk for exercise should be performed at each rehabilitation session and include:

- Consideration of ECG surveillance that may consist of telemetry or hardwire monitoring, “quick-look” monitoring using defibrillator paddles, or periodic rhythm strips
- Blood pressure (BP)
- Body weight
- Heart rate (HR)
- Symptoms or evidence of change in clinical status not necessarily related to activity (e.g., dyspnoea at rest, lightheadedness/dizziness, palpitations or irregular pulse, and chest discomfort)
- Symptoms and evidence of exercise intolerance
- Medication compliance

EXERCISE PRESCRIPTION

The techniques used for the apparently healthy adult population or for those classified as low risk for occurrence of cardiac events during exercise training may be applied to many low –and moderate – risk patients with cardiac disease. The ACSM (2010) provides specific considerations and modification of the exercise prescription for patients with known CVD.

Key variables to be considered in the development of an exercise prescription for cardiac patients include (AACVPR 2004):

- Safety factors, including clinical status, risk-stratification category, exercise capacity, ischaemic/angina threshold, and cognitive/psychological impairment that might result in non-adherence to exercise guidelines
- Associated factors, including vocational and avocational requirements, musculoskeletal limitations, premorbid activity level, and personal health/fitness goals.

FREQUENCY

Exercise frequency should include participation in sessions most days of the week, i.e., 4-7d.wk^{-1}. For patients with very limited exercise capacities, multiple short (1-10 min) daily sessions may be prescribed. Patients should be encouraged to perform some of the exercise sessions independently (i.e., without direct supervision).

INTENSITY

Exercise intensity may be prescribed using one or more of the following methods (AACVPR 2004; Schairer et al 2006) :

- RPE of 11 to 16 on a scale of 6 to 20.
- 40% to 80% of exercise capacity using the HR reserve (HRR) or Karvonen method, percent oxygen uptake reserve (VO_2R) or %VO_{2peak}) techniques if maximal exercise test data are unavailable. The recommended frequency, intensity, time and type of exercise (FITT) framework for cardiac patients without an entry exercise test is outlined (ACSM 2010).
- Exercise intensity should be prescribed at a HR below the ischaemic threshold if such a threshold has been determined for the patient. The presence of classic angina pectoris that is induced with exercise and relieved with rest or nitroglycerin is sufficient evidence for the presence of myocardial ischeamia.

Table 2 - <u>Recommended Frequency, intensity, time and type (FITT) framework for cardiac patients without an entry exercise test</u> (McConnel 1996; McConnel et al 1998)

	Training HR	Initial MET level	Monitoring	RPE	MET Progression Increments
No exercise or pharamacological test available	**Upper limit of HR_{rest} + 20 beats.min^{-1}. Gradually titrate to higher levels according to RPE, signs and symptoms, normal physiological responses**	**2-4**	**ECG,BP,RPE, and signs or symptoms of ischaemia**	**11-14**	**1-2**
Pharmacologic test available (positive for ischaemia)	**If good HR increase: 70%-85%HR_{max}. If HR does not increase: HR_{rest} + 20 beats.min^{-1} with progression as described for no exercise or pharamcological test available**	**2-4**	**ECG,BP,RPE, and signs or symptoms of ischaemia**	**11-14**	**1-2**
Pharmacologic test available (positive for ischaemia)	**10 beats.min^{-1} below ischaemic threshold (if determined). If ischaemic threshold not determined, use procedure for no exercise or pharmacologic test available**	**2-4**	**ECG,BP,RPE, and signs or symptoms of ischaemia**	**11-14**	**1-2**

For the purposes of the exercise prescription, it is preferable for patients to take their prescribed medications at the recommended time. However, dependant on the purposes of the exercise test (e.g., diagnosis in a changing clinical condition) medications may be withheld before testing with physician approval. Nonetheless, individuals on beta-blockers may have an attenuated HR response to exercise and an increased or decreased exercise capacity. For patients whose beta-blocker dose was altered after an exercise test or during the course of rehabilitation, a new graded exercise test would be beneficial. However, another exercise test may not be medically necessary or may even be impractical. When these patients are exercising without a new exercise test, signs and symptoms should be monitored and RPE and HR responses recorded at previously performed workloads. These new HRs may serve as patients' new exercise target HR range (THR). In addition, individuals on diuretic therapy may become volume depleted or suffer from hypokalaemia or orthostatic hypotension. For these patients, the BP response to exercise, potential symptoms of dizziness or lightheadedness, and dysrhythmias should be monitored while providing education regarding proper hydration (ACSM 2007). Common and other medications that may influence the exercise and post-exercise response is further presented (ACSM 2010).

TIME (Duration)

Warm-up and cool-down activities of 5 to 10 minutes – including static stretching, range of motion, and low-intensity (<40%VO_2R) aerobic activities – should be a component of each exercise session and precede and follow the conditioning phase, respectively. The goal for the duration of the aerobic conditioning phase is generally 20 to 60 minutes per session. After a cardiac event, many patients begin with 5 to 10 minute sessions with a gradual progression in aerobic exercise time of 1 to 5 minutes per session or an increase in time per session of 10% to 20% per week. However, there is no set format for the rate of progression in exercise session duration. Thus, progression should be individualized to patient tolerance. Factors to consider in this regard include initial physical fitness level, patient motivation and goals, symptoms, and musculoskeletal limitations. Exercise sessions may include

continuous or intermittent exercise, depending on the capability of the patient (AACVPR 2004; Franklin 2003). ACSM provides a recommended progression using intermittent exercise (ACSM 2005).

TYPE

The aerobic exercise portion of the session should include rhythmic, large muscle-group activities with an emphasis on increased caloric expenditure for maintenance of a healthy body weight. To promote whole-body physical fitness conditioning that includes the upper and lower extremities, multiple forms of aerobic activities and exercise equipment should be incorporated into the exercise programme for patients with cardiac disease. The different type of exercise equipment may include:

- Arm ergometer
- Combination upper/lower extremity ergometer
- Upright and recumbent cycle ergometer
- Elliptical
- Rower
- Stair climber
- Treadmill for walking

Lifestyle Physical Activity

In addition to formal exercise sessions, patients should be encouraged to gradually return to general activities of daily living such as household chores, yard work, shopping, hobbies, and sports as evaluated and appropriately modified by the rehabilitation staff. Relatively inexpensive pedometers may enhance compliance with walking programmes. Walking for 30 $min.d^{-1}$ equates to 3000 to 4000 steps whereas a mile (1.6 km) walk equates to 1500 to 2000 steps. For overall health/fitness benefits, a minimum of 10 000 $steps.d^{-1}$ is recommended (ACSM 2010)

Types of outpatient exercise programmes

Ideally, most patients with cardiac disease should participate in a medically supervised exercise programme for at least a few weeks to facilitate exercise and lifestyle changes and return to work. However, patients who experience an acute coronary syndrome and receive percutaneous coronary intervention for revascularization often return to work within 1 week of hospital discharge and may not be able to exercise during the operating hours of a supervised exercise programme. Additionally, although all patients with CVD should be encouraged to attend a formal and supervised exercise rehabilitation programme, some patients live in regions without a local programme or who do not wish to attend a programme for a variety of reasons. In these cases, an independent programme with follow-up by the patient's healthcare providers may be the only option. Some programmes provide programmatic options for these patients, such as regular telephone, internet, or mail contact, and should be investigated as alternatives to direct supervision.

Most patients will transition from a medically supervised programme to an independent one (i.e., non-monitored, unsupervised home exercise programme). The optimal number of weeks of attendance at a supervised programme before entering an independent programme is not known and is likely patient specific. Unfortunately, insurance reimbursement often determines the length of time of participation in a supervised programme. The patient and rehabilitation team should investigate thoroughly the limits of reimbursement and the ability of the patient to continue the programme to develop the proper progression of exercise to ready the patient for eventual transfer into an independent programme. Some programmes offer long-term supervision. Suggestions for criteria to determine when a patient is appropriate for an independent exercise programme are as follows:

- Cardiac symptoms stable or absent
- Appropriate ECG, BP, and HR responses to exercise
- Demonstrated knowledge of proper exercise principles and awareness of abnormal symptoms
- Motivation to continue to exercise regularly without close supervision

Special considerations

Patients with a sternotomy

For 5-8 weeks after cardiothoracic surgery, lifting with the upper extremities should be restricted to 5 to 8 pounds (2.27 – 3.63 kg). Range of motion (ROM) exercises and lifting 1 to 3 pounds (0.45 – 1.36 kg) with the arms is permissible if there is no evidence of sternal instability, as detected by movement in the sternum, pain, cracking, or popping. Patients should be advised to limit ROM within the onset of feelings of pulling on the incision or mild pain.

Continuous Electrocardiographic Monitoring

ECG monitoring during supervised exercise sessions is routinely performed during the first several weeks. Insurance reimbursement sometimes requires ECG monitoring. The following recommendations for ECG monitoring are related to the patient associated risks of exercise training.

- Low-risk cardiac patients may begin with continuous ECG monitoring and decrease to intermittent ECG monitoring after 6 to 12 sessions as deemed appropriate by the rehabilitation staff.
- Moderate-risk patients may begin with continuous ECG monitoring and decrease to intermittent ECG monitoring after 12 to 18 sessions as deemed appropriate by the rehabilitation staff.
- High-risk patients may begin with continuous ECG monitoring and decrease to intermittent ECG monitoring after 18, 24, or 30 sessions as deemed appropriate by the rehabilitation staff.

Recent Pacemaker/Implantable Cardiovertor Defibrillator Implantation

Implantable cardiovertor defibrillators (ICDs) are small, battery-powered devices implanted into the body to monitor the electrical impulses in the heart. ICDs deliver electrical stimuli to make the heart beat or contract in a more normal rhythm when necessary. Cardiac pacemakers are used to restore more optimal cardiac function when there is a loss of normal sequence of atrial and ventricular filling and contraction that results in deterioration of

cardiovascular function and the onset of signs and symptoms. Specific indications for pacemakers include sick sinus syndrome with symptomatic bradycardia, acquired atrioventricular (AV) block, and persistent advanced AV block after MI. There are different types of pacemakers that fulfil specific functions and are described in detail (ACSM 2010)

ICDs are devices that monitor heart rhythms and deliver shocks if dangerous rhythms are detected. ICDs are used for high-rate ventricular tachycardia or fibrillation in patients who are at risk for these conditions as a result of previous cardiac arrest, heart failure, or ineffective drug therapy for abnormal heart rhythms. When ICD's detect a too-rapid or irregular heartbeat, they deliver a shock that rests the heart to a more normal heart rate and electrical pattern (i.e.; cardioversion). Thus ICDs protect against sudden cardiac death from ventricular tachycardia and ventricular fibrillation.

Exercise prescription considerations for those with pacemakers are as follows:

- Pacemakers may improve functional capacity as a result of an improved HR response to exercise.
- The upper HR limit of dual-sensor rate responsive and VVIR pacemakers should be set 10% below the ischaemic threshold (i.e.; the 10% safety margin)
- When an ICD is present, exercise training intensity should be maintained at least 10 beats.min^{-1} below the programmed HR threshold for defibrillation.
- To minimize the risk of lead dislocation, for 3 weeks after implantation, all pacemaker patients should avoid activities that require raising the hands above the level of the shoulders.

Patients after cardiac transplantation

The purpose of medical management for the cardiac transplant patient is to control immune system rejection while avoiding possible adverse side effects of immunosuppressive therapy, such as infections, dyslipidaemia, hypertension, obesity, osteoporosis, renal dysfunction, and diabetes mellitus.

For the first several months after surgery, the transplanted heart does not respond normally to sympathetic nervous stimulation (Keteyian et al 2003). The clinician and cardiac rehabilitation professional should be aware of the following haemodynamic alterations during this time: (a) resting HR (HR_{rest}) is elevated; and (b) the HR response to exercise is abnormal, such that the increase in heart rate during exercise is delayed, and the peak HR (HR_{peak}) is below normal. Exercise prescription for these patients does not include use of a THR. For these patients, the clinician and cardiac rehabilitation professional should consider (a) an extended warm-up and cool-down if limited by muscular deconditioning; (b) using RPE to monitor exercise intensity; and (c) incorporation of stretching and ROM exercises (ACSM 2010). However, at 1 year after surgery, approximately one third of patients exhibit a partially normalized HR response to exercise and may be given a THR based on results from graded exercise test (GXT) (Squires et al 2002).

Exercise prescription without a preliminary exercise test

With shorter hospital stays, more aggressive interventions, and greater sophistication of diagnostic procedures, it is not unusual for patients to begin cardiac rehabilitation before having a graded exercise test.

Reasons for no available preliminary exercise test (McConnell 1996; McConnell et al 1998)

- Pharmacological stress test without sufficient data to formulate an exercise prescription
- Extreme deconditioning
- Orthopaedic limitations
- Left ventricular dysfunction limited by shortness of breath
- Known coronary anatomy; therefore exercise test felt clinically nonessential
- Recent successful percutaneous intervention or revascularization surgery
- Uncomplicated or stable myocardial infarction (MI)

For those without exercise tests, exercise prescription procedures are based on what was accomplished during the inpatient phase, home exercise activities, and close surveillance for signs and symptoms of exercise intolerance, such as excessive fatigue, dizziness or lightheadedness, inotropic or chronotropic incompetence, and signs and symptoms of ischaemia. Suggestions for developing an exercise prescription in the event of no available GXT have been presented in Table 2.

Resistance training for cardiac patients

The development of muscular strength and endurance is essential for resumption of work and efficient performance of activities of daily living. Most patients with cardiac disease should be encouraged to participate in resistance training. The specific reasons that patients with CVD should participate in resistance training are listed hereunder :

Purposes of resistance training for patients with cardiac disease (ACSM 1998; Leon et al 2005)

- Improve muscular strength and endurance
- Improve self confidence
- Increase ability to perform activities of daily living
- Maintain independence
- Decrease cardiac demands of muscular work (i.e., reduced rate pressure product [RPP]) during daily activities
- Prevent and attenuate the development of other diseases and conditions, such as osteoporosis, type 2 diabetes mellitus, and obesity
- Slow age – and disease- related declines in muscle strength and mass

Patient criteria for a resistance training programme [a] (AACVPR 2004)

- Low to moderate risk patients and possibly higher risk patients with supervision

- Those who require strength for work or recreational activities, particularly in their upper extremities
- Initiate a minimum of 5 weeks after myocardial infarction (MI) or cardiac surgery, including 4 weeks of consistent participation in a supervised cardiac rehabilitation endurance training programme[b] **(**Range of motion [ROM] and very light resistance exercise of 1-3 lb [0.45 – 1.36 kg] may be started earlier if tolerated.)
- Initiate a minimum of 2 to 3 weeks following transcatheter procedure (i.e.; PTCA or other), including 2 weeks of consistent participation in a supervised cardiac rehabilitation endurance training programme[b] (ROM and very light resistance exercise of 1 - 3 lb [0.45 – 1.36 kg] may be started earlier if tolerated.)
- No evidence of congestive heart failure (CHF), uncontrolled dysrhythmias, severe valvular disease, uncontrolled hypertension, and unstable symptoms

[a] A resistance training programme is defined as one in which patients lift weights ≥ 50% one repetition maximum (1RM). The use of elastic bands, 1-3 lb (o.45 – 1.36 kg) hand weights, and light free weights may be initiated in a progressive fashion at outpatient programme entry provided no other contraindications exist. ACSM (2010) provides further information on the FITT framework for resistance training.

[b] Entry should be a rehabilitation staff decision with approval of the medical director and surgeon as appropriate.

Resistance training guidelines (ACSM 2010)

- Equipment (Type)
  - Elastic bands
  - Light (1- 5 lb; 0.45 – 2.27 kg) cuff and hand weights
  - Light free weights (1 – 5 lb; 0.45 – 2.27 kg)
  - Wall pulleys
  - Machines (dependant on weight of lever arms and range of motion)

- Proper technique
  - Raise and lower weights with slow, controlled movements to full extension.
  - Maintain regular breathing pattern.
  - Avoid straining.
  - Avoid sustained, tight gripping, which may evoke an excessive blood pressure (BP) response.
  - A rating of perceived exertion (RPE) of 11 to 13 (“light” to “somewhat hard”) on a scale of 6 to 20 may be used as a subjective guide to effort.
  - Terminate exercise if warning signs or symptoms occur, including dizziness, dysrhythmias, unusual shortness of breath, or angina discomfort.
- Initially load should allow 12 to 15 repetitions that can be lifted comfortably (30% to 40% one repetition maximum [1-RM] for the upper body; 50%-60% for the lower body).
  - Increase loads by 5% increments when the patient can comfortably lift 12 to 15 repetitions
  - Low risk patients may progress to 8 – 12 repetitions with a resistance of 60% to 80% 1-RM
  - Because of the potential for an elevated BP response, the rate pressure product (RPP) should not exceed that during prescribed endurance exercise as determined from the graded exercise test (GXT).
  - RPE is 11 to 13 (“light” to “somewhat hard”) on a scale of 6 to 20.
- Each major muscle group (i.e., chest, shoulders, arms, abdomen, back, hips and legs) should be trained with two to four sets.
  - Sets may be of the same exercise or from different exercises affecting the same muscle group.
  - Gains in muscular strength and endurance are obtained with one set, particularly in novices
  - Perform 8 to 10 exercises of the major muscle groups

- Exercise large muscle groups before small muscle groups
- Include multi-joint exercises or 'compound' exercises that affect more than one muscle group

- Frequency: 2-3d.wk^{-1} with at least 48 hours separating training sessions for the same muscle group. All muscle groups to be trained may be done in the same session, i.e., whole body, or each session may "split" the body into selected muscle groups so that only a few are trained in any one session.
- Progression: Increase slowly as the patient adapts to the programme (2 – 5 lb.wk^{-1} [0.91 – 2.27 kg] for arms and 5 – 10 lb.wk^{-1} for legs [0.91 – 4.5 kg]).

Exercise training for return to work

For those returning to work, exercise training must be specific to the muscle groups and energy systems used for occupational tasks, particularly for those whose employment involves manual labour. Exercise results in better appreciation of the ability to perform physical work, improved safety, enhanced self-efficacy, of the ability to perform physical work, greater willingness to remain employed long term following a cardiac event, and appropriate perception of job demands (Leon et al 2005; Sheldahl et al 1995).

Exercise prescription and return to work

- Assess patient's work environment
  - Nature of work
  - Muscle groups used at work
  - Work demands that primarily involve muscular strength and endurance
  - Primary movements performed during work
  - Periods of high metabolic demands versus periods of low metabolic demands
  - Environmental factors

- Average metabolic demands for 8 hours of work should not exceed 50% of maximal functional capacity

- Exercise prescription
  - Use exercise modalities that use muscle groups involved in work tasks
  - Prescribe intensity versus duration in intermittent fashion as is similar to that of work tasks
  - If possible, use exercises that mimic movement patterns used during work tasks
  - Balance resistance versus aerobic training relative to work tasks
  - If environmental stress occurs at work, educate the patient about appropriate precautions, expose them to similar environmental conditions while performing activities similar to work tasks (ACSM position stands 2007 and 2006; Sheldahl et al 1995) and ACSM 2010 guidelines for additional information on environmental precautions.
  - Monitor the physiologic responses to a simulated work environment

2.7 Rehabilitation after cardiovascular diseases, with special emphasis on developing countries

Developments in Rehabilitative Care (WHO1993)

Demographic factors have had a radical influence on the range of cardiac patients considered eligible for exercise therapy during rehabilitation. Among patients with coronary heart disease, it is not only those who have recovered from uncomplicated myocardial infarction, but also patients with complications of the acute episode, those with angina pectoris of varying severity, and those who have undergone coronary artery bypass surgery and coronary angioplasty who are now considered candidates for rehabilitative care. The spectrum of coronary disease is extensive. At one end are the patients treated by acute myocardial re-perfusion with coronary thrombolysis and/or early coronary angioplasty or coronary bypass surgery, who exhibit a lesser severity of disease, minimal residual symptoms, little functional impairment, and a characteristically excellent prognosis. At the other are patients who, having survived several acute infarctions and surgical procedures, often have severe end-stage coronary heart disease characterized by varying combinations of myocardial ischaemia, ventricular dysfunction, and ventricular arrhythmias (Mathes 2007).

For all these patients, one of the most significant advances has been the emergence of a variety of test procedures designed to identify both the risk of early recurrent coronary events and the long-term prognosis.

These assessments are typically exercise-based, and are designed to distinguish patients who can perform reasonable levels of activity without adverse consequences (low-risk patients) from those with a very limited exercise capacity in whom there is early onset of myocardial ischaemia, ventricular dysfunction, or serious arrhythmias. An intermediate risk group can also be identified. This delineation can serve as a basis for recommending not only medical and surgical therapies but also exercises (including the need for intensity and duration of professional supervision of exercise). It can also serve as a guide to the resumption of work and other pre-illness activities.

At these extremes of the coronary risk profile, computation of morbidity and mortality is unlikely to be a sensitive measure of the outcome of rehabilitative or other interventions. For very low-risk coronary patients, the morbidity and mortality are so low, at least in the short term, any intervention is unlikely to affect the outcome. On the other hand, the outlook in end-stage coronary disease is so uniformly poor that other measures are required to ascertain the benefits of any intervention.

Prominent among these are likely to be quality of life measures, which are related to an individual patient's perception of improvements in physical, social, and emotional status, and the value he or she places on such improvements (WHO 1993).

Other categories of patients now considered candidates for exercise training during rehabilitation include those who have undergone cardiac valvular surgery, those (both adults and children) who have undergone surgical correction or amelioration of congenital heart disease, those with cardiomyopathy and ventricular dysfunction of other aetiology, those with implanted cardiac pacemakers and cardio-defibrillators, and even individuals who are recovering from cardiac or cardiopulmonary transplantation.

These categories include large numbers of elderly cardiac patients. In both developed and developing countries, the numbers of "frail elderly" – the oldest members of society are increasing more rapidly than any other population group. For many elderly patients with cardiovascular disease, return to remunerative work is often not an appropriate outcome measure of rehabilitation: rather, the attainment and maintenance of an independent lifestyle is an outcome that is valued both personally and, given the high cost of institutional care, by society. Thus, small improvements in capacity for physical work may exert a major and favourable impact on the quality of life of elderly cardiac patients (WHO 1993).

In addition to the more favourable functional status and prognosis in a variety of cardiovascular illnesses, which reflect improved medical and surgical therapies, changes in a number of aspects of rehabilitative care *per se* have substantially influenced its application.

First, there is evidence that patients classified by stratification procedures as being at low risk can safely exercise without medical supervision and safely

and promptly return to pre-illness activities, including remunerative work. Further, it is now accepted exercise training of low to moderate intensity can produce improvements in functional capacity comparable to those produced by higher intensity exercise. The lower intensity exercise is characterized by greater safety, which is particularly important if exercise sessions are unsupervised; it causes less discomfort and is more enjoyable, and thus makes adherence to the recommended exercise regime more likely. Among patients who can safely perform modest levels of dynamic exercise, the relatively safety and substantial value of low-intensity isometric or resistive (strength training) exercise have also been identified. That patients receiving all types of antianginal drugs can benefit from exercise training has been extensively documented. Cardiac enlargement and compensated heart failure are no longer considered contraindications to physical activity, and exercise rehabilitation has improved functional status. Another important observation is the lack of correlation between the extent of ventricular dysfunction and physical work capacity (WHO 1993).

Greater attention is now being devoted to the education and counselling components of rehabilitative care, with new techniques being applied in these areas as well.

Prominent among these is the behavioural approach to reducing coronary risk; this comprises not only transmission of information, but also practical training in the skills needed for adoption of a healthy lifestyle, and provision of opportunity to practise and reinforce these skills. To achieve successful lifestyle changes, patients must actively participate in the management of their disease. Evidence that favourable modification of coronary risk factors can not only limit progression of the disease but even induce regression of the underlying atherosclerosis has encouraged efforts in this area. This is particularly true for individuals with requirement for myocardial revascularization procedures. The importance of the family – and often the workplace – in encouraging and reinforcing efforts to reduce coronary risk is increasingly acknowledged. It is thus essential that health care professionals at all levels are trained to be effective teachers of their patients.

Perception of health status is recognized as having an influence on clinical outcomes; for example, the perceived ability to exercise correlates better with resumption of work than does the objective measurement of exercise capacity during formal testing. There is also substantial correlation between perception of health status and return to usual family and community activities, and recreational and occupational pursuits. Importantly, this perception can be favourably altered by education and counselling.

Psychological problems, predominantly anxiety and depression, are recognized as greater obstacles to the resumption of pre-illness activities by coronary patients than physical incapacity. Return to work is increasingly viewed as an outcome measure that is economically, physically and socially relevant to a wide variety of coronary patients, but one that may relate poorly to restoration of functional capacity. Total restoration of functional status, occupational as well as physical, remains a challenge to be met.

Another major development is the emphasis that is now placed on the need to tailor rehabilitative care to the needs of the individual, basing it on the patient's clinical status, personal desires, and requirements for specific interventions. This approach is likely to prove more successful, and more cost-effective, than the indiscriminate application of multiple components of rehabilitative care (WHO 1993).

Implementation of cardiac rehabilitation in developing countries

In order to define the nature of the rehabilitative care required for cardiac patients, especially in developing countries, it is helpful to identify the goals of rehabilitation. These may be briefly stated as follows:

- Rehabilitation care should be available to all patients with cardiovascular disease in all countries
- Every professional health care worker, and the general public, should be aware of the need for cardiac rehabilitation.
- Appropriate education should be provided to all cardiac patients and their families, and to all health care professionals involved in cardiovascular rehabilitation.

- The type of cardiovascular rehabilitation programme should be matched to the needs and resources of each community, and there should be provision for periodic re-evaluation of the programme.
- Cardiac rehabilitation should be integrated into the existing health care delivery system of each country.

Assessment of a patient for entry into a cardiac rehabilitation programme requires:

- a diagnosis of the cardiac condition, prescription of appropriate medical or surgical treatment, and an opinion on further prognosis and risks;
- identification of the appropriate type of cardiac rehabilitation;
- evaluation of the patient's condition as a basis for future surveillance and further evaluation.

In establishing a cardiac rehabilitation programme, the following needs should be considered:

- trained personnel
- physical facility, equipment, and educational materials
- financing arrangements (within the context of the existing health care system)
- programme of exercise and patient education

These four elements are discussed below for each of the three possible levels of cardiac rehabilitation facility. The simplest level delivers cardiac rehabilitation at the local community level (basic facility). At the second level cardiac rehabilitation is developed within a local town or city hospital (intermediate facility). The third level is the establishment of a cardiac rehabilitation centre associated with a major medical centre (advanced facility).

For a successful programme in a cardiac rehabilitation facility the following are required:-

Basic facility

A basic rehabilitation facility is located in a village or community and integrated into existing local community health services.

Personnel

A trained community health worker, preferably a health professional, is required to operate the facility.

Physical facility, equipment, and educational materials

Any available community centre (local meeting place, hall, school, or place of worship) may be used for the facility. A sphygmomanometer, preferably with a stethoscope, should be available, and the health worker should be able to check the patients' pulse rates. Educational material and charts and a suitable area for a walking exercise programme are required.

Financing

It should be possible to finance the facility from the resources of the existing health care system.

Programme of exercise and patient education

A minimally supervised exercise programme of low or moderate intensity should be followed (Kellerman 1975). It should preferably be conducted in a group setting and consist of callisthenics and light exercise (see Annexures 1 and 2). Patients and their families should be given a certain amount of basic information and their long term compliance with the programme should be encouraged.

Intermediate facility

An intermediate facility for rehabilitation is normally located in a hospital where general medical services are available.

Trained personnel

A facility of this type requires the following categories of trained personnel:

Physician. At least one physician should be trained in cardiological practices, including exercise physiology, exercise testing, cardiac rehabilitation, and cardiopulmonary resuscitation techniques. This physician, who will have

overall responsibility for the service, may be the only fully trained person available at this level and may have to train all other personnel.

Nurse/health professional/administrative assistant. Personnel at this level will often have to fulfil several functions and therefore be trained as, for example, exercise specialists, physical therapists, or dieticians. They may need to be sent to other facilities for specialized training. There must be at least one clerk/secretary to help maintain records and perform other administrative functions. All or some of these personnel may be part-time and may have additional responsibilities elsewhere in the hospital.

Physical facility and equipment

An intermediate facility will require at least one office for administrative purposes. It will also require a multipurpose exercise room with one area specifically for exercise testing (with treadmill, bicycle ergometer, or at least steps). A 3-channel ECG recorder and display (or at least a single-channel ECG making with a modified exercise lead but without monitor) should be available. Another area could serve as classroom, but the main space should be reserved for exercising.

Financing

A simple budget plan is required, even for the smallest facility of this type.

Programme of exercise and patient education

A minimally supervised exercise programme of low to moderate intensity should be followed. It should preferably be conducted in a group setting and consist of callisthenics and light exercise (see Annexures 1 and 2). Patients and their families should be given a certain amount of basic information and their long term compliance with the programme should be encouraged. It should be noted that for patients returning to certain high-intensity, demanding jobs, a higher level of exercise training may be necessary, either to improve their general fitness or to increase muscular strength for specific tasks (AHA 1990).

Advanced facility

The advanced cardiovascular rehabilitation centre is associated with a major medical centre where medical services of high standard are available. It

should be a leasing referral centre for patients with cardiovascular diseases having :-

Trained personnel

An advanced rehabilitation centre requires the following personnel:

Medical director. The director should be a trained cardiologist with experience in rehabilitative techniques.

Programme co-director. The co-director of the programme should be a highly trained health professional.

Exercise specialist. This person should have extensive knowledge of exercise physiology and practical experience in cardiac rehabilitation.

Administrative executive

Physiotherapist

Occupational/Vocational therapist. This person must have background experience and preferably specialized training in this area.

Psychologist

All or some of these personnel may be part-time and may have other responsibilities elsewhere in the hospital.

Physical facility and equipment

An advanced facility will require offices for senior medical staff, for examination of patients, and for administration. There should be an exercise testing area and a comfortable exercise room and/or gymnasium with exercise testing and resuscitation equipment. Access to two-dimensional echocardiography and a nuclear medicine facility is essential. Classrooms for lectures/counselling and a library/audiovisual room are required and there should be space for special clinics and blood collection.

Financing

A budget plan should be developed, appropriate for the programme that will be undertaken at the tertiary level.

Programme of exercise and patient education

In a fully equipped and staffed cardiac rehabilitation centre, it is possible to select either a high-intensity exercise training programme which requires exercise testing (possibly with imaging and monitoring) or a non-equipment-

based exercise programme of low or moderate intensity as recommended for basic and intermediate rehabilitation facilities.

In making the choice of programme, it is important to embrace the concept of risk stratification and to be aware of the relative benefits and risks of high-intensity and low or moderate-intensity exercise programmes. Accurate clinical risk stratification is possible (Fry 1981) for most patients (see annexure 3), but exercise testing and other investigations may be required in selected individuals. In an advanced medical centre, the recurrent evaluation of clinical accuracy will justify the costs involved by confirming the value of the techniques used and underlining their cost-effectiveness.

The minimal difference in outcome between high and low level exercise training programmes (Goble 1991; Blurmenthal 1988) has led some centres to reduce the level of physical training in their cardiac rehabilitation programmes. If a high-intensity exercise programme is followed, the approach recommended by the American Heart Association should be adopted (Exercise Standards 1990). High intensity exercise programmes necessitate exercise testing (Pryor 1989- annexures 4,5,6). If an exercise programme of low or moderate level is preferred, this could be based upon calisthenics and light exercise (annexures1,2). However the same educational programme is required regardless of the type of exercise programme.

Special Considerations applicable to diagnostic groups (WHO 1993)

The categories of patients with coronary heart disease and its complications who may need rehabilitation services are the following:

- those who have sustained myocardial infarction
- those who have been admitted to hospital for unstable angina
- those with chronic ischaemic heart disease who are starting an exercise programme
- those who have undergone coronary bypass surgery and percutaneous transluminal coronary angioplasty.

The largest group will be patients who have sustained acute myocardial infarction, and this should be taken into consideration in planning personnel training and facilities for exercise programmes.

Risk assessment of patients entering exercise programmes is essential, as is the identification of any factors that would contraindicate exercise. Individually prescribed exercises should take account of the degree and type of surveillance necessary for safety and for assessment of results. It is also important to assess patients' education and needs and to develop plans for secondary prevention. Any special needs (e.g. psychological or vocational) must also be considered

In many developing countries, rheumatic heart disease is a problem of childhood, adolescence, and young adulthood. The disease progresses rapidly and few of those affected survive into middle age without proper medical and surgical treatment. In both rheumatic heart disease and coronary heart disease, many of the common residual defects and haemodynamic derangements leave post-surgical patients with varying degrees of disability.

This is further compounded by problems of chronic anti-coagulation in patients with mechanical prosthetic valves.

Patients who may need rehabilitation generally belong to one of the following categories:

- those who have become inoperable or whose lesions are too complex for the available surgery;
- postoperative patients in whom results and prognosis are good
- postoperative patients with significant and residual defects
- those who need chronic anticoagulation and prophylaxis for rheumatic fever

While patients with rheumatic heart disease and congenital heart disease have to be cared for in the same rehabilitation facility as those with other cardiac problems, it is apparent that patients in the first group may be of a very different age and will need special care and assessment. These concepts are further developed in the technical report (WHO 1993).

Cardiomyopathies are heart muscle diseases of unknown origin and are classified as (a) dilated, (b) hypertrophic, and (c) restrictive varieties. They are distinct from specific heart muscle diseases of known cause or associated with disorders of other systems. The most common are the dilated and hypertrophic varieties, while the restrictive variety, although rarer in many countries, is common in Africa and South America. All ages and both sexes are affected. The disease may be very mild and chronic, or severe enough to result in death in a short period of time. There is increasing evidence that some form of exercise is of benefit to patients with dilated cardiomyopathy. Careful exercise training may result in sufficient significant improvement in effort tolerance; it can thus transform a totally dependant person into one capable of independent self-care and even of training for a sedentary job.

It has become apparent that exercise capacity may not correlate with left ventricular function in the individual patient. The special needs of patients with cardiomyopathies include strict medical management of congestive failure and arrythmias. Some patients with dilated cardiomyopathy will need long-term anticoagulation, and exercise in hypertrophic cardiomyopathy may carry the risk of arrythmia and sudden death.

Requirements for trained personnel, facilities and equipment, patient evaluation, exercise programmes, and surveillance are no different from those discussed previously for medically complex cardiac patients, and need only to be suitably modified for the local conditions in a developing country.

While pregnancy is not usually a problem in a number of cardiac conditions, it is generally a high-risk situation and may be contra-indicated in the presence of severe right ventricular hypertension or Eisenmenger reaction, severe aortic stenosis, peripartum heart disease, Marfan syndrome, or severe coarctation of aorta. Correction of disease and disability must be attempted before pregnancy is considered. A patient must also be informed of the greater chances of transmission of heritable disease to the child, particularly in the case of Marfan Syndrome.

In planning the care of pregnant women with heart disease, certain information is essential:

- Is this a planned pregnancy in a patient with a mild or corrected lesion who has been medically evaluated and cleared for pregnancy, or is it an unplanned pregnancy in a patient with either a previously undiagnosed cardiac condition or an inadequately treated or severe cardiac condition? Obviously, the risk is higher in the latter case than the former, and such a patient may need to be referred to a specialized centre or considered for termination of pregnancy when appropriate.
- What is the functional class of the pregnant patient? Irrespective of the aetiology of the heart disease, there is a clear relationship of foetal loss and maternal morbidity and mortality to the functional class of the patient before and during the pregnancy. The highest morbidity and mortality occur in patients of classes III and IV (see annexure 7) (WHO 1993).

Non-equipment-based exercise training (WHO 1993)

Clearly, programmes that rely heavily on equipment-based exercise techniques will encounter financial difficulties in acquiring equipment and maintaining it in good working condition, and in training the necessary personnel. For most developing countries, particularly in rural areas, such programmes are an unrealistic proposition. Thus, non-equipment-based cardiovascular rehabilitation programmes are the most practical option for developing countries.

In designing a non-equipment-based exercise programme to be both efficient and cost-effective, certain critical factors must be considered. These factors relate to the individual patient, to the resources available in the community, to the patients physical environment, and to the national health care structure.
The second stage in design involve considering the type, severity, and prevalence of cardiovascular disability and choosing appropriate types of non-equipment-based exercise with well defined minimal end-points or goals. These considerations govern the choice of potential exercise sites.

Stage I: Consideration of socioeconomic, cultural, and physical factors related to the patient and the environment

The patient. In both equipment-and non-equipment –based programmes, the ability to communicate with the individual is crucial for success. The health professionals involved should be able to explain the content and purpose of the exercise programme to each patient, and should anticipate – and be prepared to answer fully – the questions that patients are likely to ask. This may involve preparing appropriate educational and instructive materials.

Routine information that should be recorded for each patient includes age, sex, and anthropometric measurements related to body size and other relevant characteristics. Information on socio cultural factors such as the time, type, and size of major daily meals, sleep patterns, sexual habits, and religious practices may be critical to the implementation and outcome of an exercise programme. Since professional and psychological integration are important goals of most rehabilitation programmes, information on profession and/or income (in the sense of employment or unemployment, physical or sedentary work) may be important but is unlikely to be particularly relevant in some rural settings. Careful investigation and understanding of the "role" of the individual in a given social or cultural setting may be crucial. The concept of the "individual" may be quite complicated in some cultures where there is a strong sense of "collectivity" and where the accomplishments of "all" rather than those of the "individual" are emphasized. Moreover, an understanding of some of the rites and taboos (such as those related to sexual practices or to standards of dress e.g. requiring the head or face to be covered) may reveal certain limitations in terms of potential programme options for some individuals (WHO 1993).

Resources available in the community. It is essential to have detailed information on all potential health facilities available in each community, from basic health units to relatively sophisticated and more complex units such as hospitals, paying particular attention to details such as their capacities and capabilities. Since these units will be sources of patients, points of reference around which rehabilitation centres will be located, or resources for training the health professionals who will be involved in rehabilitation programmes, the potential value of this detailed information (particularly in regard to handling

complications or accidents) cannot be over emphasized. Equally detailed information must be given to transportation facilities and the quality of the road network available in each community. Local schools or other educational facilities, places of worship, clubs, and cultural groups may provide suitable environments for initiating programmes in which group participation, education, and interpersonal communication are important elements.

The heterogenous nature of most urban communities in developing countries renders any rigid distinction between rural and urban settings – in terms of health care potential and availability – invalid. Some individuals in urban communities will be able to afford and benefit from the most modern equipment – and non-equipment based exercise programmes, where others in the same communities may be limited to non-equipment-based programmes as the only option. Similarly, individuals in rural areas that are close to urban communities may be able to benefit from both equipment and non-equipment-based programmes (WHO 1993).

Physical environment and climatic conditions. Non-equipment–based exercise programmes may be undertaken indoors or outdoors but, in either case, air quality, the effects of altitude, and potential temperature and humidity variations must be carefully assessed. In regions where highways and pedestrian areas are not separately designated, appropriate flat or sloping open areas must be identified. If nowhere suitable is readily available, closed structures of appropriate dimensions can be erected, or pedestrian paths or open spaces created by the community. Aquatic exercises may be an option for some cardiac patients with other physical disabilities, although the necessary degree of supervision, the need for initial training of personnel, and other safety considerations may make this an unrealistic option.

The national health care structure. Most programmes should be designed to permit their easy integration into the existing health care structure in order to limit operating costs and ensure continuity. In most developing countries, the private sector is scarcely established, and the state remains the major health care provider, a fact that is particularly critical for rural communities. The most difficult task in establishing new programmes may be to alert governments to the growing significance of cardiovascular disorders and the costs of resulting

disability, and to convince them of the importance of rehabilitative and preventative techniques in reducing actual and potential health care costs. Consideration should also be given, however, to other sources of health care, such as nongovernmental organizations, whose contributions in terms of financial and human resources, and to some extent infrastructure, may be important determinants of implementation of rehabilitation programmes in a particular community or region.

Stage II: Consideration of medical and technical factors

Type and degree of cardiovascular disability (ISFC Scientific Council on Rehabilitation 1983). It is important to consider the type and degree of functional impairment, i.e. to examine the relationship between functional class, clinical status, and maximal oxygen consumption. (see Annexure 7)

Principles and types of non-equipment-based exercise training. It has been clearly shown that the intensity and frequency, and the rate of increase in intensity and duration, of exercise are crucial determinants of the benefits of exercise training. It may be extremely useful to develop a subjective "quantitative" scale based on the patient's own perception of exertional intensity: this might be similar to Borg scale (Borg 1970 - see annexure 8).

In the final selection of an exercise programme, the following considerations are of prime importance:

- Each exercise protocol must be adaptable to or integrated into a general multidisciplinary programme of cardiovascular rehabilitation
- The choice of an exercise programme must be guided by clearly stated goals regarding the future role of the patient in a given community or particular socio cultural setting, and by whether or not these goals include the patient's resumption of work.
- When decisions on possible exercise intensity are being made, a concept of energy expenditure(combining elements based on patients' own perception of expenditure and the actual energy

expenditure involved in a given activity) should be used in counselling and motivating patients (Pryor 1989; Kellerman 1968)

- ACSM (2010) guidelines outline exercise prescription for the cardiac population
- The choice of the type of exercise and the exercise site must take into consideration:

- The quality and availability of trained personnel to implement and supervise the exercise
- A well defined strategy for handling potential accidents and complications. This may involve training personnel to recognise problems and to administer cardiopulmonary resuscitation to patients if the need arises. A minimal chain of communication, with carefully formulated plans for evacuation of patients to units with more resources, is important, especially when high-risk patients are involved.
- The physical environment, including the effects of altitude and other climatic variables (temperature, humidity, and air quality in general).

- It is essential to train and maintain teams of personnel capable of designing, implementing, supervising, and evaluating exercise programmes. These teams may be based in central and well developed health facilities and be responsible for training other personnel for peripheral health units with particular emphasis on the education of patients in each community.

There are special considerations for non-equipment-based exercise training and education in remote areas. Communication, accessibility, and socio cultural considerations may be limiting factors for education in most rural communities in developing countries (Guzman 1986). Education cannot be effective if these factors present significant obstacles. Financial investment and investment in trained human resources are frequently the only options available to overcome these obstacles. Socio cultural factors may be quite subtle, so that considerable insight is required to design an effective

programme capable of producing acceptable results. For instance, standard energy expenditure tables use terms like “light or heavy housework” and give the associated metabolic cost of such activity. “Housework” for a woman in a rural community may include fetching water, which may frequently involve carrying heavy containers several times daily over considerable distances. The role of a 9-year-old in a similar community may involve activities with associated energy expenditure levels usually expected of adults. In some cultures, individuals can be ostracized if they are unable to assume the minimal roles expected of them; the repercussions of this social rejection may range from damage to the psychological equilibrium of the individual to the eventual disintegration of entire family groups.

In developing countries, the distribution of types of problem, socioeconomic factors, and peoples access to health care are quite different from those in developed countries. Different types of cardiovascular disease require different programmes, but most requirements can probably be met by simple community-based programmes working with groups of patients with family support. Although the requirements of patients in small towns and villages are likely to differ somewhat from those of patients in cities, the aim for all should be minimal sophistication within the framework of good medical and community practice at affordable cost.

In summary, lower intensity programmes are an attractive solution to the problem of exercise rehabilitation: sophisticated testing is not required for the vast majority of patients, and even relatively simple testing may be unnecessary for most.

Assessment of patients for return to work (WHO 1993)

At Grey’s Hospital the occupational therapy department and the physiotherapy department conduct work and functional assessments for patients. Currently due to poor referral of patients to these departments for cardiac rehabilitation, cardiac patients are not being assessed for return to work by occupational therapy and physiotherapy. Cardiac patients would also benefit from being rehabilitated for the return to work.

The assessment of patients with cardiovascular disease for ability to resume work depends upon the exact nature of the disease and upon the type of work to be undertaken.

The physical demand of a wide range of specific activities undertaken in different occupations are set out in Annexure 9, where the work done is expressed, in terms of oxygen consumption, as metabolic equivalents of the task (METs). For the average person, 1 MET = 3.5 mlO_2 /minute per kg of body weight, which is oxygen uptake at rest. Oxygen uptake is a guide to the effort required for a specific task, but considerable variation occurs according to the duration and pace of activity. It is therefore also important to have an understanding of the nature of the work being undertaken (WHO 1993).

The WHO technical report continues to describe the requirements for tasks including :-

- Managerial, secretarial, or clerical work
- Office support work
- Production line work
- Factory work
- Outdoor heavy industrial and construction work
- Rural work

Apart from clinical examination, assessment of an individual patient for return to work or for social reintegration involves consideration of several factors:

- the diagnostic group into which the patient most readily fits;
- the attitude and understanding of the patient's family;
- the nature and extent of the patient's work experience and the availability of suitable work;
- the cooperation of the potential employer.

Preparing patients for return to work and other normal activities after myocardial infarction should follow a similar pattern in developing and developed countries, with rehabilitation programmes directed towards

restoration of both physical capacity and confidence. Individual assessment can be made after patients have spent some weeks in exercise programmes and discussion groups.

Patients in developing countries often have the additional benefit of good family support, even if sophisticated social services are lacking. However, the interviewing of spouses, in the courses of assessment, particularly of women concerning their husbands, may be unacceptable in some societies. Psychological assessment may be interpreted as implying mental instability, and be similarly unacceptable. For government employees who are unable to continue working, pension plans or compensation for redundancy are usually available. Many of those who are privately employed work for family business and retirement or resumption of employment is thus facilitated. For some patients, however, there may be no suitable arrangements, either for retirement or for return to work.

During assessment and preparation each patient will know the physical and psychological demands of his or her job and be well aware of the environment in which the work is performed. Assessment for return to work will therefore be facilitated by asking the following two questions early in the rehabilitation programme:

- What is the nature of the job to which you hope to return?
- What is the most strenuous or demanding aspect of the job?

The nature of work and possible problems related to its resumption should be the topics for at least one hour's group discussion during a programme of 6-8 weeks. Patients should be encouraged to talk about how they perceive their resumption of work and to raise any anticipated problems with the programme coordinator.

Many problems can be resolved by discussion with the patient and close family members, and one of the most important features of a rehabilitation programme, especially for severely disabled patients, is thus a thoughtful and well prepared educational programme for patients and their families. Group education, especially in developing countries, has proved to be a most

effective tool for promoting hygiene, encouraging compliance with therapy, and teaching preventative measures. Clearly, the content of these programmes must take account of and be adapted to patient's educational, cultural, and ethnic backgrounds.

Any significant physical demands imposed by particular work should be defined; the patient's programme should then be modified to increase progressively the physical demands of specific activities, by repeated use of relevant muscle groups or by simulation of the actual work. Activities could include lifting weights, carrying buckets or boxes, or ascending stairs, steps, or scaffolding. Straining efforts and physical demands should be increased slowly and repeatedly until they can be achieved at the rate normally required in the work. It may be assumed that cardiac recovery has usually occurred within 2 months, and muscular recovery been achieved within 3 months of an acute myocardial infarction.

A patient who notices undue breathlessness, chest tightness, anginal chest pain, palpitations, or swelling of the ankles should be medically reviewed and treated appropriately. Once his or her condition has been stabilized with medication, the programme of increasing activity to normal work levels should continue. After cardiac surgery, major considerations in assessing fitness to return to work include incisional pain and psychological problems. The latter may require specific support and reassurance. For self-employed patients, appropriate modification of work is usually no problem, but changes in the work pattern of specific tasks of employees may require agreement between patients, programme coordinator and employers (WHO 1993).

With reference to the assessment of patients for return to work, guidelines are given in the WHO technical report series for :-

- Patients with acquired or congenital heart disease
- Work simulation
- Work trial
- Modification of physical work

Considerations for secondary prevention (WHO 1993)

Education is an important element of secondary prevention and constitutes a major part of all rehabilitation programmes. Exercise increases cardiovascular functional capacity and reduces oxygen demand for any level of physical activity, although regular physical activity is essential to sustain the benefits of training. The risks of complication can be reduced by timely medical evaluation, appropriate supervision of exercise, and avoidance of strenuous activity among high-risk patients (see annexure 3).

For patients with coronary artery disease there is great potential for secondary prevention. More precise identification of patients most likely to benefit from secondary prevention and other therapeutic measures should reduce morbidity and mortality for those participating in rehabilitation programmes.

In the urban centres of developing countries, the predominant cardiovascular problems are hypertension and coronary heart disease. They represent the dominant cause of total mortality, especially among people aged over 50 years. Prognosis may be affected by all of the many factors that can adversely affect the baseline state of the disease and that may be liable to ethnic and cultural influences, e.g. risk of hypertension, changes in lipid metabolism, and the habit of cigarette smoking.

Increasing evidence supports the need for widespread application of specific measures to prevent recurrence after a first coronary event. In the short term, abstinence from cigarette smoking is extremely effective in reducing morbidity and mortality. In the long term, correcting serum lipid abnormalities appears to slow the progress of coronary artherosclerosis and may improve outcome (Blankenhorn 1987).

Trials of cardiac rehabilitation programmes applied in addition to standard care has revealed a significant reduction in mortality (O'Connor 1989). In one long-term study of multifactorial intervention following acute myocardial

infarction (involving exercise training and control of risk factors), follow-up of patients after 3 and 10 years showed that mortality was lower in the intervention group than in the control group who received no additional rehabilitative care (Kallio 1979; Hamalainen 1989).

Criteria for admission of patients to cardiac rehabilitation programmes vary in terms of the extent of myocardial infarction and residual cardiac function. This variability, added to poor adherence to the programmes, makes comparison of results from different rehabilitation centres very difficult. Generally, however, return to work, after myocardial infarction is a parameter for evaluation of programme efficacy in patients of appropriate age and where jobs are available.

Advanced rehabilitation programmes

Advanced facilities for medically supervised rehabilitation programmes exist only in a limited number of places. Elements of these programmes include the following.

Early post-infarction exercise testing. Exercise testing soon after myocardial infarction may be useful in formulating plans for the discharge of patients from hospital, and in determining the activity threshold at which symptoms and signs appear. The safety of early exercise testing appears to be related more to the severity of the disease than to the interval between infarction and exercise testing or to the test protocol.

Intermediate convalescence. On discharge from hospital, patients should be able to perform customary activities at home and continue the activities started in the hospital. The immediate objective of exercise training is thus the reversal of deconditioning. The patient is asked to walk every day on level ground, increasing the distance as exercise tolerance improves. Approximately 6 weeks after hospitalization, a symptom-limited maximal exercise test can be conducted. Contraindications to exercise testing and reasons for termination of the exercise (Clinical competence in exercise testing 1990) are detailed in annexures 11 and 12. If results are acceptable, activity levels can be increased.

Group programmes. An exercise facility with trained personnel and monitoring equipment and the provision of educational components are

essential for group exercise programmes. Patients should learn to monitor their own pulse rates and to recognize the symptoms of exercise intolerance.

Intermediate and basic rehabilitation programmes

Group programmes. Group programmes based on education and light exercise, even when monitoring and sophisticated technical facilities are unavailable, are ideal means of promoting secondary prevention.

Home programmes. In small communities with limited resources, programmes of unsupervised but medically directed home exercise are common practice. In the developing areas, where the high cost of medically supervised exercise programmes and lack of appropriate infrastructure are limiting factors, home programmes represent the ideal approach to physical rehabilitation. Exercise designed to train the specific muscles that the patient uses principally in his or her work should be included in the programme, as should guidance on secondary prevention and compliance with the programme.

Long-term programmes

The concept of long-term rehabilitation programmes is equally applicable to advanced, intermediate, and basic facilities. The purpose of such programmes is to help patients retain and reinforce learned behaviour and to motivate them towards further progress. Long-term programmes are recommended for all patients and must therefore be cost-effective. However, it is possible to establish exercise facilities without expensive equipment. Both individual and group activities can help patients maintain changed behaviour and may also lead to behavioural changes in the community as a whole.

In patients with non-coronary disease, including post-operative patients with attention to anticoagulant therapy (in patients with cardiomyopathy and valvular disease), haemodynamic variables may be only slightly altered at rest but become markedly abnormal during stress or exercise. Oxygen demand is met by means of an increase in the arteriovenous O_2 difference. In stable patients, light exercise of major muscle groups may facilitate oxygen utilization and extraction and lead to improved physical performance. However, in

cases of myocarditis or acute decompensation, exercise may prove to be hazardous and is contra-indicated.

Patients with rheumatic heart disease should be taught the importance of antibiotic prophylaxis of infective endocarditis and the regular use of antibiotics to prevent recurrence of rheumatic fever.

Cardiac surgery is advised when it is most likely to yield cure or prolonged palliation, particularly in cases of patent ductus arteriosus, atrial septal defect, ventricular septal defect, mitral stenosis, tetralogy of Fallot, and coarctation of the aorta. Some repairs are currently accomplished with percutaneously introduced devices. Reconstructive valvular procedures are not wholly successful and further surgery may be needed. Biological cardiac valve replacements generally have the advantage of requiring no permanent anticoagulation, but their durability is limited. Other prosthetic devices necessitate permanent anticoagulation therapy.

In rehabilitation programmes, it is important to develop a general set of recommendations for all patients receiving anticoagulant therapy, but particularly to familiarize them with the method of administration and daily adjustment of the dose of the anticoagulant, and to teach them about drug interactions, complications, and the need for prothrombin time testing. Group discussions with patients, spouses, and other family members should be encouraged. Exercise for these patients must be carried out carefully to avoid trauma, bleeding and other complications. In summary, cardiac rehabilitation programmes facilitate functional recovery; associated education and counselling improve patients' psychological outlook. Moreover, inclusion in these programmes of a vocational rehabilitation component can yield significant economic benefits. As the principles of cardiac rehabilitation become more broadly applied, larger numbers of patients with cardiovascular disease will benefit medically, socially, and psychologically (WHO 1993).

Exercise testing and training in rehabilitation of children and young adults with cardiovascular disease (WHO 1993)

Examination of circulatory and cardiac responses to stress is often much more sensitive and informative than evaluation of cardiovascular function at rest. Since exercise is a physiological form of stress, dynamic exercise testing (or ergometry) has become a valuable non-invasive method for diagnosis and evaluation of heart disease in children and young adults (American Heart Association Council on Cardiovascular Disease in the Young 1982); many individuals with cardiovascular disease show abnormal responses to exercise as well as reduced endurance and functional capacity. In clinical practice, an objective estimate of performance or fitness can be obtained through standardized exercise tests (Exercise standards 1990).

Such tests provide objective and reliable estimates of physical working capacity and maximal oxygen uptake, and provide clues to the mechanisms that limit physical working capacity.

At Grey's Hospital the cardiology department conducts ECG stress tests (Bruce Protocol). Not all patients have the stress tests which would infer that exercise testing procedures and protocols will have to be implemented following discussion between the department of physiotherapy and the cardiology department, and prior to commencing with rehabilitation of patients in phase III of cardiac rehabilitation.

Exercise performance and working capacity may be limited by factors that include type and severity of heart disease, intolerance to stress, arterial oxygen saturation and acidosis, maximal heart rate, arrhythmia, blood pressure, stroke volume, cardiac output, and parental over-protection.

A multi-stage bicycle ergometry test is often used: heart rate, respiration, blood pressure, oxygen consumption, or other variables may be simultaneously measured and recorded while workloads are increased step-

wise. Graded exercise testing helps in estimating cardiac reserve, obtaining an objective assessment of endurance, and identifying serious arrythmias that may not be apparent at rest. The test can be performed with minimal risk to the patient (WHO 1993).

Exercise tests are performed to:

- evaluate specific symptoms and signs that may be induced or aggravated by exercise;
- identify abnormal adaptive responses occurring in patients with cardiac and other disorders;
- assess the effectiveness of specific medical and surgical treatment;
- estimate levels of functional capacity for participation in vocational, recreational, and athletic activities; and
- estimate prognosis

In deciding on the best approach to management of specific cardiac conditions and/or clinical situations, it is of great benefit to the clinician to combine the results of exercise testing with other relevant medical data.

Many physicians rely upon the instincts of children with cardiovascular disease to regulate the intensity of their physical activity. The success of this approach; however, may be limited by the fact that other major risk factors may result in a morbid or fatal event. An abnormal fall or rise in blood pressure, significant ischaemia-like S-T segment changes, and rate, rhythm, and conduction abnormalities may occur in the absence of symptoms or a reduction in working capacity. Medical history and physical examination can often identify the children or young adults in whom exercise testing will contribute to clinical management (WHO 1993).

Children and young adults with cardiovascular disease whose working performance and adaptive responses to exercise are normal can probably participate in various physical activities with no greater risk than normal

individuals (American Heart Association Council on Cardiovascular Disease in the Young 1982). During exercise testing, ventilation and respiratory gas-exchange, cardiac performance and function, myocardial perfusion, cardiac electrical stability, working performance, and perceived exertion can be assessed with techniques of reasonable sensitivity and reliability. Exercise testing can reveal the abnormal response to exercise and the intensity of exercise required to produce abnormality. Test results, especially when combined with other relevant clinical data, provide information on which recommendations regarding physical activity in specific individuals can be based.

Physicians must be aware that a child with mild heart disease, or referred for cardiovascular evaluation and found to be normal may be restricted in physical activity by an over-protective parent. Exercise testing can provide a functional assessment for the physician to use in the education of both parent and child.

Exercise testing primarily identifies mechanisms of cardiovascular responses to stress. Myocardial ischaemic and exercise-induced arrhythmias can be identified with a high degree of reliability. Other abnormalities, such as restricted stroke volume causing a change in systolic arterial pressure and pulse pressure during exercise, can be inferred from specific measurements and observations or from measurements made during routine testing. These abnormalities may occur in many different types of lesions that affect the systemic circulation and pulmonary systems.

Serial exercise testing using the same protocol before and after therapeutic intervention can provide valuable and objective information about the success of the intervention (WHO 1993).

Exercise testing is recommended in the evaluation of children and young adults with cardiovascular disease before special exercise training is undertaken in rehabilitation programmes. The evaluation will reflect an individual's exercise tolerance, suggest the appropriate type and intensity of exercise training, and perhaps indicate the required specific physical activity

(Blurmenthal 1988). Patients' progress and accomplishments in a special programme can be followed by serial exercise testing.

Specific variables measured during exercise testing

Working capacity

Working capacity, assessed by maximal oxygen uptake, power output, or work output, may be affected by the type of heart disease and its severity. Given estimates of working capacity, the physician can monitor the severity of a lesion, and prescribe appropriate recreational and vocational activities, special exercise training, and rehabilitation programmes.

Cardiac rhythm

In some patients with or without recognizable heart disease, abnormal changes in cardiac rhythm during exercise may be revealed by electrocardiogram. Exercise testing is useful in evaluating cardiac dysrhythmias in patients with specific types of disease (mitral valve prolapse and postoperative tetralogy of Fallot) and a history of sudden death in the family.

Premature ventricular contractions are a frequent clinical problem in patients without recognizable heart disease, and may be suppressed or aggravated by exercise. Ventricular dysrhythmias that are induced or aggravated by exercise, particularly in postoperative patients, should be taken seriously and evaluated for treatment with anti-arrhythmic drugs.

Atrial dysrhythmias may be affected by exercise; dysrhythmias that were considered insignificant at rest may become significant during exercise. Exercise testing should be included with other procedures (i.e. ambulatory ECG monitoring and electrophysiological studies) in evaluating cardiac dysrhythmias.

Blood pressure

Mean blood pressure increases during exercise primarily because of an increase in systolic pressure. Diastolic pressure changes are minimal. A lack of increase in systolic blood pressure, or a decrease below the normal resting level indicates serious impairment of cardiac performance. In patients with aortic valvular insufficiency, coarctation of the aorta, and systemic arterial hypertension, an exaggerated increase of systolic pressure may occur with exercise. An exaggerated systolic pressure response during exercise may thus have important implications for therapeutic measures and levels of physical activity.

Exercise-induced S-T depression

Myocardial ischaemia revealed by exercise-induced S-T depression occurs in several types of cardiac problems in the young (see Table 3), and the frequency and amplitude of the depression increase with the severity of the cardiac abnormality. There may or may not be associated with chest pain. In severe disease, S-T depression tends to develop at lower levels of work than in mild or moderate disease. Information about S-T segments has been used in both medical management of patients and evaluation for surgical treatment. It is important to record the electrocardiogram for up to 10 minutes after exercise in order to increase the chance of observing any abnormal S-T depression occurring during the recovery period.

Onset of symptoms

The nature and time of onset of any specific symptoms should be recorded during the exercise test. As with vigorous exercise, the risk of cardiac events during exercise testing varies directly with the incidence of cardiovascular disease. Guidelines (ACSM 2010) for exercise testing and prescription refer to several studies that have looked at the risks of exercise testing. The risks of various cardiac events are summarized including acute myocardial infarction, ventricular fibrillation, hospitalization and death. These data indicate that in a mixed population the risk of exercise testing is low, with approximately six cardiac events per 10000 tests. One of these studies includes data for which the exercise testing was supervised by nonphysicians.

In addition the majority of these studies used symptom-limited exercise tests. Therefore, it would be expected that the risk of submaximal testing in a similar population would be lower. The guidelines (ACSM 2010) continue to expound on the risks of cardiac events during cardiac rehabilitation. The prevention of exercise-related cardiac events is also outlined.

According to the American college of sports medicine (ACSM) – guidelines for exercise testing and prescription (2010), for certain individuals the risks of exercise testing outweigh the potential benefits. For these patients it is important to carefully assess risk versus benefit when deciding whether the exercise test should be performed. The absolute and relative contra-indications are listed below :

Absolute contra-indications

- A recent significant change in the resting ECG suggesting significant ischaemia, recent myocardial infarction (within 2 days), or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac dysrhythmias causing symptoms or haemodynamic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Acute systemic infection, accompanied by fever, body aches, or swollen lymph glands

Relative Contra-indications

- Left main coronary stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities (e.g., hypokalaemia, hypomagnesemia)

- Severe arterial hypertension (i.e., systolic BP of > 200mmHg and/or a diastolic BP of > 110 mmHg) at rest
- Tachydysrhythmia or bradydysrhythmia
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise
- High degree atrioventricular block
- Ventricular aneurysm
- Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis, or myxedema)
- Chronic infectious disease (e.g., mononucleosis, hepatitis, AIDS)
- Mental or physical impairment leading to inability to exercise adequately

Relative contra-indications can be superceded if benefits outweigh risks of exercise. In some instances, these individuals can be exercised with caution and/or using lower-level end points, especially if they are asymptomatic at rest.

Performing the pre-exercise test evaluation and the careful review of prior medical history, helps identify potential contra-indications and increases the safety of exercise tests. Patients with absolute contra-indications should not perform exercise tests until such conditions are stabilized or adequately treated. Patients with relative contra-indications may be tested only after careful evaluation of the risk/benefit ratio. However, it should be emphasized that contra-indications might not apply in certain specific clinical situations, such as soon after myocardial infarction, a revascularization procedure, or bypass surgery to determine the need for, or benefit of drug therapy. Finally conditions exist that preclude reliable diagnostic ECG information from exercise testing (e.g. left bundle block, digitalis therapy). The exercise test may still provide useful information on exercise capacity, dysrhythmias, and haemodynamic responses to exercise. In these conditions, additional

evaluative techniques such as respiratory gas exchange analysis, echocardiography or nuclear imaging can be added to the exercise test to improve sensitivity, specificity and diagnostic capabilities. Emergency departments may perform an exercise test on low-risk patients who present with chest pain (i.e within 4 to 8 hours) to rule out myocardial infarction. Generally, these patients include those who are no longer symptomatic and who have unremarkable ECGs and no change in serial cardiac enzymes. However, exercise testing in this setting should be performed only as part of a carefully constructed patient management protocol and only after patients have been screened for high-risk features or other indicators for hospital admission (ACSM 2010).

Exercise testing is used to determine patients' capacity to adapt to physical stress. In patients with heart disease whose capacity is severely impaired, exercise intensity should be increased stepwise, starting at a low level of physical activity. The following principles should be applied to exercise testing, to avoid risk to patients (WHO 1993):

- A multi-stage workload test is preferred. However, a single-stage test, using the step test or a bending and stretching test, is acceptable in areas where resources are limited.
- Testing should begin at a work level below the estimated level of impairment.
- The workload at each level should be maintained for a sufficient time to stabilize the individual response: 1 minute for lower levels, 3 minutes for higher levels.
- Progress towards maximal working capacity should be achieved stepwise.
- As a minimum, it is essential to monitor the patient's general condition, plus blood pressure and heart rate, during each workload and during the recovery phase. Where resources are available, ECG monitoring is highly desirable.

- With due allowance for the medical care setting and local culture, informed consent should be obtained from patients before exercise testing.
- Exercise testing should be terminated in accordance with the commonly used criteria (see annexure 11).

The patient (or parents or guardian) should be fully informed about the test, and should give written consent to its performance, on the understanding that testing will be terminated upon demand by the patient, parents, or guardian. The exercise test may be performed with the parents or guardian in the testing area; any decision to the contrary should be made at the local level, based on usual clinical practice.

Each patient should be given a general explanation of the equipment and test procedure as well as of the tasks expected during the test. He or she should avoid food intake for at least 2 to 3 hours before the study; comfortable clothing should be worn (or bare feet). Medical history, including medications, physical examinations, and routine 12-lead electrocardiography (if available) should be reviewed to identify any patient for whom this test is contraindicated or should be performed only with special considerations. A cardiologist should be consulted before any patient with symptoms of cardiovascular disease is tested.

Equipment

Basic level facilities (WHO 1993)

Step test (see Table 4). The step test is simple, and the equipment is portable and highly suitable for testing in a doctor's office and for field studies. A constant step height and gradual increase in the rate of stepping are recommended for the test. Music of increasing tempo or a metronome can be used to increase the stepping rate. Pulse rate and blood pressure should be measured at specific intervals and recorded. The step ergometer can be constructed using locally available materials.

The bending and stretching test is used to evaluate changes in heart rate respiration, and cardiac arrhythmias. The subject squats 30 times, as rapidly as possible; there is minimal monitoring before and after the test.

Data for this and the step test in normal children are scanty; studies are needed for different populations and different conditions.

Intermediate level facilities (WHO 1993)

The *step test* may be used, but the bicycle ergometer is most appropriate in care facilities at the intermediate level. Normal data are available for each ergometer. The *bending and stretching test* may be used for evaluation of arrhythmias. Single-lead electrocardiography is useful in detecting regional ischaemia-like signs in varied types of congenital heart disease, but of limited value compared with multi-lead ECG. However, heart rate, arrhythmia, and 85% of S-T segment changes during testing can be recorded using a single lead in the V5 position. During exercise, blood pressure can be measured using a *mercury sphygmomanometer.* Estimates of working capacity, assessment of heart rate, rhythm, and myocardial conduction, and blood pressure responses observed during tests with this equipment reflect cardiac performance and afterload resistance.

Advanced level facilities (WHO 1993)

The equipment available in advanced level facilities should include either a bicycle ergometer or a treadmill (but ideally both). Electrocardiographic equipment is essential and should be readily available; it should be able to monitor three leads of electrocardiographic data in different orthogonal vector planes simultaneously, and instrumentation should be available to record all data. A manual or automatic sphygmomanometer is also essential. For more objective measures of aerobic fitness, measurements of respiratory gas exchange are required. Measurement of oxygen uptake is standard for assessing fitness and the effects of training; appropriate equipment should be available in a paediatric cardiac centre. The Douglas bag type of apparatus for expired gas collection is adequate but new devices are available which integrate a gas analyser and pneumatachograph with a microcomputer for

oxygen uptake. Measurements of heart rate, blood pressure, oxygen saturation, ventilation, gas exchange, and end-tidal gas concentration are also possible with these computerized systems, which offer a high level of data processing and presentation.

With reference to precautions certain basic observations and measurements should be made before, during and after the exercise test. Some are made continuously and others intermittently, depending upon the particular test protocol.

- During the exercise test, the patient should be observed for *symptoms* of cardiorespiratory distress, such as chest pain, premature exhaustion, claudication, headache, dizziness.

- During the exercise test, the patient should be observed for signs of cardiovascular instability, i.e. pallor, sweating, inappropriate effect, and respiratory distress (such as wheezing).

- *Heart rate* can be determined by measuring the R-R intervals on the electrocardiogram or by using a digital heart-rate meter triggered by the electrocardiogram.

- S-T depression as evidence of myocardial ischaemia and dysrhythmias are detected by *electrocardiogram*.

- Blood pressure must be recorded from the right arm during the exercise test, with cuff sizes appropriate to patients' sizes where feasible; a conventional mercury sphygmomanometer or a remotely controlled pneumatic cuff system is recommended

- Estimates of *working capacity* are made using the following indices from standardized exercise procedures:

- maximal power output: the highest rate of work achieved during a continuous or intermittent graded test;

- endurance time: total exercise time to exhaustion or to predetermined endpoints in a continuous graded test;

- physical working capacity: the highest rate of work at which heart rate and respiratory rate do not exceed 170 beats/minute and 30 breaths/minute, respectively, during a continuous graded bicycle exercise;

- total work: accumulated work to exhaustion or to predetermined endpoints during cycle or treadmill exercise.

- *Ventilation and pulmonary gas exchange* are commonly measured during exercise by collecting expired gas over time and determining the average fractional concentration of oxygen in inspired and expired gas. This method yields respiratory rate, respiratory minute ventilation, oxygen uptake, and carbon dioxide production. The respiratory exchange ratio and oxygen ventilatory equivalent can be calculated. The measurements are simple to perform and economical for most advanced clinical laboratories.

Optional measurements and techniques for assessing cardiovascular function and performance are further described in the WHO report – and these include:-

- Cardiac output
- Systolic time intervals
- Intravascular catheterization
- Echocardiogram
- Scintigraphic (radionuclide) techniques

The increased use of the step test (Table 4) and the 9-and 12-minute walk/run test for estimating level of fitness in the paediatric population is being studied. These tests do not require expensive equipment or highly trained personnel. However, there is a need for standardization of testing, increased reliability of

data, and more data for normal children. Guidelines for the step test are provided by the ACSM and the American Thoracic society offers guidelines for the 6 minute walk test.

Several protocols are available, for bicycle ergometer or treadmill testing (see annexure 5). A common goal of exercise protocols is to estimate or measure maximal oxygen uptake. The principal use of these tests is in measuring exercise responses during a steady state.

Different protocols and normal data for bicycle and treadmill ergometers are detailed in the WHO technical report.

Clinical situations and recommendations (WHO 1993)

S-T depression or T-wave changes occurring with exercise may indicate myocardial ischaemia in patients with left ventricular outflow tract obstruction, cardiomyopathies, or coronary artery disease (Table 3).

Significant hypertension is present if serial measurements of resting blood pressure are between the 95th and 99th percentiles for age.

In the USA, recent 99th percentile blood pressure values (National heart, lung and blood institute, 1977) by age are:

6-9 years – 130/86 mmHg (17.3/11.5kPa)

10-12 years – 134/90 mmHg (17.9/12.0kPa)

13-15 years – 144/92 mmHg (19.2/12.3kPa)

16-18 years – 150/98 mmHg (20.0/13.1 kPa)

Some patients will have diastolic pressures below the values given above, but higher systolic pressures. If these individuals have no evidence of end-organ damage, they should be evaluated and followed up in the same manner as patients with significant, but not severe, hypertension. In all cases where there is no secondary to severe essential hypertension, athletes may continue with sports activities. Dangerous elevations of blood pressure will not occur in

this group during static activity. However, dynamic exercise programmes are preferred for persistently hypertensive children, although power weightlifting should be excluded. Major attention should be directed towards weight control, and avoidance or cessation of smoking.

The WHO technical report continues to describe findings during exercise testing in conditions listed below and recommendations are made for the modifications in training, recreational and vocational activities;

- Diagnosis of exercise-induced symptoms
- Evaluation of dysrhythmias
- Uncomplicated lesions
- Congenital complete atrioventricular block
- Atrial septal defect
- Ventricular septal defect
- Pulmonary stenosis
- Aortic stenosis
- Coarctation of thoracic aorta
- Tetralogy of fallot
- Transposition of great arteries after arterial switch
- Kawasaki disease

Table 3 - Examples of conditions that can cause significant S-T depression during exercise in the young

Significant aortic stenosis
Significant pulmonary stenosis
Cardiomyopathies
Coarctation of aorta
Severe mitral regurgitation
Significant aortic regurgitation
Hypertension
Anomalies of coronary arteries
Severe chronic anaemia
Premature artherosclerosis
Kawasaki disease
Myocarditis
Mitral valve prolapse
Other myocardial diseases

Table 4 - Specifications for single step test

***Notes*: Sturdy construction and firm attachment of the step to the floor are essential. Rates below 60 paces/min may be uncomfortably slow, and rates above 180 paces/min may lead to tripping**
Height : 23 cm (9 inches) **Width: 50 cm (20 inches)** **Depth: 25cm (10 inches)** **Rate: 60-180 paces/min** **Pacer: metronome, or pendulum (weight attached to string, 150cm long), or music**

Exercise training in rehabilitation (WHO 1993)

Exercise training and cardiovascular rehabilitation are essential components of the treatment of children with cardiovascular disease. (Muskin 1986; Longmuir 1985; Bar-O 1985; Beekman 1986; Goforth 1984; Goldberg 1981; James 1976). Increased physical activity, education and counselling of the child and family, and reduction of morbidity and mortality are major goals of a comprehensive cardiovascular rehabilitation programme. Programmes that involve a variety of enjoyable and spontaneous physical activities, encourage group participation and parental involvement for role-modelling, use peer-directed approaches, and contain an incentive/reward element are particularly acceptable and successful in the paediatric age group.

Exercise tolerance is unimpaired in some patients, but most have mild to severe aerobic capacity impairment. Evaluation of exercise tolerance may therefore be mandatory for every patient with a cardiovascular disease, unless contraindicated. Any subsequent exercise programme must be based on the results of the evaluation.

Simple physical performance tests for endurance, flexibility, strength, and co-ordination are suggested for assessment of children before and after exercise training. Training activities that require minimal skill and equipment for participation are most desirable. Personnel with practical knowledge and experience of exercise, and of the limitations of children with disease of varying severity, can supervise and monitor the training sessions.

A modified Borg Scale (see annexure 8) for perceived exertion can be used to estimate intensity and affect during exercise testing and training. The WHO report details flexible exercise training programmes that are suitable for use in young patients with cardiovascular disease of varying severity and that require minimal skills and equipment. These programmes can be executed at the basic, intermediate, or advanced level of care (WHO 1993).

A satisfactory training effect may be obtained by dynamic exercise (working, jogging, or bicycling) at 50-80% of the maximal VO_2, which is approximately equivalent to 60-85% of the maximal attainable heart rate ("target" heart rate). For safety, ECG changes or serious haemodynamic changes as a result of exercise testing (see annexure 11) should be avoided, and the "target" heart rate zone should therefore be below this level.

Exercise training programmes that emphasize aerobic fitness, flexibility, strength development, and coordination – performed indoors and outdoors – are most effective and acceptable to children. All young cardiac patients, especially those with severe disease, should begin the exercise training programme at a low intensity and progress stepwise towards their exercise training goal. The training period should be maintained for at least 20-60 minutes, preceded by a warm-up and followed by a cool-down period.

It is possible that results similar to those of high-intensity exercise programmes may be achieved in children by longer-lasting, less intensive exercise; this has been recently recognized in adults. However, the possibility has not yet been investigated or adequately reported in the medical literature.

The components essential for the establishment of an exercise testing and training unit (for advanced care facilities, unless otherwise indicated) are outlined below.

The exercise laboratory should have an area of at least $25m^2$, adequate ventilation, had an optimal ambient temperature of 22 degrees Celsius with approximately 50% humidity. The size of the room, the number of people in it, and the amount of heat generated by equipment are important determinants of temperature control. Most exercise data have been collected in such settings. Appropriate modifications should be made according to available resources and climatic conditions (WHO 1993).

At the basic level, clinically trained personnel administering the exercise test should be capable of recognizing external signs and symptoms of cardiopulmonary distress and of performing basic cardiopulmonary resuscitation. In the absence of a physician, another trained health professional may conduct the test. At intermediate and advanced levels, personnel who administer exercise tests should have training in exercise physiology, and should be familiar with children who have serious cardiac illness. At least one person trained in advanced cardiac life support (according to American heart association standards) should be present. A physician who is experienced in exercise testing may conduct the test or be available nearby, and resuscitative equipment must be immediately available in the event of an emergency.

Clinical exercise laboratories of advanced care facilities should ideally have three types of ergometer (bicycle, treadmill, and handgrip) because each has a particular use in evaluating patients. Both bicycle and treadmill ergometers are adequate for collecting diagnostic or functional information, and generally provide more reliable and reproducible loads on the oxygen transport system than other methods. Selection of the appropriate ergometer will depend upon a patient's needs and the characteristics of the facility. Bicycle ergometers are portable, convenient where space is limited, and relatively silent. They allow easy access to the patient and, because the patient's trunk and arms are stable during exercise, permit several measurements and specialized diagnostic tests, e.g. radionuclide imaging and echocardiography, to be accomplished.

Mechanical friction ergometers are less expensive and easier to calibrate than electromagnetic resistance bicycle ergometers, which deliver a constant level of work throughout the range of pedalling speeds.

The treadmill is generally noisy, occupies a relatively a large space, and requires a ceiling height of at least 2.7 metres to permit its use by tall subjects. Strenuous levels of exercise and high levels of oxygen uptake can be achieved on the treadmill, which is useful for evaluating physical working capacity and the effects of training, especially in healthy individuals. The

treadmill can be calibrated with relative ease, without the need for special equipment, but it is usually more costly than the bicycle ergometer.
The handgrip dynamometer is used to produce isometric or static exercise. During isometric exercises, the cardiovascular responses relate proportionally to the percentage of maximal tension in the muscle group involved. The technique requires rapid squeezing to determine maximal hand strength; then, after a recovery period, the dynamometer is held with a sustained grasp at a percentage of the maximal hand strength, usually for 3 minutes.

Exercise training protocols designed to teach techniques of exercise and self-monitoring, and to utilize a variety of physical activities for improving flexibility, physical strength, aerobic fitness and coordination are the most desirable for the paediatric age group. These protocols allow patients with severe disease to begin training at low intensity levels and to progress stepwise to a symptom or sign-limited level. Exercise training protocols that are used in young adults with cardiovascular diseases are described in the WHO technical report series.

Normal values – Comparatives for exercise testing and training regimes (WHO 1993)

Interpretation of test results and comparison with normal values must take country and race into consideration. There are small, but significant, differences in expected average fitness between the USA and Europe, for example, and also differences in exercise physiology between races. This is especially true for the African and Caucasian races in the USA: body size and thoracic height/body height ratio are different in the two races. There are also difference between the Caucasian populations of North America and Europe: European Caucasians tend to be taller and thinner for age. Normal values were established largely by work done in Germany, North America, and Scandinavia (Norway and Sweden), and cannot simply be applied to other races or national groups. Maximum exercise values should therefore be reported as absolute numbers and percentages of predicted values for age,

weight, body surface area, and maximal oxygen uptake (estimated or measured). The WHO technical report has tabulated normal values.

Summary

Based on the previous information exercise testing and training in rehabilitation can be established at acceptably low cost but require the co-operation of physicians, government, voluntary organizations and the patients themselves. Successful rehabilitation of paediatric patients will assist them in leading long and productive lives, and is thus of economic benefit to society.

Exercise testing in developing countries can be performed at a basic level of care using the step test with manual measurement of pulse rate and blood pressure. Given appropriate guidelines, properly trained personnel can undertake such testing in the absence of a physician.

At higher levels of care, treadmill and/or bicycle ergometers are recommended for multi-stage testing with additional measurements of cardiovascular responses. Electrocardiographic recordings are essential to provide specific details of rate, rhythm, and conduction changes, and S-T segment displacement during testing. In some institutions, ventilation, oxygen consumption, carbon dioxide production, and cardiac output are also measured. Isometric stress can be measured by means of a sustained handgrip test against resistance (dynamometer).

During exercise, it is also possible to examine the ventricular shortening fraction by means of echocardiography and the ejection fraction by means of radionuclide angiography. Radionuclide preparations can be used during exercise and again at rest to confirm suspected localized ischaemia.

An exercise test may be used to determine peak exercise capacity and identify any cardiovascular limitations that may affect the design and intensity of individual rehabilitation programmes.

The WHO recommends the light exercise programme (see annexures 1 and 2) for most cardiac patients.

Rehabilitation of severely disabled, medically complex cardiac patient (WHO 1993)

At Grey's Hospital the acutely ill patient is treated in the coronary care unit by the cardiology team which include the cardiologist, nurse, dietician and physiotherapist. The physiotherapy interventions include chest physiotherapy and mobilization of the patient.

Developments in cardiac care have contributed to improved survival of patients with advanced heart disease (Cohn 1986). The purpose of cardiac rehabilitation is to improve the functional status of these patients, to help them maintain independence, and to enhance the quality of their lives. (Position report 1986; Hedback 1987; Kellerman 1990; Oldridge 1988; Wenger 1989 & 1991; American Association of Cardiovascular and pulmonary rehabilitation 1991).

A major proportion of the target population in developing countries will include patients with cardiomyopathies and valvular heart disease, rather than mainly coronary heart disease. However, the epidemiological trend suggests that coronary heart disease is likely to increase in prevalence.

Patients in New York Heart Association (NHYA) functional classes III and IV, and Canadian Cardiovascular Society classifications III and IV (for angina pectoris) are included in the group of severely disabled cardiac patients. They are subject to moderate to severe limitations in daily living activities, such as bathing and dressing, in performing household tasks, in standing for long periods of time, and even in slow walking. The caloric expenditure for such activities is less than 3 cal_{th}/minute (1-2 METs) – (1 cal_{th} – 4.184J). Patients in class IV are unable to carry out even minimal physical activity without discomfort (see annexure 4).

A suitable and feasible rehabilitation programme is needed for these severely disabled patients (Coats 1990); even modest improvements in physical working capacity can substantially improve their independence and quality of life. It is important to assess both the functional capacity and the risk status of these patients before considering them as candidates for

exercise rehabilitation (Haskell 1978; Jennings 1990; Van Camp 1989).

According to Cohn (1987) when feasible, exercise testing is useful before exercise rehabilitation is undertaken. It allows the identification of adverse responses to exercise, risk stratification, and assessment of functional capacity.

Adverse responses to exercise and risk stratification can be identified in the severely disabled cardiac patient, as exercise testing can provide information about the risk of myocardial ischaemia (Van Camp 1986), the inability of the heart to meet the needs of muscular effort, the occurrence of exercise-induced arrhythmias and their characteristics, or combinations of these problems (Herzel 1985).

Ischaemia must be quantified (Laslett 1985): time of onset, amplitude, and delay in recovery of S-T segment of displacement in relation to the intensity of the exercise and the associated increase in heart rate are therefore recorded. Once appropriate anti-ischaemic drugs have been administered, a second exercise test helps in the design of a safe and effective exercise programme.

An inadequate increase or a fall in systolic blood pressure, a low exercise capacity, and, in many cases, an inappropriate or exaggerated acceleration of heart rate, dyspnoea, pallor, and cold sweat are common markers of exercise-induced pump failure.

Exercise-induced high-risk ventricular arrhythmias contraindicate unsupervised exercise training. In patients with cardiomyopathies and rheumatic heart disease, atrial fibrillation is common. Atrial fibrillation with a ventricular response that is controlled at rest may become very rapid with exercise and induce pulmonary oedema. When triggered by exercise, rapid atrial fibrillation may induce severe ischaemia in a coronary patient. Control of the rapid ventricular response by medication can improve exercise capacity.

Besides identifying the risks of exercise, exercise testing provides information about exercise capacity, which depends on a complex metabolic process in which cardiac output is a major factor (Wasserman 1990). Pulmonary function, muscular strength and fitness, joint flexibility, coordination, body weight, level of haemoglobin, and nutritional status are also important. The contributions made by all these factors to the limitation of exercise capacity must be assessed by clinical examination combined with knowledge of patients' previous physical activity levels and fitness. Any remedial features should be addressed before exercise testing is undertaken: lack of fitness of other origin can exaggerate the apparent severity of cardiac impairment at exercise testing (WHO 1993) .

Generally, however, there is good correlation between NHYA functional classification and exercise capacity expressed as duration and workload sustained at exercise testing, oxygen consumption, and MET levels (see annexure 7).

Performing an exercise test before rehabilitation is undertaken provides assessment of cardiovascular fitness and thus a basis for appropriate exercise prescription. In this regard, workload and heart rate at peak exercise are particularly important (Hellerstein 1992, Weber 1987, Kellerman 1969). For individuals receiving medication on a regular basis, the exercise test should be performed while they are receiving these drugs. In some cases, it may be necessary to perform exercise testing using an arm ergometer because of orthopaedic problems or leg claudication.

An overview of the methodology of describing the rehabilitation of patients severely disabled by cardiovascular disease includes optimal medical therapy and, when appropriate, surgical intervention. Treatment should be reassessed before rehabilitation begins because an optimal regimen of drugs may substantially improve functional capacity. Patients with compensated chronic heart failure due to rheumatic or other valvular disease, to coronary heart disease, or to cardiomyopathy can often be included in a training programme of low to moderate intensity. Such patients, and others with depressed left ventricular ejection fractions can participate in long-term

exercise rehabilitation programmes without further deterioration of ventricular function and with their improved functional capacity maintained (WHO 1993).

The energy requirements of work (see annexures 9 and 10) indicate that the caloric requirements of various activities can serve as a guide for restoring an acceptable quality of life to many severely disabled cardiac patients. The patient who can look forward to a productive and creative daily life will benefit from an improved mental state, and reduced anxiety, fear, and depression (Roviaro 1984). The need for structured psychological support can be reduced in patients who are able to return to productive work in occupations with low caloric requirements or in sheltered workshops. For success, rehabilitation must be flexible enough to take account of the social and cultural background of the patient and of local conditions.

Class IV patients have only a minimal ability to engage in physical activity requiring greater energy expenditure than 1.5-2.5 cal_{th}/min^1, even for short periods of time. Exercise rehabilitation should therefore not involve traditional aerobic training. Short walks on level ground for up to 10-15 minutes once or twice a day should be tried. Breathing and relaxation exercises and passive exercise may be helpful initially. Occupational therapy up to $1.5cal_{th}$/min is well tolerated by most patients, and light sedentary activities can also gradually be undertaken (see annexure 10).
Patients should be told to cease immediately any activity that causes symptoms such as increasing breathlessness, resting and anginal patient, and/or severe palpitations. The programme should be revised and new recommendations made if necessary. Symptomatic complications of this nature can be anticipated in Class IV patients.

Exercise rehabilitation of Class III and Class IV patients may be divided into supervised and unsupervised programmes.

Supervised programmes

Typically, patients of Classes III and IV are admitted for 6-8 weeks to a facility where close medical supervision is provided and a systematic increase in

physical activity is monitored. It is rare for complications to occur in the circumstances (see annexure 2).

In order to obtain a training effect, work intensity in the range of 65-75% of peak work capacity has to be achieved for approximately 30 minutes each session at least three times a week. There is good correlation between heart rate and work capacity, with a heart rate of 70-85% of peak corresponding to 65-75% of peak work capacity. Exercise training intensity can be conveniently monitored where the exercise prescription is based on a target heart range, particularly in a supervised setting.

Unsupervised programmes

Exercise of lower intensity but of longer duration and greater frequency can provide the same benefit (Fry 1981). The lesser risk of lower intensity exercise is important in unsupervised programmes. Self monitoring in the absence of supervision should include checking the pulse rate, using the Borg scale of perceived exertion (Borg 1970), or being able to continue talking to a companion during exercise.

In developing countries where the prevalence of coronary heart disease is increasing, comprehensive cardiac rehabilitation programmes are indicated for Class III and IV patients after myocardial infarction or coronary bypass surgery (Aldeman 1983). Since supervision by physicians may be minimal in many non-urban areas, approaches that involve non-physician health professionals should be considered.

The non-exercise recommendations for Class III and Class IV patients suggest that class III and IV patients should receive information that will help them achieve positive modification of lifestyle (e.g. cessation of smoking, diet modification) and precise information relating to their specific diseases.

The exercise recommendations for Class III and Class IV patients by disease category; coronary heart disease, cardiomyopathy, or valvular heart disease should be followed.

Patients with coronary heart disease should undergo clinical evaluation and exercise testing for risk stratification when possible (see annexure 3) to determine the potential risks of exercise. Scores for quantification of the severity of disease may be useful, although they are based on specific test protocols.

High-risk patients (see annexure 3) should participate in supervised exercise training programmes.

Patients who are impaired by effort angina during exercise training should take sublingual nitroglycerine before beginning exercise.

In rural areas, with basic equipment and facilities, the first priority should be to establish a comprehensive education programme focussing on the patient's cardiovascular problem. If possible, an exercise test should be performed and a low-intensity programme prescribed (see annexure 1).

Recommendations continue to include the conditions listed below :-

- Hypertrophic cardiomyopathy
- Valvular heart disease

An overview of patients with severe cardiac failure (Classes III and IV) states that heart failure is not a disease entity but a manifestation of many causes of heart disease, including dilated cardiomyopathy, hypertensive cardiac failure, valvular heart disease, endomyocardial fibrosis, and ischaemic ventricular dysfunction. The last is a major cause of heart failure in developed countries and an increasing cause is developing countries.

Comprehensive rehabilitation programmes for patients with compensated heart failure and severely impaired left ventricular function are also described by the WHO. Medical and surgical therapy have significantly decreased morbidity and mortality in patients with compensated heart failure and severely impaired left ventricular function (Cohn 1986; Mancini 1987; Massie 1987; Kellerman 1990). Patients with chronic stable heart failure are disabled by breathlessness and fatigue. There is no constant correlation between these symptoms, which limit exercise tolerance, and the degree of left

ventricular dysfunction (Franciosa 1981; Litchfield 1982). The decreased muscular function (Wilson 1984) may be due either to hypoperfusion during exercise (Sullivan 1989) or to prolonged deconditioning. Respiratory discomfort is caused both by hyperventilation, which provokes premature fatigue of the respiratory muscles, and to some extent by an increase in pulmonary vascular pressures, which gives rise to a sensation of suffocation.
Thus, to improve exercise tolerance, maximal blood flow should be increased, muscle vasodilation improved, and deconditioning avoided. The drugs normally used to compensate heart failure result in improved exercise tolerance. Studies on the effects of exercise training in patients with heart failure are limited, but preliminary results have been encouraging (Conn 1982; Cody 1983; Ehsani 1986; Mathes 1988). A training induced-decrease in lactate accumulation, a consequent delay in onset of anaerobic threshold, and an increase in exercise endurance favourably affect the submaximal exercise level involved in patients' day-to-day activities.
In addition to the exercise programme, cardiac rehabilitation in these patients includes dietary advice and long-term control of medical therapy. Malnutrition is common in patients with heart failure because of decreased food intake and poor intestinal absorption. For those patients with heart failure who are significantly overweight, weight loss is important: excess weight increases cardiac work. Restriction of sodium intake is important in both groups. Teaching these patients work techniques that will simplify their usual daily activities improves their ability to maintain independence.

After large myocardial infarction, even patients of NHYA functional class III or IV may achieve some relative benefit from an exercise programme. Clinical studies have shown that, although patients with left ventricular dysfunction, especially those with ischaemic heart disease, are at potentially high risk of exercise-related arrhythmias, the actual risk is relatively small when compared with the high incidence of non-exercise-related sudden death. One report (Jugdutt 1988) describes adverse effects of early high-intensity exercise training on ventricular function in some patients with large anterior Q-wave myocardial infarction; several other studies have failed to confirm this. (Kellerman 1990; Coats 1990; Sullivan 1989). None the less, patients with

large infarction should be considered with caution for long-term exercise therapy. Serial clinical evaluation of heart size and left ventricular function should be carried out; in case of worsening, physical training should be reduced or stopped (WHO 1993).

Exercise training helps to improve the functional capacity, and hence the quality of life, of patients with compensated heart failure and reduced left ventricular ejection fraction (Shabetai 1988; Williams 1981). The ability to increase low level activity by even 1-2 METs may mean the difference between an independent existence and living in a chronic care facility.
Patients with severe left ventricular dysfunction can improve their exercise capacity by increasing their target heart rates gradually, by small increments, during the exercise programme. With time, skeletal muscles extract more oxygen from the blood during exercise (Saltin 1982), thus widening the arteriovenous oxygen difference. Exercise tolerance improves, as demonstrated by lower heart rates during submaximal exercise and increased peak workloads.

Patients must be evaluated carefully by a physician before starting the exercise programme (Jennings 1990). They should be free of unstable angina, decompensated heart failure, or arrhythmias that compromise haemodynamic stability before exercise.

Patients should be told to use subjective indicators such as the Borg scale of rate of perceived exertion (see annexure 8) to guide the intensity of their activity during exercise sessions and in day-to-day tasks.

Patients with left ventricular dysfunction can tolerate only limited workloads, but most can gradually increase the duration of their exercise. Rest intervals during exercise (interval training) may allow more activity during a training session. Warm-up and cool-down periods should be prolonged. Dynamic resistance exercise can produce muscle strengthening; when comfortably seated in an armchair a patient with heart failure may accomplish substantial muscular work with the arms or the legs using light dumb-bells or, when

possible, pulleys and counterweights, without adverse effects. Interval training is also advised for muscle-strengthening exercises.
Ideally, there should be ECG monitoring of patients with severe left ventricular dysfunction throughout warm-up, exercise, and cool-down, at least during the initial sessions.

In fixed rate pacemakers it has been found that many patients who are pacemaker-dependant at rest show a reappearance of atrioventricular conduction when they exercise, although many others remain pacemaker-dependant. It is not possible to consider the heart rate as a parameter for exercise-prescription in patients of this group (Pashkow 1992).
In a pilot study, a cardiovascular training response of this type was obtained in patients with fixed-rate pacemakers (Superko 1983).

For variable-rate pacemakers and In patients with pacemakers that are atrioventricular-synchronized and/or rate-responsive, exercise testing can be used both to set the pacing rate of the pacemakers and to prescribe exercise training based on heart rate (Humen 1985; Landzberg 1990).

Rehabilitation of patients with serious arrhythmias poses complex problems. Currently there is concern about prescribing certain antiarrhythmic drugs because of their proarrhythmic effects. Beta-blocking agents seem to reduce the incidence of sudden death after myocardial infarction among patients for whom their use is suitable; in many patients, unfortunately, the negative inotropic effect of these drugs reduces exercise capacity. Ideally an evaluation of the effect of antiarrhythmic drugs by an exercise test and/or ambulatory ECG monitoring should be conducted.

Atrial fibrillation is one of the most common supraventricular arrhythmias, and makes a heart rate parameter during exercise unreliable. In patients with atrial fibrillation, the Borg scale of rate of perceived exertion (see annexure 8) may be a valuable guide to exercise training.

Implanted cardioverter defibrillators are increasingly used for management of life-threatening arrhythmias. Although the number of patients with these devices who will undergo exercise training is limited, the following points should be emphasized (Pashkow 1992) :

- Exercise testing can identify the patients with exercise-induced arrhythmias who should not undergo exercise training.
- Exercise testing can be a guide to heart rate settings, ensuring that a device responds to life-threatening arrhythmias but is not triggered by heart rates achieved during exercise.
- Other patients who share the same exercise sessions should be reassured that no harm will result from touching patients with cardioverter defibrillators during discharge of the devices.

Rehabilitation of elderly cardiac patients (Wenger 1989, AACPR 1991) occurs as populations age in both developed and developing countries, and there are more elderly patients with cardiac disease who will be enrolled in rehabilitation programmes. Coronary heart disease is the most common problem in developed countries. Elderly coronary patients are medically complex because of the frequent complications of coronary disease and concomitant problems of diabetes, cerebral and peripheral vascular disease, hypertension, and chronic obstructive pulmonary disease.

The exercise capacity of elderly cardiac patients reflects the nature of their disease, other concomitant diseases, and frequently, the deconditioning resulting from a sedentary lifestyle, all superimposed on the physiological effects of aging. Exercise training may help reduce the consequent limitations of activity and provide the sense of well-being and self-esteem necessary to prolong active and independent life.

Important considerations for exercise training of elderly cardiac patients include the following:

- high impact activities should be avoided;
- prolonged warm-up and cool-down periods are necessary;
- training should begin at low intensity and progress gradually;

- repeated short periods of activity may be as beneficial as a single, more prolonged session;
- exercise intensity should be reduced in hot and humid environments because of patients' impaired thermoregulation;
- exercise-related orthostatic hypotension resulting from delayed baroreceptor responsiveness should be assessed;
- specific muscle-strengthening activities can aid in self care.

Rehabilitation in cardiac transplantation may occur pre-transplantation or post-transplantation. Patients awaiting transplantation are often deconditioned and exhibit severe cardiac impairment, breathlessness on exertion, and cardiac cachexia; they are also at increased risk of sudden cardiac death. The goal of exercise is to prevent further deconditioning and, in some patients, to improve skeletal muscle status. Standard exercise testing or cardiopulmonary exercise testing is valuable in formulating recommendations for physical activity. These patients are at high to intermediate risk for exercise rehabilitation.

Education and counselling can introduce the concept of reducing coronary risk factors after transplantation, improve patient's motivation, and encourage family support.

After transplantation, patients receive immunosuppressive medication including ciclosporin. They are at high risk of infection, and exhibit predisposition to artherosclerosis, susceptibility to transplant rejection, diastolic dysfunction of the transplanted heart, chronic effect of medication-related hypertension on cardiac function and exercise, wasting of skeletal muscle, weakness resulting from corticosteroid therapy, and a blunted heart-rate response and lower cardiac output with exercise because of cardiac denervation.

Once these patients are stabilized postoperatively, exercise training carries intermediate or low risk. They generally remain in a supervised rehabilitation programme at the transplant centre, participating in exercise training 2-4 times a week for 4-6 weeks as a component of intensive early postoperative treatment and rehabilitation.

Subsequent rehabilitation services will vary according to where the patient receives primary long-term care. Rehabilitative exercise training may take place in a community-based facility or be undertaken without supervision at home. Patients are typically followed by their referring community physician for risk factor modification and most other routine treatments, based on recommendations from the transplantation centre. Periodic visits to the transplant centre are scheduled (Wenger 1991; Kavanagh 1988; Savin 1980; Haskell 1992; Wenger 1990).

Patient education and counselling is one of the most important features of a rehabilitation programme, especially for those who are severely ill. A well prepared and thorough educational programme for patients and their families is beneficial. To be successful, comprehensive rehabilitation needs both the dedicated assistance of the medical profession and the willingness of patients and families to cooperate.

Rehabilitation is an essential part of the management of the severely disabled, medically complex cardiac patient, and leads to an increase in physical capacity and improved quality of life. It demands great expertise on the part of the patient's physician and other health professionals because of the potential hazards involved; available medical and surgical services should be fully utilized, with cost-effectiveness a consideration at every level of care. The result of a successful, continuing rehabilitation programme is greater self-confidence and self-reliance for the patient, and lowered demands on health services, particularly for in-patient care. If the patient's capacity for self-sufficiency and independent living can be maintained or restored, the need for institutional care is also reduced (WHO 1993).

Current and future approaches to education in the rehabilitation of patients with cardiovascular disease (WHO 1993)

At Grey's Hospital patient education is currently being done by nurses, doctors and dieticians in the cardiac units. Cardiac units have posters displayed with different cardiac conditions. Nurses provide information booklets to patients with advice on diet and lifestyle modification.

The WHO stresses the importance of education and counselling in cardiac rehabilitative care. The definition and goals are the education of patients and their families which involves the provision of carefully constructed opportunities for learning. It is designed to facilitate patients' ability to initiate and sustain changes in health behaviour and to achieve predetermined goals. Educating a patient's family and/or spouse is as important as educating the patient in achieving active and informed participation; all should learn about the disease, the process of recovery, and the benefits of rehabilitation. The family is an important source of social support for the patient.

The benefit to patients is significant as acute or episodic care alone is inadequate for most chronic diseases, and patients themselves and their families must therefore assume greater responsibility for care (Wenger 1986; Nakajima 1991). They must be trained to become active partners in the rehabilitation process. Through education, the cardiac patient's feelings of hopelessness and helplessness can be reduced, self esteem restored, confidence in a successful outcome increased, and ability to cope with problems of illness enhanced. Understanding the disease can also increase the patient's compliance with recommendations for care. Some of the educational goals are thus short-term and some long-term, but the ultimate aim of education is to improve cardiovascular "health" and quality of life (Wenger 1992).

Education and counselling also improve the patient's perception of health status and aid in resumption – at an appropriate level – of family,

occupational, and community roles (Nikolaeva 1986; Evans 1986; Taylor 1992; Comross 1992).
Society also benefits though initially, education may entail an increase in health care costs because of greater use of services, but patients will subsequently manifest fewer recurrences or complications or less progression of disease; costs of hospital care, use of emergency facilities, etc. will thus ultimately be reduced.

Educational concepts and principles that are relevant are that physicians and health professionals should be caring, compassionate, and dedicated to patients, to keeping them well, and to helping them during illness. For each patient it is important that they devise a plan of action for transmitting the knowledge, values, skills, and attitudes that are essential to improved prognosis and social reintegration.
In some countries there is a legal requirement for patients to be instructed in self-care, an integral part of planning for their discharge from hospital. Health professionals bear responsibility for the content and presentation of the appropriate information, and for ascertaining that patients have fully comprehended it. It is a significant challenge to integrate all aspects of cardiac rehabilitation – including the educational component – into existing health care systems in a cost-effective manner (Wenger 1986).

An overview of the process suggests that although the aims of education programmes have universal relevance, their content may require modification to take account of local languages, culture, educational levels, available communications media, and disease patterns. Ideally, programmes should be relatively inexpensive, informative, accurate, and attractive. If patients are to be correctly informed about their disease, the subsequent need for care, and the importance of modifying health-related behaviour, a systematic approach and consistent presentation of material are essential (Nikolaeva 1986). Patients must be motivated to continue in an educational programme because the skills and knowledge acquired are important to health and to the prolongation of life.

Patients and their families need basic information if they are to comply with long-term requirements of care programmes designed to reduce disability and improve outcome (Wenger 1986).

Information should cover the nature, progress, control, and possible complications of their disease(s), and the names, purpose, doses, effects, and side-effects of medications.

Learning how to lead a healthy lifestyle is of utmost importance to the cardiac patient. Wise eating habits for correct nutrition, cessation of smoking, the physical activities that are recommended and those that should be restricted or avoided (including work limitations) should all be discussed individually with the patient, who should also understand the value of a healthy lifestyle and the possible adverse implications of resuming an earlier unhealthy lifestyle. Family and social support can help in implementing these beneficial changes and in preventing relapses.

The patient should also understand the significance of symptoms such as shortness of breath, chest pain, palpitations, swollen legs, and the appropriate responses to them. Psychological (i.e. mood) changes are secondary to the physical symptoms of the disease, and full psychosocial recovery over a period of time is the norm.

The patient with coronary heart disease should be taught about normal cardiac structure and function, the development of artherosclerosis – progression and regression, the changes that occur with myocardial infarction, and the ability of the heart to heal and recover its functions.

Guidance should be provided on resumption of general and sexual activity, return to work, the specific medications prescribed (with reasons for each), and appropriate responses to new or recurring symptoms. It is also important to give advice on problems the patient may face upon returning home and the community resources that may aid rehabilitation. Basic information on risk factors, tailored to the patient's individual needs, will support behavioural changes.

The goal of “reducing progression and inducing regression” of artherosclerosis can be attained by following a vegetarian or low-fat diet, ceasing to smoke, taking regular, moderate exercise, understanding why lipid-lowering medication should be taken if prescribed, controlling hypertension, and practising stress management and relaxation techniques (Ornish 1991).

Diet change is a complicated process involving alterations in patterns that have been firmly established by culture, family, and personal factors, but is often prompted by a coronary event (an “opportune time” for the patient). Most successful dietary interventions involve relatively frequent long-term contact with health professionals. Appropriate selection and preparation of foods should be emphasized.

Essential *weight reduction* in obese patients is obviously strongly related to changes in diet and exercise habits.

When physicians and medical teams are committed to smoking cessation, success rates of 50% or more have been reported among cardiac patients. Most smokers manage to stop on their own, but the greatest problem is relapse; preparation for this must be included in the smoking cessation plan. Role-play, cigarette refusal, and enlisting the social support of family, friends, and colleagues reinforces the non-smoking behaviour.

Physical activity and exercise are important parts of cardiac rehabilitation. Patients should be taught about their target heart rate and how to count their pulse, especially in programmes without supervision. They should understand the importance of warming-up and cooling-down periods when exercising. The Borg scale of rate of perceived exertion (see annexure 8) is a valuable guide, with the desired level being between 13 and 15.

Different methods of coping with stress should be taught.
Stress management training aims to change environmental triggers to the stress response and/or change inappropriate behavioural, physiological, or cognitive responses that occur in response to this event (McGee 2007). High

levels of muscular tension can be reduced through relaxation techniques: triggers can be identified and modified using problem-solving strategies; cognitive distortions can be identified and changed through cognitive techniques such as cognitive restructuring; and “stressed” behaviours can be changed through consideration and rehearsal of alternative behavioural responses.

Sexual activity can be continued and this should be discussed with patients and their partners. The effects of medication on sexuality should also be explained.

The names, dosages, and potential side-effects of each medication prescribed should be discussed with the patient (Manning 1986). It is also important to review the proper use of drugs – when to take them, how much to take, and how long to continue. The better the patient’s understanding of the actions of prescribed drugs and the reasons for taking them, the better will be compliance with drug schedules.

Training members of the patient’s family in cardiopulmonary resuscitation is an important part of rehabilitative education. The patient also has a crucial role to play in the early phase of treatment, and must be given guidance on recognizing symptoms, and confidence in ease of access to the health care system. After percutaneous transluminal coronary angioplasty, for example, patients must be aware of early restenosis symptoms and appropriate responses. After a stay in hospital, it should be clearly explained to patients when they can resume home activities such as climbing stairs, lifting, driving, socializing with visitors, shopping, walking outdoors. Specific information from test procedures (e.g. treadmill and appropriate exercise testing) should be related to daily or occupational activities.

Treatment of *hypertension* in coronary patients should focus on weight reduction and essential dietary changes, and on adherence to medication. Management of *diabetes mellitus* associated with coronary heart disease

should also focus on weight reduction and, if applicable, dietary changes, exercise, foot care, and adherence to any prescribed medication.

Return to work is discussed in the report. Reducing cardiovascular risk factors involves alterations in several of those risk factors simultaneously, using both behavioural and pharmacological interventions.

Other conditions where education is necessitated include hypertension, rheumatic heart disease, congenital heart disease, cardiomyopathies, congestive heart failure, Kawasaki disease and pacemakers. The WHO provides guidelines for these and table 5 illustrates basic educational components in the stable phase of the disease.

Governments can support and facilitate cardiac rehabilitation through suitable legislation or government-sponsored insurance, where applicable within existing health systems. Effective rehabilitative services can reduce the burden on the health services of cardiovascular disability. Government support may also extend to the provision of guidelines for, and implementation of, training of health professionals.

Professional medical associations should become strong advocates of cardiac rehabilitation services, including patient education, for which they should develop their own local standards.

Voluntary organizations should support cardiac rehabilitation services, develop training systems for professional health education and for patients' education, and initiate research to evaluate the efficacy of cardiac rehabilitation programmes. In addition, such organizations can foster self-help programmes for patients and family support during the recovery period from acute cardiac illness. Governments and voluntary organizations should work together to create the appropriate environment, legislation, infrastructure, and workforce required for the education of the cardiac patient and for the training of teachers for such patients.

Tobacco advertising in all mass media and smoking in public places should be curtailed by legislation. Creating a social climate that is not conducive to smoking is effective in reducing smoking rates.

National campaigns (e.g. “heart weeks”) that create awareness of healthy lifestyles can be organized or sponsored by governments and by professional associations such as the International Society and Federation of Cardiology. In focusing on the promotion of non-smoking, the labelling of heart-healthy foods etc., national campaigns can be complemented at the local level by health “fairs” in community centres.

It is a challenge and a responsibility for health professionals to persuade governments to adopt a positive role in areas of health promotion such as patient education, fitness in schools, and nutritional guidance.
Governments and private sector educational institutions should collaborate with universities and colleges to integrate these aspects of health education into the training curricula for health care professionals in medical and nursing schools, health sciences, and other medical areas, and for specialists, to promote the skills and information required for education of cardiac patients. Curriculum guidelines for non-physician health professionals are available from such bodies as the American College of Sports Medicine and the American Association of Cardiovascular and Pulmonary Rehabilitation, and could be incorporated into existing professional education systems (ACSM 1978; AACPR 1991)

Training in basic or advanced cardiopulmonary resuscitation should be provided at the appropriate level of care.

It is particularly important for general practitioners and primary care physicians to understand the need to educate their patients, and to acquire the teaching skills to do so. Incorporation of patient education into the training of medical doctors is essential but will require long-term planning.

Depending on a country's system for delivering and financing health care, it might be appropriate to involve medical insurance companies in patient education.

Agencies such as the World Health Organization, the International Society and Federation of Cardiology, the International Telecommunication Union, the World Federation for Medical Education, broadcasting organizations, and international development agencies may support pilot studies to assess the cost-effectiveness of specific new educational interventions in improving the health of cardiac patients.

Pilot programmes for health and education in developing countries – for example Project SHARE, co-sponsored by INTELSAT (International Telecommunications Satellite Organization) and the International Institute of Communications – may be able to benefit from having free satellite time available (INTELSAT 1990).

Educational components for particular disease categories

Table 5 - Education of cardiac patients and their families

Education Component	Coronary heart disease	Systemic arterial hypertension	Rheumatic heart disease	Congenital heart disease	Cardiomyopathy or congestive heart failure
Medical follow- up	++	++	++	++	++
Taking medication	++	++	++	++	++
Rheumatic fever prophylaxis			++		
Endocarditis prophylaxis			++	++	-/+
Anticoagulant treatment	-/+		++	-/+	-/+
Response to symptoms of severity	++		++	++	++
Advice about pregnancy	-/+	++	++	++	-/+
Career counselling/choice			++	++	+
Return to work	++	++	++	+	++
General nutrition	+	+	++	++	++
Weight/obesity control	++	++	++	++	++
Fat/cholesterol intake	++	++	+	+	+
Sodium intake	++	++	+	+	++
Blood pressure control	++	++	-/+	-/+	++
Smoking cessation	++	++	++	++	++
Diabetes control and education	+	++	-/+	-/+	+
Physical activity/exercise	++	++	++	++	++

Key

-/+ -------if applicable

+ -------routine

++ -------high priority

Conclusions and recommendations (WHO Expert Committee – Rehabilitation after cardiovascular diseases, with special emphasis on developing countries – WHO 1993)

Conclusions

1. Cardiac rehabilitation is part of the long-term comprehensive care of cardiac patients.
2. Cardiac rehabilitation should include both an individualized regimen of physical activity and health education and counselling as appropriate for the individual patient's needs and specific cardiac problem.
3. Cardiovascular disease is an increasing problem in developing countries. In children and young adults it is likely to be a lifelong problem; in adults, the cardiovascular diseases of industrialized societies are becoming more prevalent. The growing numbers of elderly people in most developing nations warrant attention being given to cardiovascular disease in this section of the population as well.
4. the benefits of total rehabilitative services, which make well organized programmes cost-effective, include:
   - improved physical function and health status;
   - improved quality of life
   - greater social independence and a more satisfactory place in society;
   - improved chances of resuming and continuing remunerative work.
5. Governments and nongovernmental organizations can use training facilities available through international and regional agencies.
6. Cardiac rehabilitation services and regimens can improve recovery from chronic cardiac illness in a number of ways, including:
   - improving the capacity for physical activity and thus speeding physical recovery;
   - preventing invalidism;

- improving patients' compliance with treatment recommendations and suggestions for behaviour modification;
- reducing hospital readmissions and recurrences of cardiovascular events;
- speeding psychological recovery;
- facilitating social reintegration;
- hastening return to work and resumption and maintenance of recreational activities;
- increasing the degree of independence possible for elderly patients;
- improving quality of life and sense of well-being;
- maintaining physical and social capacity for self-care and independence

7. Although cardiovascular disease is likely to become a growing problem in the workplace, most patients with cardiovascular diseases are capable of returning to work. Rehabilitative care helps to make their return more rapid and effective; for paediatric patients, it can provide guidance in appropriate choice of and preparation for future occupation.
8. The benefits to employers of rehabilitative care for their employees include:
   - earlier return to work;
   - less disability;
   - less absenteeism;
   - reduced financial commitment to sickness and disability payments;
   - reduced training costs for replacement of personnel;
   - greater productivity.
9. Both paediatric patients and their families benefit from rehabilitative care that includes physical activity, education, and counselling, and that is designed to promote a long-term healthy lifestyle. The benefits include:
   - increased self-esteem in the child;
   - lesser risk of over-protective attitudes and behaviours in the parents;

- healthy physical and psychological development;
- lesser risk of habitual and unwarranted invalidism persisting into adult life;
- fewer recurrences and/or complications of cardiovascular disease;
- better guidance for later married and family life.

10. Most children with cardiac disease are capable of participating in a variety of physical activities, even at high-intensity levels. This participation facilitates their social integration with healthy peers and contributes to a healthy lifestyle and improved quality of life.

Recommendations – WHO 1993

1. Cardiac rehabilitation should be an integral component of the long-term, comprehensive care of cardiac patients.
2. Cardiac rehabilitation programmes or services should be available to all patients with cardiovascular disease, both children and adults.
3. Rehabilitation services should be provided by any trained health professional caring for cardiac patients, since no sophisticated equipment or facilities are required. Both patients and their families should participate.
4. Rehabilitation programmes should be integrated into the existing health care system; this can be done at modest cost. The major requirement is for health professionals to be trained in prescribing appropriate exercise and providing health education and vocational guidance.
5. Responsibility for the implementation of cardiac rehabilitation should be given to a designated health professional at the local level, trained as a coordinator. This individual should, in turn be responsible, to an appropriate physician or to a department, hospital, or other health care facility, which may operate under the auspices of the government or a nongovernmental organization or other agency.
6. All plans for the implementation of rehabilitative programmes should include provision for evaluating the efficacy of the programmes.
7. School officials should consult responsible medical personnel regarding the physical activities appropriate for individual children with cardiac disease.
8. Because of the increase in prevalence of cardiovascular disease and the importance and value of cardiac rehabilitation services, WHO should, in collaboration with the International Society and Federation of Cardiology and other interested bodies, seek to facilitate:
    - transmission of recommendations for cardiac rehabilitation to member states
    - provision of international or regional training courses;

- provision to governments and professional associations of guidelines on the implementation of rehabilitative care (within existing health care systems).

9. Relevant international agencies that might appropriately be contacted to help with training of personnel and implementation of cardiovascular rehabilitation include:
   - International Commission on Occupational Health
   - International Council of Nurses
   - International Federation of Sports Medicine
   - International Labour Organisation
   - International Telecommunication Union
   - International Union of School and University Health and Medicine
   - Rehabilitation International
   - United Nations Educational, Scientific and Cultural Organization
   - World Bank
   - World Hypertension League
   - World Rehabilitation Fund

2.8 Current Practice at Grey's Hospital

Doctors, nurses, occupational therapists, dieticians, psychologists and physiotherapists are among the healthcare workers that interact with cardiac patients in Grey's Hospital. It is noted that the cardiac condition that the patient presents with is usually a co-morbidity to other medical conditions. As a tertiary facility, Grey's Hospital services both regional and district hospitals (see annexure 13).

Cardiac patients are attended to by a team of cardiology doctors who are responsible for investigations and medical and surgical interventions which include percutaneous coronary intervention (PCI) and intra-aortic balloon pumps in the acute setting. Patients are referred to Inkosi Albert Luthuli Hospital for Coronary Artery Bypass Graft surgery as Grey's Hospital does not conduct all cardiac procedures.

The patients who access the cardiac out- patients' clinic are from the Pietermaritzburg area as well as rural referral hospitals. These patients have follow up appointments for review. The cardiac clinic attends to approximately 120 patients per week who may have a 6 or 12 month review date. In this way the doctors monitor the patient's condition and treatment is administered accordingly. Other points of access for cardiac patients are the medical admissions ward for new admissions, the coronary care unit (CCU) for acutely ill patients and the inpatient cardiac ward D1 for those patients requiring admission for investigations, elective procedures and post-operative patients. The cardiac catheterization laboratory which opened in 2006 conducts cardiac procedures as depicted in figure 10.

Cardiology doctors are involved in investigations and procedures which include stress testing, ECG, echocardiography and angiograms. Physician referral is imperative in cardiac rehabilitation in relation to assessment, risk stratification and suitability of the patient for participation in exercise. Due to

attrition of cardiology staff in recent years a cardiac rehabilitation protocol is not in place at Grey's Hospital.

Nurses provide in-patient care, co-ordinate the out-patient cardiac clinic and nurses with appropriate training assist with stress tests.

Dieticians offer advice to patients at the cardiac clinic and to cardiac patients who are referred or followed up as out-patients.

Cardiac patients are not routinely referred to physiotherapy, occupational therapy, and psychology for cardiac rehabilitation intervention. Consultations with patients follow a referral system and each discipline attends to the patient when the referral is made. These interactions are few.

Psychologists consult with patients who have cardiac disease as a co-morbidity. Interventions related to the cardiac pathology specifically are minimal as there is no referral specifically in terms of cardiac rehabilitation.

Physiotherapy treatment occurs usually in the CCU and ward D1 when patients are referred for chest physiotherapy and mobilization. There is no out-patient phase III intervention in place.

Many patients who access Grey's Hospital services live far away in rural areas and follow up after the cardiac event can prove difficult. Patients are also referred to Inkosi Albert Luthuli Hospital as not all cardiac procedures are done at Grey's Hospital and may visit Grey's Hospital when reviewed at the cardiac clinic.

Healthcare workers who participated in this study indicated whether they felt it would be beneficial to implement a cardiac rehabilitation programme at Grey's Hospital and referral hospitals.

Summary of literature review

The literature review aimed at providing an overview of the status of cardiac rehabilitation as secondary intervention. Statistics presented indicate that CVD is a leading cause of death and disability globally and in South Africa.

Cardiac rehabilitation in South Africa is undertaken at certain institutions and physiotherapists are usually involved in the treatment of patients in (Phase 1) the acute hospital setting. There is limited Phase III cardiac rehabilitation in hospitals in South Africa.

Exercise as a component of cardiac rehabilitation has physiological benefits and these were described as well the effects of cardiac rehabilitation on mental health.

The cost-benefit ratio relating to cardiac rehabilitation has implications for the national health system. Studies have shown reduction in costs with fewer admissions and lower costs for patients who have enrolled in cardiac rehabilitation programmes.

In 2007 the American heart association and the AACVPR issued a scientific statement outlining the core components of cardiac rehabilitation. These components were presented as they describe the interventions necessary to conduct a cardiac rehabilitation programme.

The American college of sports medicine provides guidelines for exercise testing and prescription in the cardiac population (ACSM 2010). Guidelines for exercise prescription were detailed as physiotherapists are usually involved in the exercise component of cardiac rehabilitation. There are special considerations for cardiac patients in different phases of rehabilitation and with different conditions. These factors were presented in the literature review.

South Africa is a developing country and the WHO report which outlines interventions for developing countries was presented. This report was presented in Geneva in 1993 and it was included in the literature review as it provides guidelines and recommendations for conducting a cardiac rehabilitation programme in countries where human and equipment resources are poor.

CHAPTER 3

Methodology

3.1 **Study Period**

The study commenced in March 2011 and was concluded in July 2012.

3.2 **Study Site**

The study was conducted at Grey's Hospital in Pietermaritzburg, Kwa Zulu-Natal. This institution is a tertiary facility in the Umgungundlovu district. Figure 4 is a map which shows the geographical location of Grey's hospital and annexure 13 is a diagrammatic representation of the referral pattern for Grey's Hospital. Tabular information presented below describes the constitution of the hospital relevant to this study.

3.3 **Study Design**

The study is an exploratory survey in a "case study" setting of a provincial hospital in Kwa Zulu-Natal viz. Grey's Hospital. The instrument used to conduct this study was a questionnaire distributed to multi-disciplinary health care workers in the respective units of Grey's Hospital. The questionnaires consisted of open and closed ended questions. The data was analysed qualitatively and the open-ended questions were quoted verbatim and were summarized into themes for data analysis.

Figure 4 – Map indicating location of Greys Hospital

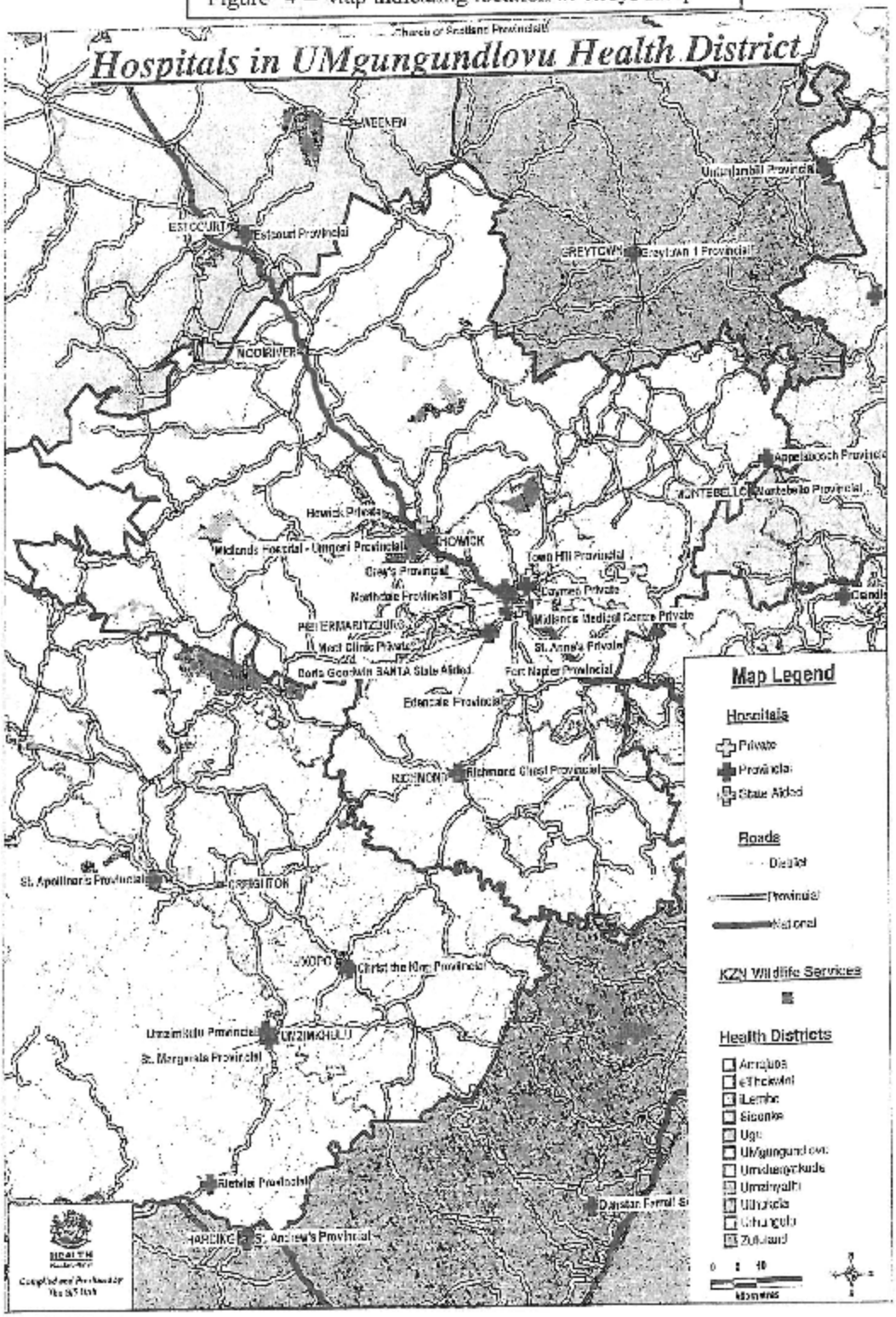

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Table 6 - Grey's Hospital In-patient Status

Department	Section	Beds	Ward
Internal medicine	Medical high Care	3	
	Neurology	14	D1
	Cardiology	13	D1
	Renal	11	H1
	Pulmonology	8	H1
	GIT	9	H2
	Infectious Disease	8	H2
	Dermatology	4	H2
	Endocrinology	4	H1
	Haematology	6	H2
	General medicine	14	MAW
	Rheumatology	4	H1
	CCU	2	
	Medical ICU	2	CCU
	Isolation beds	1	
	TOTAL	**103 beds**	
Obstetrics and Gynaecology	High care and general ward	25	M1
	Post natal	26	M2
	Gynaecology	21	M4
	TOTAL	**72 beds**	
Orthopaedics		27	B1
		27	B2
	TOTAL	**54 beds**	
Paediatrics		30	A1
		28	E1
		13	PICU(E2)
		30	NICU
	TOTAL	**101 beds**	

Department	Section	Beds	Ward
Oncology	**TOTAL**	**14 beds**	M3
Surgery	ENT	9	C1
	Plastics	10	10
	Opthalmology	8	C1
	Collorectal Surgery	13	C2
	Trauma	14	C2
	Maxillo-facial	4	G1
	General Surgery	3	G1
	Hepatobiliary	14	G2
	Burns	6	G2
	Upper GIT	5	G2
	Upper GIT	8	F2
	Breast endocrine	12	F2
	Paeds surgery	6	F2
	Burns	6	F1
	Orthopaedics	7	F1
	Paeds surgery	10	F1
	Plastics	5	F1
	ENT	2	F1
	Urology	2	F1
	Urology	20	G1
	Opthalmology	2	F1
	TOTAL	**166 beds**	
ICU		**6 beds**	

Total number of beds at Grey's Hospital : 516

Population of Healthcare workers at Grey's Hospital

Table 7 - Distribution of nurses at Grey's Hospital

Profession	Designation	Number employed
Nurses	Operational Managers	30
	Professional nurses	429
	Community service	20
	Enrolled nurses	210
	Enrolled nursing assistants	120
	Students	496
	Nursing manager	1
	Assistant nursing managers	11
	Infection control	1
	Occupational health and safety	1
	Case manager	1

Table 8 - Distribution of doctors at Grey's Hospital

	Full time consultants	Part-time consultants	Medical officers	Registrars	Interns
Anaesthetics	8	2	17	9	18
ENT	1				
Internal Medicine	19	7	10	20	
Orthopaedics	8	4	4	17	
Obstetrics & Gynaecology	5	5	7	18	34
Paediatrics	20		29	17	
Radiology	5		2	6	
Surgery (general)	6		17	17	15
Maxillo-facial	2		3		
Plastics	2			2	
Paeds Surgery	2				
Urology	1		2	2	
Oncology	3		5		

Table 9 - Distribution of Allied medical staff at Grey's Hospital

Profession	Designation	Number
Occupational Therapy	Assistant Director	1
	Chief Supervisory	1
	Production	4
Physiotherapy	Assistant Director	2
	Chief Supervisory	2
	Production	4
	Community Service Officer	1
Psychology	Principal Psychologist	1
	Senior Clinical Psychologists	2
Dietetics	Assistant Director	1
	Chief Supervisory	2
	Production	5

Table 10 - Healthcare workers in various cardiac units at Grey's Hospital

		Ward D1	CCU	Cath lab	cardiac clinic
Nurses					
	Professional Nurses	6	22	6	2
	Staff nurses	5	2	-	1
	Enrolled nursing assistants	3	1	2	1
Cardiology Doctors	Consultants	1	1	1	1
	Senior Registrars	1	-	1	1
	Junior Registrars	1	-	1	1
	Medical officers	4	-	-	4
	Interns	1	-	-	1
Occupational Therapists		1	1		
Dieticians		1	1		`1
Psychologists		1	1		
Physiotherapists		1	1	-	1

Table 11 - Number of patients seen in 2011 at Grey's Hospital and percentage of patients for cardiac interventions

	Jan	Feb	March	April	May	June
Total number of patients	20649	19168	18953	18744	20673	20716
Number of cardiac patients	410	361	379	400	293	293
Percentage cardiac patients	2.0	1.9	2.0	2.1	1.4	1.4
	Jul	Aug	Sep	Oct	Nov	Dec
Total number of patients	18300	19342	20504	20749	18789	17390
Number of cardiac patients	425	397	342	404	335	147
Percentage cardiac patients	2.3	2.1	1.7	1.9	1.8	0.8

3.4 **Study Population**

The study population were healthcare workers employed by the Department of Health and working in the relevant cardiac units of Grey's Hospital. The professionals included nurses, doctors, occupational therapists, dieticians, psychologists, dieticians and physiotherapists.

Table 12 - Role of healthcare workers in respective cardiac units

Professional	Unit	Role
Nurse	CCU	***Observations** including patient for chest pain, changes in ECG, blood pressure, respiration, temperature, monitoring fluids, bloods, daily ECG,echo, chest x-rays and other parameters on the CCU chart ***Patient Preparation** for angiogram, PCI, CABG ***Gradual mobilization** following bedrest ***Health education** including smoking cessation, alcohol intake, exercise, sex, diet, travel, pulse checks, worsening symptoms, stress, adherence with medication and keeping appointments
Nurse	Cardiac catheterization laboratory	The staff of cath lab work within a specialized unit providing diagnostic and therapeutic intervention to patients with unstable angina, congenital heart disease, ischaemic heart disease, coronary artery disease heart block, valve workup, thermo-dilution, swan-ganz catheter insertion, right

Nurse	Cardiac catheterization laboratory	ventricular biopsy, balloon mitral valvuplast and insertion of duct occluder *Planning and organizing of optimum patient care within the department *Manage appropriate bookings for angiogram according to the slate *Liase with the ward if patients have been fully prepared according to policy to avoid delay and unnecessary cancellation *check booked cases for different procedures and blood results, vital signs, gcs and inform professional nurse in charge of the unit *Ensure that correct patient preparation is done on receiving the patient and that handing over is properly done after the procedure *observe proper identification of the patient to prevent medico-legal hazards *Provide quality nursing care and reassurance so as to meet the patient's needs and implement Batho Pele principles
Nurse	Cardiac Clinic	*Health education (diet, medication) *Measurement of vital signs and reporting of abnormalities *Triage patients as per protocol *Directing patients to procedure rooms

Nurse	Cardiac clinic	*Counselling patient for surgery *Following up on scans *Contacting wards to admit patients *Follow up appointments
Doctor	All units	*To assess and manage patients with cardiac conditions (inpatients and outpatients). *To provide medical management of patients and assess patients for surgical management in acute and chronic settings
Occupational Therapist	D1,Outpatients	*To assist with functional independence and adaptations, enabling the patient to be more independent and adopt long term healthy lifestyle whilst recovering from a cardiovascular related illness or surgery. *To enhance and maintain the the physiological and psychological status of the patient *Improving tolerance for functional activities by conserving energy while completing ADLs *Maximising patients functional ability and independence with graded activity *Reducing stress, anxiety and depression *Preparing patients physically and psychologically for return to home, activities of daily living, work and leisure

Occupational Therapist	D1, Outpatients	*Advise in adaptive techniques e.g. sitting while grooming instead of standing *Provision of adaptive equipment or devices to aid with daily activities *Client education in observation and recognition of signs of cardiac stress during activities of daily living *Family education, supportive balance between over exertion and deconditioning *Suggest modifications to home or work environment based on ergonomics that might reduce cardiac stress *Job analysis, including amount of dynamic and static work done, energy requirements in terms of metabolic costs, temperature stress and psychological stress *Modify leisure interests to fit within energy expenditure levels permitted
Dietician	D1, Cardiac clinic, CCU, Outpatients	*To assess the cardiac patient according to anthropometric (weight, height, BMI, waist circumference), biochemical, clinical and dietary information to evaluate whether the patient is malnourished (underweight or overweight/obese) or not *To provide adequate nutritional support (special diets, supplements, tube feeds or TPN) to the cardiac patient

Dietician	D1, Cardiac clinic, CCU, outpatients	throughout their stay in hospital according to their nutritional needs and through appropriate route (oral, enterally or parenterally). *To provide sound nutrition advice on cardiac disease (education on low fat and cholesterol, high fibre, exercise, weight-loss, diabetes, low salt) to the patient and family members before or on discharge. Nutrition supplements may be provided depending on the nutritional assessment of the patient in order to achieve and maintain optimal nutritional status at home. Supplementation is done bearing in mind the patient's socio-economic status. *To follow-up the Greys Hospital cardiac patients post-discharge to provide nutritional support and monitor the patient's nutritional status as required. All cardiac patients transferred to their base hospital dietician for further management.
Psychologist	CCU,D1, Outpatients	*Play an active role in the MDT providing the psychological component of treatment, ensuring adjustment post infarct and enabling maximal mental health functioning post infarct. *Assisting systematically with integration into community, family and occupation *Stress management

Psychologist	CCU, D1, Outpatients	*Compliance/adherence to treatment regimes *Family interventions especially if patients lifestyle needs to change drastically *Assist with lifestyle changes
Physiotherapist	CCU,D1, outpatient	*Prevention of sequelae of immobilization *Improvement in exercise capacity *Provision of respiratory therapy *patient education

3.4.1 **Study Sample**

Grey's Hospital staff members were targeted and 58 questionnaires were distributed. The study sample comprised of health care workers currently employed in the following relevant units of Grey's Hospital :

- Coronary Care Unit (CCU)
- Cardiac Clinic
- In-patient cardiac ward (D1)
- Department of Dietetics
- Department of Psychology
- Department of Physiotherapy
- Department of Occupational Therapy

Purposive sampling of the relevant health practitioners was conducted.

3.4.2 **Inclusion Criteria**

(a) Staff that consent to participate in the study
(b) Permanent staff employed in the respective units
(c) Staff having 3 or more years of service and experience in the respective professional categories.

3.4.3 **Exclusion Criteria**

Staff not satisfying the above criteria and those not consenting to be part of the study.

3.5 **Instrument**

3.5.1 The questionnaire
A self-developed questionnaire was used in this study.
The questionnaire was divided into :

- Demographic information of healthcare workers
- Relevant interaction with cardiac patients
- Aspects of training related to cardiac conditions

Questions were directed to professionals as pertained to their respective scope of practice. Most of the responses required a circle of the appropriate response. Some questions were “open” ended and required responses with descriptions and/or explanations.

Examples of questions

- Gender, age, number of years employed, speciality
- Are you trained in cardiopulmonary resuscitation ?
- Indicate the alternatives where you will be able to assist with achieving the goals for cardiac rehabilitation

○ improve functional capacity
○ alleviate/lessen activity-related symptoms
○ reduce unwarranted invalidism
○ enable the cardiac patient return to a useful and personally satisfying role in society

- within your professional scope of practice what interventions would you use with cardiac patients ?

3.5.2 Reliability

As there were no questionnaires developed on this topic the researcher designed a questionnaire for the study. The questionnaires were based on the objectives and literature review of the study.

3.5.3 Validity

The content validity of the questionnaires was established in consultation with cardiac rehabilitation personnel, the heads of departments of the different disciplines and similar published questionnaires (Huijbregts 2002).

3.6 **Procedure**

Ethical clearance was obtained from the Ethics Committee of the University of Kwa Zulu-Natal to conduct the study (appendix A).

Another requirement In order to conduct the study was to obtain permission from the Department of Health and Grey's Hospital manager. The permission granted is in appendix B and C.

Following the granting of permission by the Department of health and Grey's Hospital management staff were addressed in the respective units for 15 minutes. The information sheet was presented verbally and the procedure explained. Time was allocated for questions from staff. Questionnaires were left with the head of sections and the ward clerks assisted in distributing and collecting the documents. Questionnaires were collected after 2 weeks. Information sheets were distributed to staff (appendix D). This sheet informed staff of the purpose, aims and objectives of the study. Consent was obtained (appendix E). The information sheet and the consent form were issued with every questionnaire. The questionnaires are appendix F to K.

Anonymity was maintained by using coded questionnaires with no names or units of the relevant areas of practice.

Admission entries and clinic statistics were inspected between November 2011 and January 2012. The records were perused from the coronary care unit, the inpatient cardiac ward (D1) and the cardiac clinic to determine the number of patients accessing these units during the last 5 years (2007-2011). The number of cardiac patients in these units between 2007 and 2011 were recorded and data captured by the researcher.

3.7 **Data Analysis**

The data was analysed using Microsoft excel and SPSS version 21. The data was summarized using descriptive statistics. Pie charts, column graphs, cone graphs, cylinder graphs and tables were used to represent the data.

3.8 **Ethical considerations**

Ethical clearance was obtained from the Ethics Committee of the University of Kwa Zulu-Natal to conduct the study. Permission was granted by the Department of Health and Grey's Hospital management to continue with the study at Grey's Hospital. Names of participants were written on consent forms only and not on the questionnaire. Consent forms were kept separately from questionnaires. In the study names of professionals were not used and codes were used to identify respondents. Collected questionnaires would be stored in a locked cupboard at the university and be discarded after 5 years. Benefits and risks of participation were explained during the meeting with staff and were outlined in the information sheet as follows

- It is hoped that the study will create the following benefits :
- an increase in the referral of cardiac patients for cardiac rehabilitation
- an interest in a multi-disciplinary approach to cardiac rehabilitation
- the establishment of a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital

Professional staff were informed that participation in the research was voluntary and that they could withdraw their participation at any point. In the event of refusal/withdrawal of participation no penalty would be incurred. There was no prejudice following withdrawal from the study. For orderly withdrawal the researcher requested verbal notification immediately or at latest upon collection of the questionnaires.

The written dissertation as well as an electronic copy will be submitted to Grey's Hospital manager and the department of health. The dissertation and

its content may also form part of peer review journals or presentations at local, national or international conferences.

Chapter 4

Results

4.1 **Response rate to questionnaires by staff of Grey's Hospital**

Of the total of 58 questionnaires that were distributed to staff 35 were completed and returned. This is a response rate of 60%.

Table 13 - Number and professional status of respondents in the study

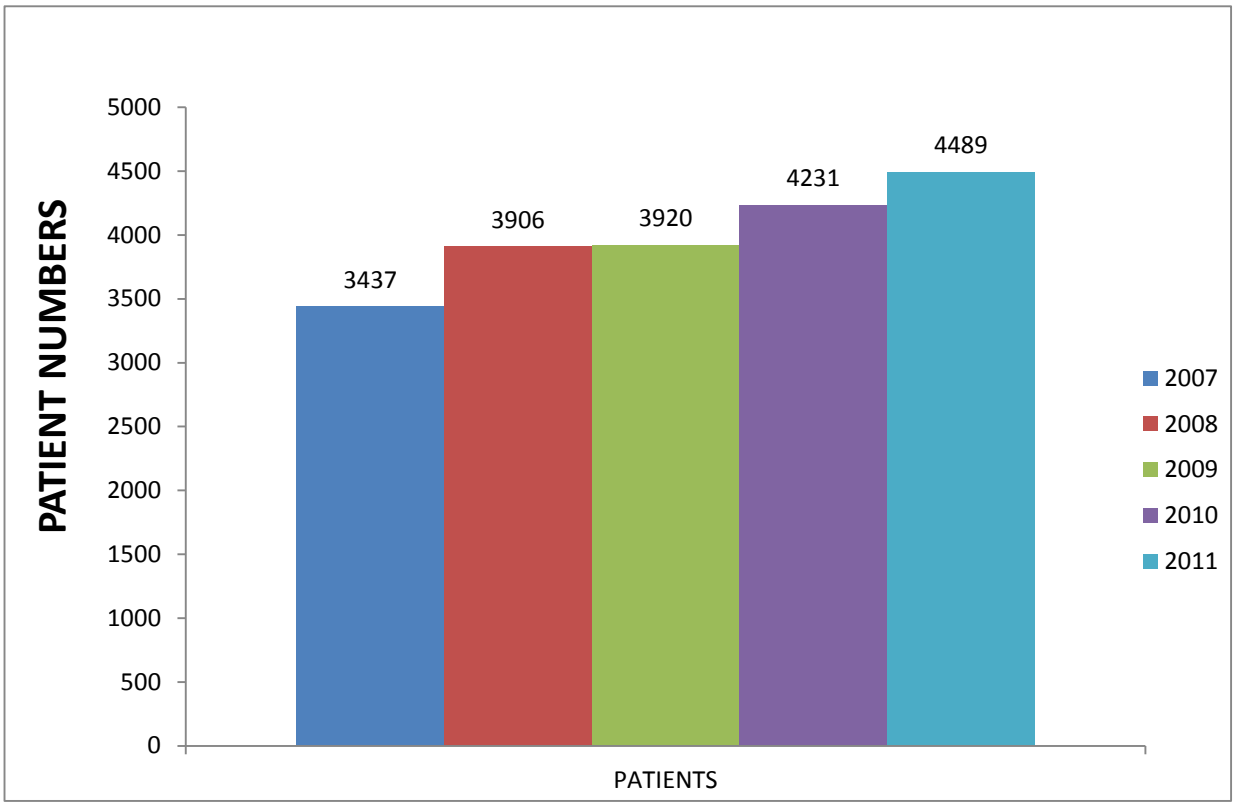
Staff	Questionnaires Distributed	Questionnaires Returned
Doctors	**10**	**5**
Nurses	**35**	**17**
Physiotherapists	**4**	**4**
Occupational Therapists	**3**	**3**
Psychologists	**3**	**3**
Dieticians	**3**	**3**
Total Number	**58**	**35**

4.2 **Cardiac patients accessing relevant cardiac units at Grey's Hospital**

4.2.1 **Total number of cardiac patients**

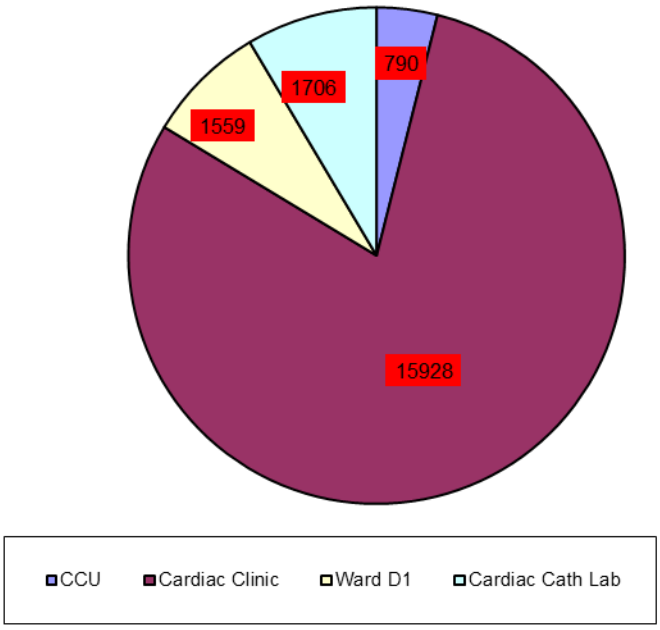
The graphs that follow depict the distribution of the total number of patients over the years in the respective cardiac units. A total of 19983 patients attended Grey's Hospital from January 2007 to December 2011.

Figure 5 – Column graphs depicting the number of cardiac patients accessing services at Grey's Hospital : 2007 - 2011



The figure above shows an annual increase in the number of cardiac patients seen over the 5 year period at Grey's Hospital. The trend indicates that the number of cardiac patients accessing Grey's Hospital is increasing over time.

Figure 6 - Pie chart showing the respective cardiac units patient numbers - over 5 years (2007-2011)

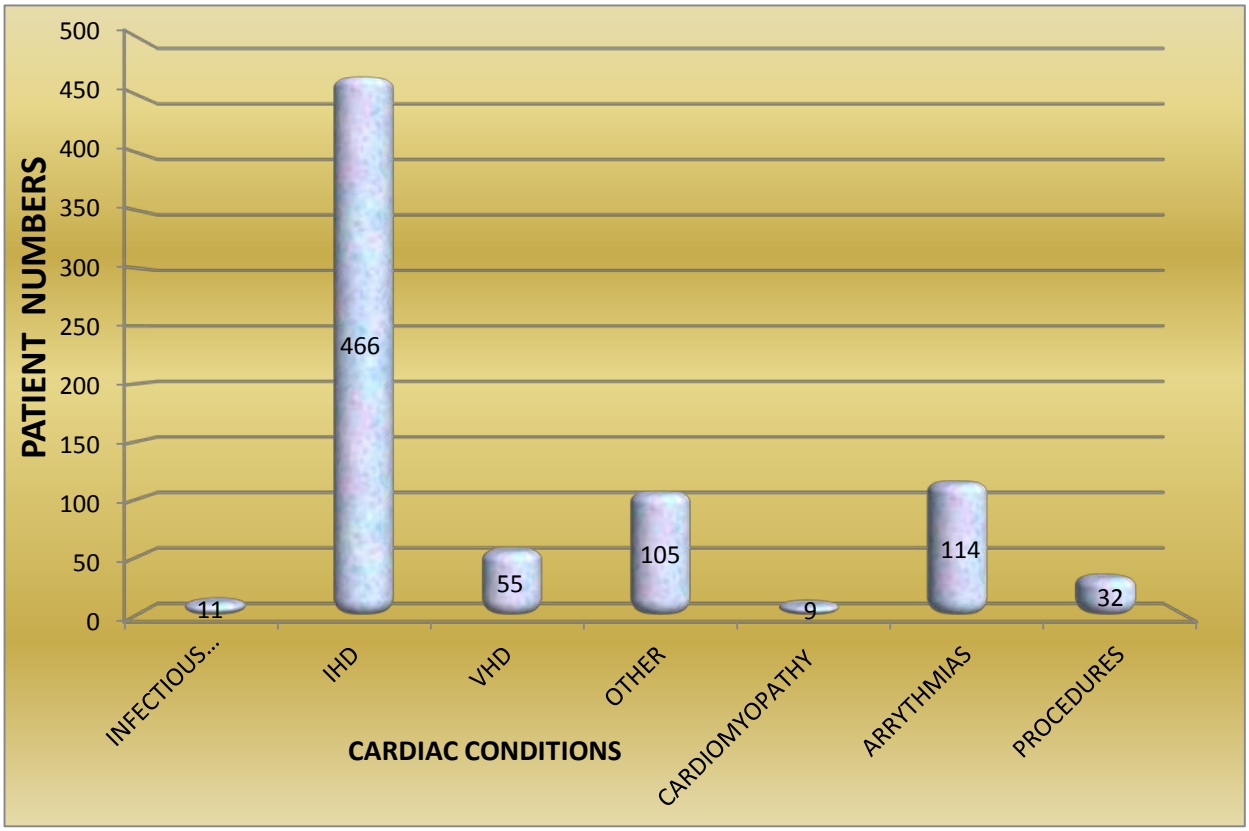


The pie chart above depicts the various cardiac units and the number of patients seen collectively in each unit over the 5 year period. The cardiac clinic has the most number of patients (15928) as most cardiac patients in zone 2 of the western half of Kwa Zulu-Natal are seen at the cardiac clinic which is a specialized out-patient service offered in this area. Patients are admitted into the other units viz. CCU and ward D1 whereas the catheterization lab is utilized for cardiac procedures.

4.2.2 **Coronary Care Unit**

Patients accessing Grey's hospital services are referred to the hospital from regional hospitals. The coronary care unit is an intensive care unit caring for the medical patient. In the period 2007 to 2011 a total of 790 cardiac patients were treated in the CCU.

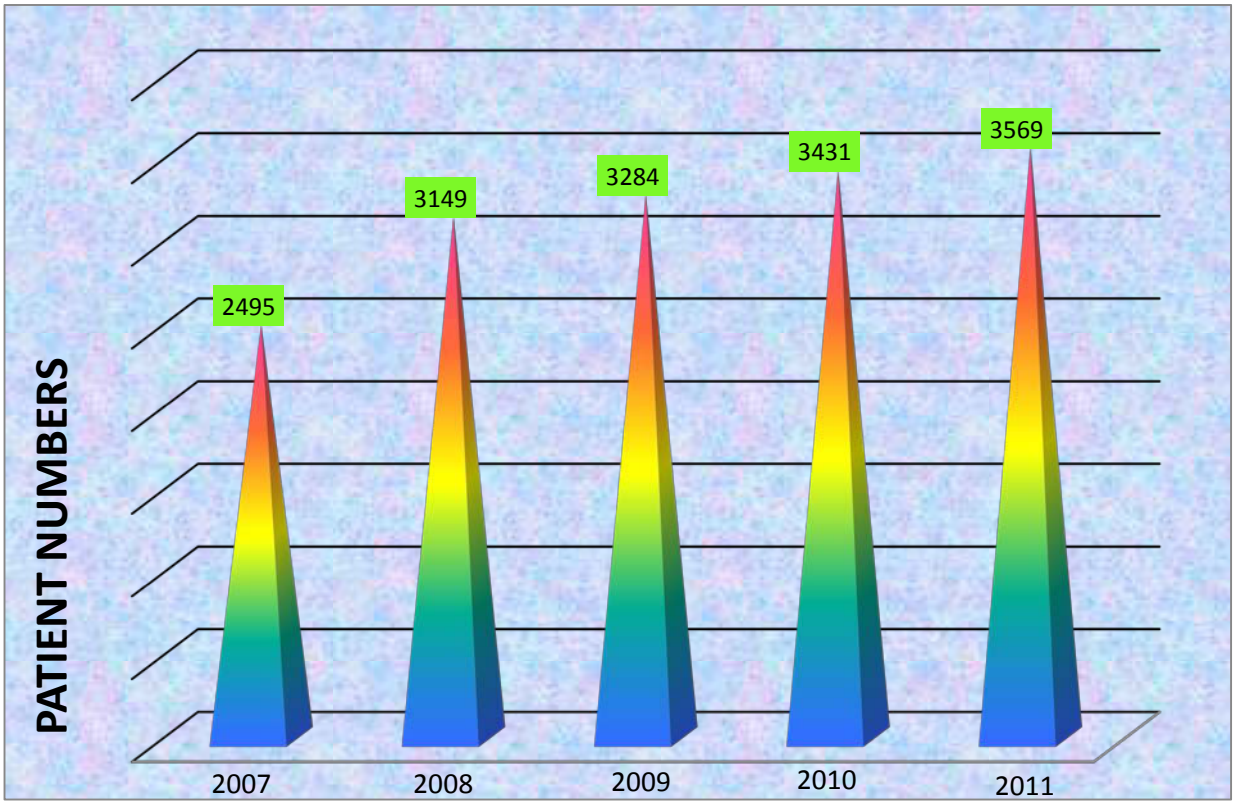
Figure 7 - Cylinder graphs illustrating the number of patients admitted to the coronary care unit and related cardiac conditions : 2007 – 2011



4.2.3 **Cardiac Clinic**

The cardiac clinic is an outpatient clinic held every Thursday morning. Patients attend this clinic from referral hospitals and usually are seen every six months for follow up. In the period 2007 to 2011, 15928 patients attended the clinic.

Figure 8 – Pyramid graphs depicting the number of patients seen at the cardiac clinic : 2007 - 2011

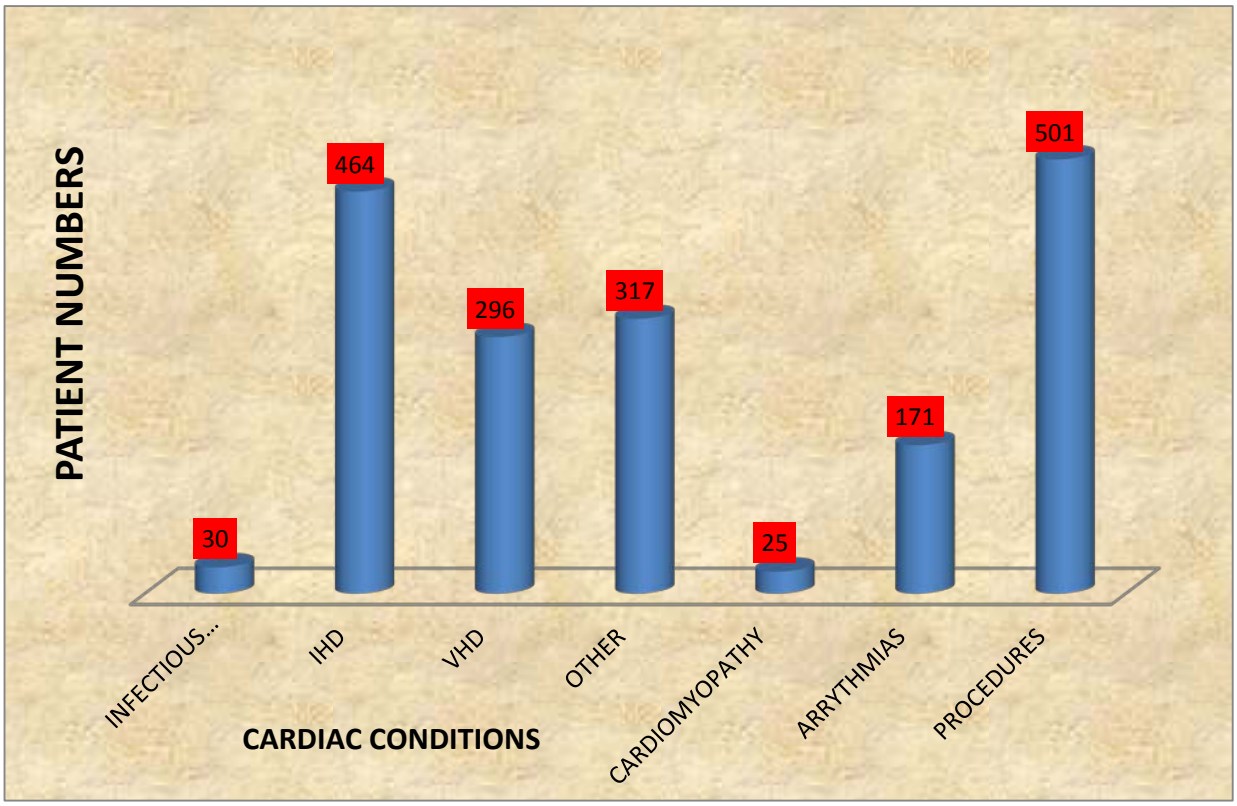


The pyramid graphs illustrate the number of patients seen each year at the cardiac out-patient clinic. There is an increase annually in the number of patients between 2007 and 2011. This trend depicts an increase in the number of patients over time

4.2.4 **Inpatient cardiac ward (D1)**

Patients admitted for cardiac investigations, (e.g. angiograms) procedures or post CCU care - are admitted to Ward D1. Between 2007 and 2011 there were 1559 admissions to ward D1.

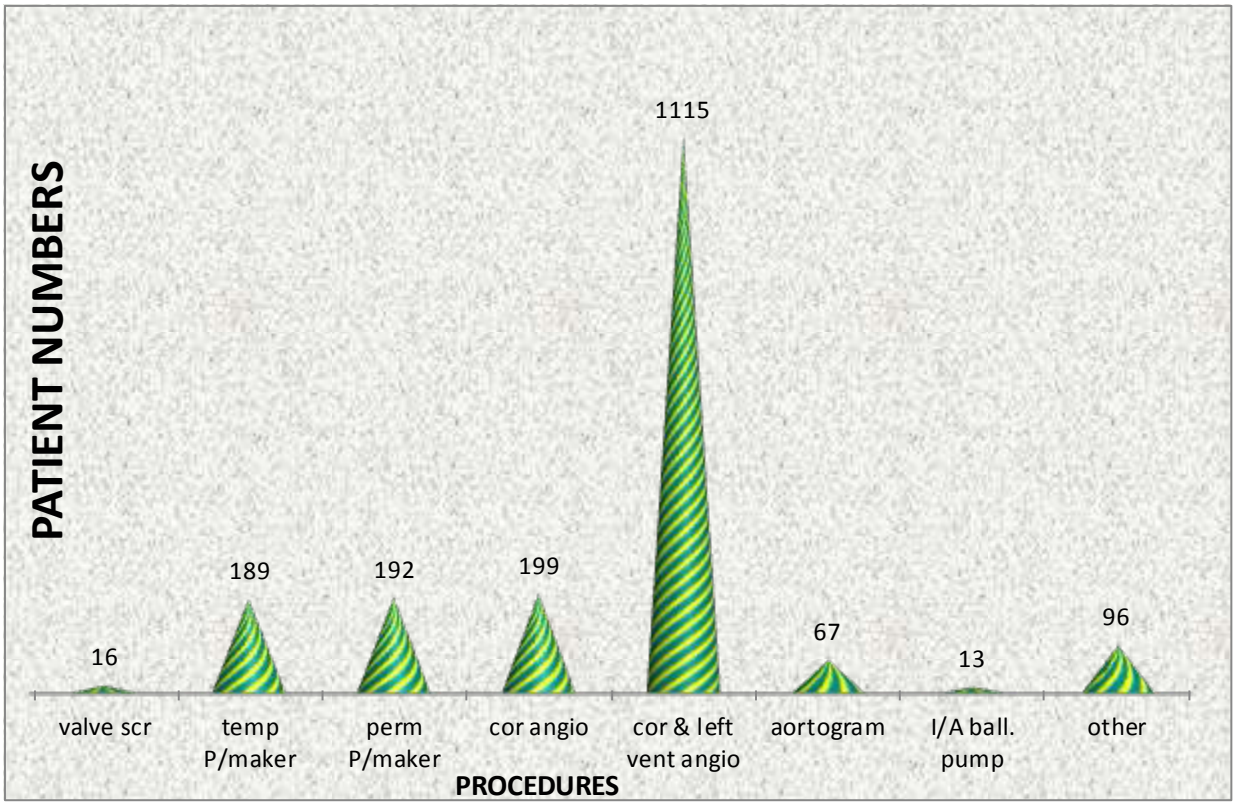
Figure 9 – Cylinder graphs showing the number of patients admitted to ward D1 and related cardiac conditions



4.2.5 **Cardiac Catheterization Laboratory**

The cardiac catheterization laboratory began cardiac procedures in the year 2006. Procedures include screening of valves and insertion of pacemakers. In the period 2007 to 2011 a total of 1706 patients were seen at the cardiac catheterization laboratory.

Figure 10 - Cone graphs illustrating the number of patients having procedures at the laboratory



4.3 (Professional specific) Healthcare workers employed at Grey's Hospital

4.3.1 Nurses

The total number of nurses that participated in the study was 17.

Table 14 – Nurse's Responses

Demographic Information				
	Males		Females	
Nurses Gender	0		17	
	25-35 years	36-45years	46 years and above	
Ages of Nurses	8	5	4	
	Less than 10 years		10 years and more	
Number of years employed	8		9	
Cardiac Rehabilitation Scope of Practice				
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society
Cardiac Rehab Goals	7	1	0	14
	Counselling		Pamphlets	
Method by which information is imparted to patients during stay or discharge	13		8	
	Diet	Exercise	Lifestyle modification	Awareness of medical condition	Medication
Information given to patients	14	13	16	15	15
	Yes		No	
Need for a cardiac rehabilitation programme at Grey's Hospital	15		1	
	Yes		No	
Need for a cardiac rehabilitation programme at referral hospitals	16		1	
Training	CPR is part of undergraduate training			

4.3.2 Doctors

The total number of doctors that participated in the study was 5.

Table 15 – Doctor's Responses

Demographic Information					
	Males			Females	
Doctors Gender	3			2	
	25-35 years	36-45years		46 years and above	
Ages of Doctors	4	0		1	
	Less than 10 years			10 years and more	
Number of years employed	4			1	
Cardiac Rehabilitation Scope of Practice					
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society	
Cardiac Rehab Goals	5	3	1	4	
	Counselling		Pamphlets		
Method by which information is imparted to patients during stay or discharge	4		4		
	Diet	Exercise	Lifestyle modification	Awareness of medical condition	Medication
Information given to patients	4	4	4	4	4
	Yes		No		
Need for a cardiac rehabilitation programme at Grey's Hospital	4		0		
	Yes		No		
Need for a cardiac rehabilitation programme at referral hospitals	4		0		
Training	Medical training and emergency procedures including CPR and use of the cardiac defibrillator				

4.3.3 Occupational Therapists

The number of occupational therapists that participated in the study was 3.

Table 16 - Occupational Therapist's (OT's) Responses

Demographic Information					
	Males		Females		
OT's Gender	0		3		
	25-35 years	36-45years	46 years and above		
Age of OT's	1	2	0		
	Less than 10 years		10 years and more		
Number of years employed	1		2		
Cardiac Rehabilitation Scope of Practice					
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society	
Cardiac Rehab Goals	3	2	2	3	
	Counselling		Pamphlets		
Method by which information is imparted to patients during stay or discharge	2		2		
	Diet	Exercise	Lifestyle modification	Awareness of medical condition	Medication
Information given to patients	0	2	2	2	0
	Yes		No		
Need for a cardiac rehabilitation programme at Grey's Hospital	3		0		
	Yes		No		
Need for a cardiac rehabilitation programme at referral hospitals	3		0		
Training	CPR is not part of undergraduate training programme Therapists attend CPD courses on CPR				

4.3.4 Dieticians

The total number of dieticians that participated in the study was 3.

Table 17 – Dietician's Responses

Demographic Information					
	Males		Females		
Dieticians Gender	0		3		
	25-35 years	36-45years	46 years and above		
Age of Dieticians	2	1	0		
	Less than 10 years		10 years and more		
Number of years employed	2		1		
Cardiac Rehabilitation Scope of Practice					
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society	
Cardiac Rehab Goals	1	0	1	2	
	Counselling		Pamphlets		
Method by which information is imparted to patients during stay or discharge	3		3		
	Diet	Exercise	Lifestyle modification	Awareness of medical condition	Medication
Information given to patients	3	2	3	2	0
	Yes		No		
Need for a cardiac rehabilitation programme at Grey's Hospital	3		0		
	Yes		No		
Need for a cardiac rehabilitation programme at referral hospitals	3		0		
Training	CPR is not part of undergraduate training programme				

4.3.5 Psychologists

The total number of psychologists that participated in the study was 3.

Table 18 – Psychologist's Responses

Demographic Information					
	Males		Females		
Psychologists Gender	1		2		
	25-35 years	36-45years		46 years and above	
Age of Psychologists	1	2		0	
	Less than 10 years		10 years and more		
Number f years employed	2		1		
Cardiac Rehabilitation Scope of Practice					
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society	
Cardiac Rehab Goals	1	1	2	3	
	Counselling		Pamphlets		
Method by which information is imparted to patients during stay or discharge	2		0		
	Diet	Exercise	Lifestyle modification	Awareness of medical condition	Medication
Information given to patients	0	0	2	1	0
	Yes		No		
Need for a cardiac rehabilitation programme at Grey's Hospital	3		0		
	Yes		No		
Need for a cardiac rehabilitation programme at referral hospitals	3		0		
Training	CPR is not part of undergraduate training programme				

4.3.6 Physiotherapists

The total number of physiotherapists that participated in the study was 4.

Table 19 – Physiotherapist's Responses

Demographic Information				
	Males		Females	
Physiotherapists Gender	0		4	
	25-35 years	36-45years	46 years and above	
Age of Physiotherapists	2	1	1	
	Less than 10 years		10 years and more	
Number of years employed	2		2	
Cardiac Rehabilitation Scope of Practice				
	Improve functional capacity	Alleviate/lessen activity related symptoms	Reduce unwarranted invalidism	Enable the cardiac patient to return to useful and personally satisfying role in society
Cardiac Rehab Goals	4	4	3	4
	Yes		No	
Need for a cardiac rehabilitation programme at Grey's Hospital	4		0	
	Yes		No	
Need for a cardiac rehabilitation programme at referral hospitals	4		0	
Training	CPR is part of undergraduate training programme Information on cardiac rehabilitation accessed through journal articles Undergraduate training for management of the cardiac patient in the acute setting Limited formal post-graduate training in cardiac rehabilitation			
Current Practice	Phase 1 cardiac rehabilitation in the acute setting (CCU) Including chest physiotherapy, exercises and mobilization			
Equipment Resources	The Physiotherapy department has a resuscitation trolley, a machine which measures blood pressure, heart rate, respiratory rate and oxygen saturation,treadmills,cycles			
Equipment Needed	Rowers, steppers, dumbells and other cardiovascular exercise aids			

Table 20 - Scope of practice for current and potential interventions with cardiac patients among healthcare workers at Grey's Hospital

Occupational Therapists	Dieticians	Psychologists
Functional Rehab e.g improving endurance in activities related to work, home, school	Nutritional support to improve quality of life	Diagnosis of mental health problems
Ergonomics (home, work, school)	Prevent malnutrition	MDT liason
Lifestyle Orientation	Adjustments to food preparations	Family therapy and counselling
Work Assessment Placement/Maintenance	Nutrition education and advocacy	Motivational interviewing
Personal management and community survival	Promote balanced lifestyle	Relaxation techniques
Household adaptation if necessary	Promote appropriate balanced diet	Cognitive restructuring
Support groups	Encourage exercise and increase activity	Goal restructuring
Developmental intervention for children	Reduce smoking and alcohol intake	Coping skills
Play therapy for children	Reading of food labels to distinguish healthy food options	Cognitive behavioural therapy
Counselling and education for patients		Supportive therapy
Time management		Stress management
Stress management		Health motivation
		Psychoeducation
		Lifestyle Management

The value of a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital (as expressed by the multi-disciplinary healthcare workers) are:

Key
NR – nursing respondent **DRR – doctor respondent**
OTR – occupational therapy respondent
DTR– dietician respondent **PR – psychology respondent**
PTR – physiotherapy respondent

- "It will be beneficial for the patients as they will know how to deal with daily activities e.g. lifestyle modification, correct diet according to the new diagnosis and compliance to medication" – **NR2**
- "Patients will be educated on their conditions" - **DRR2, DRR3, NR6**
- "Patients will have access to a multi-disciplinary team which will maximise patient care with a variety of specializations leading to happier and healthier patients" – **OTR1, PR2**
- "Patients will have a more positive approach to their illness if they belong to a support group" – **NR12**
- "Return to productivity sooner i.e. going back to work" – **NR12**
- "Decrease risk of complications" – **NR13**
- "Improvement in quality of life" – **DRR1, NR13**
- "Improvement in clinical condition by rehabilitation" – **DRR1, DRR2**
- "Prevent relapse in condition" – **DRR4**
- "Improvement in functional outcomes" – **DRR2, DRR3, OTR1**
- "Greater independence" – **OTR1**
- "Improvement in activities of daily living and personal management" – **OTR1**
- "Empowered to indulge in leisure and recreational activities"– **OTR1**
- "Children will be better adjusted at school" – **OTR1**
- "Complement skills offered by other disciplines" – **OTR2, OTR3**

- “Formulate multi-disciplinary treatment plans” – **NR1, PTR5, OTR1, DTR2, PTR1, PR3, NR4 ,NR6**
- “Formulate common goals for patients” – **OTR2, OTR3**
- “Allows for an integrated approach and holistic management of patients” – **DRR3, DTR3, PR1**
- “Include family in lifestyle changes” – **PR2**
- “Introduce exercises in rehabilitation of cardiac patients” – **PTR1**
- “A large number of patients will be able to access services” - **NR3**
- “Patient education enhanced” – **NR3, NR4, NR6, NR15**
- “Shortening patients stay at Grey’s Hospital” – **NR13**
- “Gives the patient insight into his condition” **– NR15, NR16**

Benefits for a multi-disciplinary cardiac rehabilitation programme at referral hospitals (as expressed by the multi-disciplinary healthcare workers) could be:

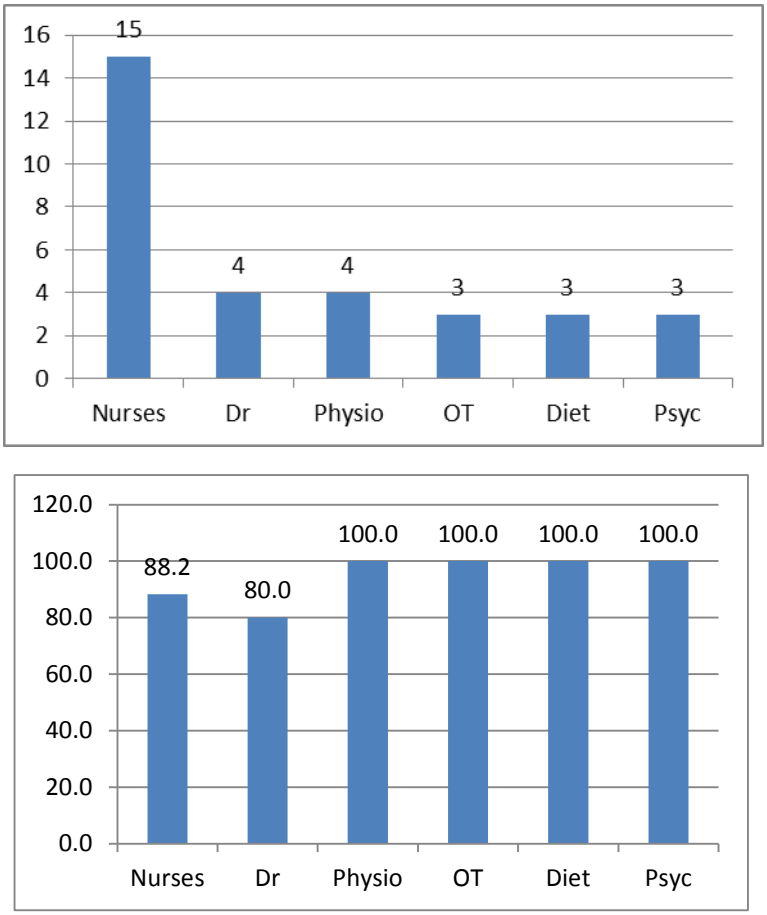
- "To improve the standard of health condition of the patient and awareness about the present condition" – **NR1, NR6, NR10**
- "Patients stay at Grey's Hospital can be reduced" – **PR1, NR2, NR5**
- "For continuity of care" – **DRR3, OTR1, OTR2, OTR3, DTR3, PR1, PR2, PR3, NR2, NR3, NR4, NR6, NR8, NR12, NR15, NR17**
- "Reduce backlogs at tertiary hospitals" – **OTR3, PR1, NR4, NR7**
- "Cardiac rehabilitation should be available at hospitals where physiotherapy services are available" – **PTR4, PTR1**
- "Decrease in hospital costs" – **DRR2**
- "Less expensive for patients" – **OTR1, PTR2**
- "Improve patient outcomes" – **PR2**
- "Monitoring of progress and evaluation of programme" – **OTR2, OTR3, NR12**
- "Regular intervention at base" – **OTR2, OTR3**
- "Easier access to support structures and qualified personnel" – **OTR1, OTR2**
- "All patients cannot be seen at tertiary level due to staff shortages" – **DRR4, OTR1, PR1**
- "Training of staff needs to be done" – **PR3, PTR4, PTR3**
- "A structured training programme needs to be developed to comply with international standards" – **PTR3**

4.4 Statistical Analysis

The question “Would it be beneficial to have a multi-disciplinary cardiac rehabilitation programme at Grey’s Hospital?” was posed to medical professionals. Analysis of the responses are:-

It was found there is strong agreement to have a cardiac rehabilitation programme at Grey’s Hospital across all disciplines. An overall agreement (32/35) for a rehabilitation programme is statistically significant with $p<0.001$ - A Binomial test was performed.

Figure 11 - Column graphs indicating positive responses for a multi-disciplinary cardiac rehabilitation programme at Grey’s Hospital



Summary of Results

The results included in the chapter depicted the response rate to questionnaires by staff of Grey's Hospital as being 60 percent.

The data for cardiac patients accessing relevant cardiac units at Grey's Hospital was represented by graphs and the numbers of patients accessing the units each year increased over 5 years. The trend thus shows an increase in cardiac patients visiting Grey's Hospital over time.

Responses of healthcare workers were presented in tables with subheadings which included demographic information, cardiac rehabilitation scope of practice and aspects of training and practice. These tables indicated involvement of healthcare workers at various levels with cardiac patients.

The scope of practice for current and potential interventions with cardiac patients among healthcare workers at Grey's Hospital was illustrated in a table. Occupational therapy, dietetics and psychology profession specific interventions were listed. The various interventions indicate that these professions do and can offer specialised services to cardiac patients.

Mutli-disciplinary healthcare workers expressed their views on the value of a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital. They also commented on the benefits for a multi-disciplinary cardiac rehabilitation programme at referral hospitals. These views were listed with an adjacent coded reference indicating the respondent who had made the comment.

The responses of professionals were analysed for statistical purposes. Following a binomial test and $p<0.001$ it was found there is strong agreement to have a cardiac rehabilitation at Grey's Hospital among healthcare workers at Grey's Hospital.

Chapter 5

Discussion

The American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recognize that all cardiac rehabilitation/secondary prevention programs should contain specific core components that aim to optimize cardiovascular risk reduction, foster healthy behaviours and compliance to these behaviours, reduce disability, and promote an active lifestyle for patients with cardiovascular disease (AHA/AACVPR scientific statement 2007).
In 1994, the American Heart Association stated that cardiac rehabilitation programmes should consist of a multifaceted and multi-disciplinary approach to overall cardiovascular risk reduction, and that programs that consist of exercise training alone are not considered cardiac rehabilitation.
This might be beneficial by means of a multi-disciplinary approach to the care of the cardiac patient as part of a secondary prevention regime.
Cardiac rehabilitation/secondary prevention programmes are recognized as integral to the comprehensive care of patients with cardiovascular disease (Balady 1994; Wenger 1995).

The prevalence of CVD continues to rise worldwide. It is estimated that by the year 2020, ischaemic heart disease (IHD) will continue as the number-one cause of mortality and disability, with unipolar major depression rising to number two (Murray and Lopez 1997). Most of these projections affect the future of health care in general and cardiac rehabilitation in particular.

Most of the healthcare workers at Grey's Hospital are interacting with cardiac patients in the in-patient phase. A multi-disciplinary booklet with cardiac care guidelines for patients is endorsed by the British Association of Cardiac Rehabilitation. The World Health Organization also emphasises the need for patient education in the secondary prevention of cardiac disease. A cardiac rehabilitation programme with exercise as a core component is advised internationally. It would be beneficial to develop a protocol for a cardiac

rehabilitation programme in all phases (I-IV) involving the multi-disciplinary team at Grey's Hospital.

Unless the epidemic of CVD is dealt with, the overall health of nations will not improve, nor will their level of development. In an increasingly integrated global economy the CVD epidemic in developing countries will divert economic goods to CVD care, resulting in a reversal of developmental efforts; productivity will decline because of the loss of more productive citizens; and consumer markets will shrink as a result of the purchasing power of these citizens (Mbewu 2006).

Pluss et al (2011) conducted an investigation with people with coronary artery disease to ascertain whether an expanded cardiac rehabilitation programme reduced cardiac deaths, myocardial infarctions and hospital admissions due to cardiovascular disease.

Their design was a randomised controlled trial with intention-to-treat analysis. A university hospital in Sweden was the setting. People who participated were aged less than 75 years who had a recent myocardial infarction or coronary artery bypass grafts. Severe co-morbidities were exclusion criteria. Randomisation of 224 participants allocated 111 to undergo expanded cardiac rehabilitation and 113 to a control group. Both groups received standard cardiac rehabilitation, including physical training, education, group and individual counselling, and support to cease smoking. All participants received appropriate preventative medications. In addition, the intervention group received 20 group sessions of stress management, 3 sessions of cooking and diet counselling by a dietician, and a 5-day stay at a "patient hotel" with several activities including physical training and information. Although other outcomes were reported at the conclusion of 1 year follow-up, the outcomes at the 5-year follow-up were rates of cardiac events: cardiovascular death, acute myocardial infarction, and readmission to a hospital due to other cardiovascular causes. All participants were followed via national registers of health and mortality. During the 5 year follow-up, 53 (48%) participants in the expanded cardiac rehabilitation group and 68 (60%)

participants in the control group had a cardiac event (hazard ratio 0.69, 95% CI 0.48 to 0.99). This difference was mainly due to only 12 (11%) participants having non-fatal myocardial infarctions in the treatment group versus 23 (20%) in the control group (hazard ratio 0.47, 95% CI 0.21 to 0.97).
The number of hospitalisations and the number of days of hospitalisation were both significantly fewer in the treatment group.

Evidence endorses the cost-benefit ratio of cardiac rehabilitation and the cost to health budgets are reduced as there are fewer admissions to hospitals with cardiac patients. This would impact on the National health budget in South Africa were if there was greater advocacy for cardiac rehabilitation programmes and their implementation nationally.

A study in the Rehabilitation and Health Centre, Virga Jesse Hospital, Belgium illustrates the long-term cost-benefit ratio of cardiac rehabilitation after percutaneous coronary intervention – PCI (Dendale 2008). The study analysed the effect of multidisciplinary, hospital-based, ambulatory cardiac rehabilitation on long-term health-related costs after PCI.

Two hundred and thirteen (213) patients were studied after PCI:133 patients referred to cardiac rehabilitation were compared with 80 patients who were referred for PCI from another hospital, where no rehabilitation was available. The hospital files of these patients were studied and the patient and/or his/her general practitioner were contacted by telephone after a follow-up of approximately 4.5 years. All cardiovascular events (recurrent angina, coronary revascularization, acute myocardial infarction, and death) were noted and their cost to the community was calculated. Compared to no cardiac rehabilitation, cardiac rehabilitation resulted in a significant reduction of hospitalizations for angina (75% vs. 45%), and coronary revascularizations (17% vs. 7%). There was a significant increase in the incidence of myocardial infarction (2.5% vs. 7.5%). The intervention group experienced a total of 0.93 events/patient, as compared to 1.52 events/patient in the control group. The total health care cost (including the cost of cardiac rehabilitation) at 4.5 years

of follow-up was lower in the rehabilitation group compared to the control group (4.862 Euro/patient vs. 5.498 Euro/patient).

The study concluded that cardiac rehabilitation after PCI not only significantly reduces the number of cardiac events, but, despite the additional cost due to cardiac rehabilitation, results in cost savings from the Belgian health care payer's perspective.

The implementation of a cardiac rehabilitation programme will have a reduction in costs of healthcare of cardiac patients. This is significant as South Africa is a developing country with an economy and health care system in transition.

The importance of a mutli-disciplinary team approach to cardiac rehabilitation has been stressed (Kellerman 1993).

Nurses at Grey's Hospital engage with cardiac patients in all units in terms of care and patient education. They possess invaluable skills and knowledge and are involved in counselling patients about their medical conditions. A booklet is in circulation which offers advice to cardiac patients in the medical wards. This booklet could be reviewed to be in line with the standard presented in the BACR cardiac rehabilitation booklet which is a multi-disciplinary compilation. Results from this study indicate 8 nurses out of 17 use written material in imparting information to patients. With a review of the written hand-outs to patients, nursing staff could become more involved in the preparation and distribution of the booklets in each unit. Specialized training in cardiac rehabilitation for nurses would be beneficial as nurses spend large volumes of contact time with patients at Grey's Hospital. Nurses indicated that 13 out of 17 are involved in exercise with patients at Grey's Hospital. It would be beneficial if nursing students were to attend and assist when conducting the exercise components of cardiac rehabilitation. They could be mentored by a professional nurse with experience in cardiac rehabilitation. Information such as BP and heart rate can be measured and recorded prior to

and post exercise. If nurses could rotate through a programme there would be continuity of service and skills would be developed.

A study in the West China school of nursing, Sichuan University indicates that a nurse-led cardiac rehabilitation programme improves health behaviours and cardiac physiological risk parameters (Jiang 2007).

The aim of the study was to examine the effect of a cardiac rehabilitation programme on health behaviours and physiological risk parameters in patients with coronary heart disease in Chengdu, China. Epidemiological studies indicate a dose-, level- and duration- dependant relationship exists between cardiac behavioural and physiological risks and coronary heart disease incidence as well as subsequent cardiac morbidity and mortality. Cardiac risk factor modification has become the very primary goal of modern cardiac rehabilitation programmes.

A randomized control trial was conducted. Coronary heart disease patients, (n=167) who met the sampling criteria in two tertiary medical centres in Chengdu, south-west China, were randomly assigned to either an intervention group (the cardiac rehabilitation programme) or control group (the routine care). The change of health behaviour (walking performance, step II diet adherence, medication adherence, smoking cessation) and physiological risk parameters (serum lipids, blood pressure, body weight) were assessed to evaluate the programme effect. Patients in the intervention group demonstrated a significantly better performance in walking, step II diet adherence, medication adherence; a significantly greater reduction in serum lipids including triglyceride, total cholesterol, low-density lipoprotein; and significantly better control of systolic and diastolic blood pressure at three months. The majority of these positive impacts were maintained at six months. The effect of the programme on smoking cessation, body weight, serum high-density lipoprotein, was not confirmed.

The study concluded that a cardiac rehabilitation programme led by a nurse can significantly improve the health behaviours and cardiac physiological risk

parameters in coronary heart disease patients. Nurses can fill significant treatment gaps in the risk factor management of patients with coronary heart disease. This study raises attention regarding the important role nurses can play in cardiac rehabilitation and the unique way for nurses to meet the rehabilitative care needs of coronary heart disease patients.

In this study the nurses at Grey's Hospital indicated they were involved in counselling of cardiac patients regarding diet, exercise, lifestyle modification, awareness of medical condition and medication in phase I, II and III of cardiac rehabilitation. CPR is part of the undergraduate training and nurses would play an integral role in a phase III multi-disciplinary cardiac rehabilitation programme. Nurses at Grey's Hospital recommended the implementation of a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital.

The screening and referral of patients by the cardiology doctors in each unit at Grey's Hospital is crucial as the suitability for participation in a cardiac rehabilitation programme, is related to the clinical presentation of the patient.

A study at McMaster University, Canada explains the role of automatic physician referral in predicting cardiac rehabilitation enrolment (Smith 2006). Despite the established benefits of cardiac rehabilitation, evidence suggests referral to, and subsequent enrolment in, cardiac rehabilitation following a coronary event remains low (10-25%). The aim of this study was to identify predictors of attendance to cardiac rehabilitation intake and subsequent enrolment in rehabilitation after coronary bypass graft surgery within the framework of an automatic referral system.

Researchers conducted a historic prospective study of patients who underwent coronary artery bypass graft surgery between 1 April 1996 and 31 March 2000 and lived within the geographic referral area of a multi-disciplinary cardiac rehabilitation centre in central-south Ontario, Canada. Coronary artery bypass graft surgery patients are automatically referred to cardiac rehabilitation at the time of hospital discharge. Consecutive health records of

eligible patients were reviewed for medical history, cardiac risk factor profiles, and evidence of cardiac rehabilitation intake attendance and enrolment. A total of 3536 patients met eligibility criteria. Patients were predominantly male (79.1%), approximately 64 years of age, living with a spouse or a partner, English-speaking, retired and had multiple cardiac factors. Of eligible patients, 2121 (60%) attended the cardiac rehabilitation intake appointment. Of patients who attended cardiac rehabilitation intake 1463 (69%) enrolled in at least one cardiac rehabilitation service, based on their risk factor profile. Selected cardiac rehabilitation services were exercise training (n=1287;88%), nutrition counselling (n=571;39.0%), nursing care (n=546;37.3%), and psychological intervention (n=223;15.2%).

The study concludes that an institutionalized, physician-endorsed system of automatic referral to cardiac rehabilitation resulted in higher rates of cardiac rehabilitation intake and enrolment following coronary artery bypass graft surgery than previously reported and should be adopted for all cardiac populations.

Due to attrition of staff in the cardiology department at Grey's Hospital it has been difficult for a cardiac rehabilitation programme to be implemented. A new Head of Department for cardiology is being assigned to the post. The cardiologist overseeing the department and cardiac patients at Grey's Hospital can endorse a system of referral to cardiac rehabilitation resulting in higher rates of cardiac rehabilitation intake and enrolment. Multi-disciplinary meeting will need to be held to facilitate the establishment of interventions and protocols in cardiac rehabilitation at Grey's Hospital.

Occupational therapists at Grey's Hospital have little interaction with cardiac patients as cardiac patients are not routinely referred for occupational therapy.

In an article relating to occupational therapy and cardiac rehabilitation (Torres 1995) it is asserted that occupational therapy in cardiac rehabilitation is aimed at enabling the patient to return to work. Ergonomics in relation to "dangerous tasks" are taught to the patient so that work may be done without risk. It is

necessary because there are differences between the work done in the effort tests and the work done in an occupation/work related setting. Thus cardiac rehabilitation is an efficient share in coronary patient treatment and occupational therapy is a significant complementary procedure.
This indicates that occupational therapists fulfil a role as part of the multi-disciplinary team in a cardiac rehabilitation programme. In this study at Grey's Hospital occupational therapists have described many current and potential interventions within their scope of practice that will benefit patients in a multi-disciplinary cardiac rehabilitation programme (Table 20). Occupational therapists indicated they were responsible for assisting the patient achieve cardiac rehabilitation goals. As there is limited interaction between cardiac patients and occupational therapy it would be beneficial for there to be multi-disciplinary involvement in an awareness programme such as Heart month which is observed every September. Each discipline could outline their role in the care of the cardiac patient. These presentations could be made to the patients at the cardiac clinic.

Dieticians at Grey's Hospital visit the cardiac clinic as part of their dietetic intervention. The results in this study indicate that dieticians play an important role in achieving cardiac rehabilitation goals with patients.

A study was conducted in America (Holmes et al 2005) to examine the effectiveness of the registered dietician and education and counselling on diet related patient outcomes with general education provided by the cardiac rehabilitation staff. The study also evaluated the effectiveness of meats, eggs, dairy fried foods, in baked goods, convenience foods, table fats and snacks. The MEDFICTS dietary assessment questionnaire was used as an outcome measure in cardiac rehabilitation. Observational study data from 426 cardiac rehabilitation patients discharged between January 1996 and February 2004 was examined. Groups were formed based on education source : (a) registered dietician and (b) general education from cardiac rehabilitation staff. Baseline characteristics were compared between groups; pre/post diet-related outcomes (lipids, waist circumference, body mass index, MEDFICTS score) were compared within groups. Controlling for baseline measures and lipid-

lowering medication, associations were examined between (a) registered dietician education and diet-related outcomes and (b) ending MEDFICTS score and diet-related outcomes. Mean age was 62 +- 11 years, 30% of patients were female, and 28% were non-white. At baseline, the registered dietician group (n=359) had more dyslipidemia (88% vs 76%), more obesity (47% vs 27%), a larger waist (40 +- 6 vs 37 +-5 inches), a higher body mass index (calculated as kg/m^2; 30+-6 vs 27+-5), a higher diet score (32 +- 28 vs 19 +- 19), and lower self-reported physical acticity (7+- 12 vs 13 +- 18 metabolic equivalent hours) (all $p < .05$) than the general education group (n=67). Registered dietician education was associated with improved low-density lipoprotein (i = 0.13; P =0.04), triglycerides (i=0.48; P=0.01), and MEDFICTS score (i=0.18; P=0.01). Improvements in MEDFICTS scores were correlated with improved total cholesterol, triglycerides, and waist measurements (all i=0.19; P=0.04).

The study concluded that dietary education by a registered dietician is associated with improved diet-related outcomes and that the MEDFICTS score is a suitable outcome measure in cardiac rehabilitation.
At Grey's Hospital dieticians have listed various current and potential interventions within their scoped of practice that will benefit cardiac patients (Table 20). Thus dieticians would be an integral component of a multi-disciplinary cardiac rehabilitation team at Grey's Hospital.

Psychologists have a major role to play in the rehabilitation of cardiac patients At Grey's Hospital patients are seen in therapy sessions to achieve treatment outcomes.

In a study in Sendai, Japan, physical and psychological improvements were reported after phase II cardiac rehabilitation in patients with myocardial infarction (Yoshida 1999). A new 4-week hospitalized phase II cardiac rehabilitation programme was designed. Twenty-nine patients (27 males, 2 females) with acute myocardial infarction who enrolled in the 4-week hospitalized phase II rehabilitation programme were assessed. All patients enrolled in this study had received coronary interventions. The rehabilitation

consisted of exercise training, education and counselling. The physical and psychological status of the patients before and just after programme, and at a 6 month follow up, was evaluated. The physical status was assessed by exercise tolerance measured by the peak oxygen consumption and anaerobic threshold, frequency of exercise, and serum concentrations of triglyceride, total cholesterol, high-density lipoprotein-cholesterol, and low-density lipoprotein-cholesterol. The psychological status was assessed by the Spielberger state-trait anxiety inventory questionnaire (STA) and the self-rating questionnaire for depression (SRQ-D). Thirty-four patients (27 men, 7 women) with MI who did not participate in the rehabilitation programme served as a control group.

After participation in the rehabilitation programme, exercise tolerance and the serum lipid profiles of the patients were improved compared with those before rehabilitation. These parameters had improved significantly 6 months after rehabilitation. The STAI anxiety score was improved significantly and the SRQ-D depression score tended to be improved just after the rehabilitation programme. Regular physical activity was continued even 6 months after the completion of the programme. The hospitalized phase II cardiac rehabilitation programme improved the management of cardiac risk factors and the psychological status in patients with MI. This comprehensive programme may contribute to the secondary prevention of MI as well as the recovery of physical and psychological activities.

Psychologists thus form an integral component of the multi-disciplinary cardiac rehabilitation team. Psychologists indicated that counselling forms part of their intervention with cardiac patients at Grey's Hospital. No pamphlets are in use. Psychologists could be involved in developing a multi-disciplinary booklet for issue to patients. In this study at Grey's Hospital psychologists have described many current and potential interventions within their scope of practice that will benefit patients in a multi-disciplinary cardiac rehabilitation programme (Table 20).

Physiotherapists at Grey's Hospital are usually involved in phase 1 with patients in the cardiac wards. The modalities used in the treatment of patients include chest physiotherapy and exercises and mobilization. In this study physiotherapists indicated that a cardiac rehabilitation programme would introduce exercises as part of the rehabilitation of cardiac patients.

A paper presented at the Cochrane Conference in Cape Town (Jolliffe 2000), illustrates the benefits of exercise based cardiac rehabilitation for coronary heart disease. The objectives were to determine the effectiveness of exercise based cardiac rehabilitation programmes on mortality, morbidity, health related quality of life, and risk factors in patients with coronary heart disease. A systemic review of the literature was carried out with quantitative synthesis. The comparison groups were exercise only interventions versus usual care, and multiple rehabilitation with an exercise component versus usual care. The following outcome measures were assessed: mortality – all-cause and cardiac: myocardial infarction (MI) and cardiovascular disease (CVD). Morbidity – cardiac events: MI, coronary artery bypass grafts (CABG), percutaneous transluminal coronary angioplasty (PTCA), CVD events: stroke, trans-ischaemic attack (TIA). Primary cardiac risk factors – smoking behaviour, blood pressure and blood lipid levels health-related quality of life. Physical activity levels of strength and stamina. In addition information was collected on age, sex, type of CHD, when the intervention was received post event (acute versus chronic condition), length and intensity of intervention, and quality assessment of studies, as a secondary objective to determine the effects of these outcomes.

Both groups of interventions show a significant decrease in both all cause and cardiac mortality, with no significant effects on the recurrence of MI. There are small but significant reductions in total cholesterol, LDL cholesterol and triglycerides in both groups of interventions. Preliminary data confirm the benefits of exercise based cardiac rehabilitation.

At Grey's Hospital there are no protocols in place for phase III cardiac rehabilitation programme with exercise as a core component. In this study physiotherapists at Grey's Hospital indicated that a cardiac rehabilitation programme will introduce exercise to patients. Based on research (Jolliffe 2000) it is indicative that a cardiac rehabilitation programme with exercise as a core component will benefit the patients at Grey's Hospital.

The WHO recommends a light exercise programme (see Annexures 1 and 2) for most cardiac patients. This programme of exercise can be utilised as part of the phase III exercise intervention for cardiac patients at Grey's Hospital. The American college of sports medicine provides guidelines for exercise prescription in the cardiac population (ACSM 2010). Physiotherapists indicated there was limited formal post-graduate training in cardiac rehabilitation in South Africa. The Department of Physiotherapy at Grey's Hospital is equipped with a resuscitation trolley, a machine which measures blood pressure, heart rate, respiratory rate and oxygen saturation, treadmills, cycles and a hydrotherapy pool. Acquisition of exercise aids as recommended by the physiotherapists in the study would be an asset to the department as it would offer patients variety in exercise and opportunities to progress their exercise regimes. These include rowers, steppers, dumbells and other cardiovascular exercise aids.

In South Africa CPR is not part of the undergraduate training programme for occupational therapists, dieticians and psychologists. It is essential as outlined in the WHO guidelines, for health care workers to be trained in CPR when treating cardiac patients. The acquisition of cardiovascular exercise aids and education material for cardiac patients would enhance a cardiac rehabilitation programme at Grey's Hospital. The WHO stipulates the requirements for a cardiac rehabilitation programme at an advanced facility and as Grey's Hospital is a tertiary hospital it would be of benefit to patients for this institution to be well resourced. The services of a biokineticist would also be beneficial as part of the cardiac rehabilitation programme involved in the exercise component.

Summary of discussion

Cardiac rehabilitation can reduce mortality and morbidity for patients with many types of cardiac disease cost-effectively, yet is generally underutilized in South Africa. The beneficial effects of rehabilitation include a reduction in the rate of death from cardiovascular disease, improved exercise tolerance, fewer cardiac symptoms, improved lipid levels, decreased cigarette smoking, improvement in psychosocial well-being and increased likelihood of return to work.

The AHA/AACVPR statement presents specific information regarding evaluation, intervention and expected outcomes in each of the core components of cardiac rehabilitation/secondary prevention programmes. The outcomes of such programmes affirm a multi-disciplinary approach. Research cited in this chapter supports the role of different healthcare workers in the multi-disciplinary team as relates to the implementation of a cardiac rehabilitation programme.

Evidence as pertains to the cost-benefit ratio of cardiac rehabilitation indicated that health budgets are reduced as there are fewer admissions to hospitals with cardiac patients.

Training of all healthcare workers involved with cardiac patients and the establishment of treatment protocols within a multi-disciplinary framework would be a starting point for the development of integrated, holistic cardiac rehabilitation intervention. Following multi-disciplinary liason, establishment of cardiac rehabilitation protocols and the acquisition of human and equipment resources the implementation of a cardiac rehabilitation programme would gain momentum.

In relation to the results of this study, the aims and objectives have been achieved. Thus it is evident there is a need for a multi-disciplinary cardiac rehabilitation programme at Grey's Hospital.

Chapter 6

Conclusion

Since the introduction of procedures at the cardiac catheterization laboratory in 2006, the number of patients accessing Grey's Hospital cardiac services has increased. A total number of 19983 patients visiting Grey's Hospital between the years 2007-2011, for cardiac related interventions, is indicative of the fact that there is a definite need for the establishment of cardiac rehabilitation programme at Greys Hospital.

As a tertiary hospital, Grey's Hospital has among its staff most of the personnel required to conduct a multi-disciplinary cardiac rehabilitation. The World Health Organization Expert Committee recommends intervention with cardiac patients in developing countries. The hospital may be classified as having some characteristics of a basic, intermediate as well as an advanced facility.

This study has determined that Grey's Hospital can function as a cardiac rehabilitation centre. However, in order for it to improve, advanced levels of training among all professionals and orienting staff to current concepts in international cardiac rehabilitation trends would be beneficial as it would ensure internationally accredited standards are practised in South Africa. The American association for cardiovascular and pulmonary rehabilitation offers guidelines for secondary prevention programmes. A resource manual accompanies this publication and provides valuable insight into the implementation of cardiac rehabilitation programmes. Core competencies and training would be an aspect that is relevant to all healthcare workers as there are international guidelines that outline the requisites of a cardiac rehabilitation programme and staff would need to be trained accordingly.

In view of limitations of human and equipment resources, cardiac rehabilitation may be conducted at Grey's Hospital as suggested by the WHO expert committee – following multidisciplinary liason. It is necessary for the

limitations to be addressed so there are no barriers to providing an efficient cardiac rehabilitation service to patients.

Following the potential benefits for cardiac rehabilitation to continue at referral hospitals, the implementation of programmes at referral hospitals is strongly supported by most staff. The healthcare workers have also indicated that training and regular workshops should be held to empower staff at district hospitals also so that effective continuation of care occurs at these hospitals following their discharge from Grey's Hospital.

Pluss et al (2011) concluded that expanded cardiac rehabilitation after acute myocardial infarction or coronary artery bypass surgery reduces the long-term rate of cardiovascular events by reducing myocardial infarctions and days in hospital for cardiovascular reasons.

Three Cochrane systematic reviews/meta-analysis have assessed the effectiveness of cardiac rehabilitation (Jolliffe et al 2001; Taylor et al 2004; Rees et al 2004). These reviews provide level one evidence (Harbour and Miller 2001) that, when compared to usual care alone :

- exercise-based cardiac rehabilitation reduces mortality and improves the risk factor profile of CHD patients
- psychology based cardiac rehabilitation improved psychological well-being and risk factor profile of coronary heart disease patients and
- exercise-based cardiac rehabilitation improves exercise tolerance and HRQoL of heart failure patients.

The impact of cardiac rehabilitation on total mortality is uncertain and further evidence is needed on the effects of cardiac rehabilitation on health-related quality of life in coronary heart disease patients and total mortality of heart failure patients (Taylor and Jolly 2007).

Cardiac rehabilitation should therefore be included as secondary prevention in all hospitals across the country as there are multi-fold benefits to the patients

and cost reduction implications for hospital budgets. The results above also advocate a multi-disciplinary approach to cardiac care.

The implementation of cardiac rehabilitation at all hospitals would have implications for healthcare workers involved in cardiac care. For physiotherapists formal training in cardiac rehabilitation is limited in South Africa. Standards and protocols for cardiac rehabilitation would have to meet international guidelines. Universities and professional bodies offering post-graduation courses would need to take measures to incorporate cardiac rehabilitation as a specialization. Staff numbers at physiotherapy departments in hospitals would have to increase as physiotherapists are involved in all 4 phases of cardiac rehabilitation. Additional exercise aids and equipment will also have to be acquired to furnish physiotherapy departments. Physiotherapists will also need to part of multi-disciplinary meetings with other healthcare workers so as to establish cardiac rehabilitation protocols in the workplace.

Limitations

The study did not focus on specific issues of training in each discipline that is required to meet international trends and standards. As a tertiary Hospital, Grey's should be recognized as an advanced facility. Grey's Hospital has not been evaluated in relation to its existing infrastructure with reference to an "advanced facility" – in the provision of care for cardiac patients in relation to cardiac rehabilitation. Also this study did not include the hospital administration and patients who also form part of the process.

Recommendations

It is recommended that further studies be done in the field of cardiac rehabilitation as relates to developing countries. In this country research could be done within different professions to ascertain the level of training that each practice is based upon. This could be compared to international guidelines and gaps that exist in training can be identified. Grey's hospital

can be evaluated with reference to its existing infrastructure in relation to an advanced facility. Such a study could result in the acquisition of equipment and human resources to facilitate a multi-disciplinary cardiac rehabilitation programme at tertiary level. Upon the commencement of a multi-disciplinary cardiac rehabilitation programme research could be conducted using a health-related quality of life questionnaire to guage the impact the programme on patients' lifestyle. Further research could be carried out within different professions and their interventions with cardiac patients. The challenges that present need to be highlighted in studies so health departments and governments are made aware of the gaps that exist in the system. The British Association of Cardiac rehabilitation and the Association of Physiotherapists interested in Cardiac Rehabilitation offer a structured instructors programme for physiotherapists. It would be beneficial to have a course based on international standards implemented in South Africa. This would enhance the knowledge base in the field of physiotherapy and cardiac rehabilitation and improve the standard of services offered to patients.

Health promotion and secondary prevention are concepts that are becoming increasingly popular in our rapidly evolving world with advancements in science and technology.

Following equipment acquisition and relevant training a further study can be conducted to demonstrate if Grey's Hospital stands up to WHO scrutiny. Patients most of all need to be empowered and healthcare workers involved in a multidisciplinary cardiac rehabilitation programme can help make that a reality.

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Annexures

Annex 1

Light exercise programme (6 weeks)

Classes for groups of 10-20 patients should be held twice weekly. Each class should last for 1 hour.

Allocation of class time

5-10 minutes	*Opening session*, greetings, discussion, determination of resting heart rate
10-15 minutes	*Calisthenics*, following exercise sheets[1]
30 minutes	*Circuit exercises*, with rest and determination of pulse rate between successive exercises. Activity levels should be restricted to keep the increment in heart rate to < 20 beats/minute over the resting level, i.e. exercise should be observation- and symptom-limited.
5-15 minutes	*Closing session*, final discussion and determination of heart rate, advice on home exercise programmes.

Calisthenics

Patients should progress through 12 levels, increasing the number of repetitions of each exercise by 2-3 at each class. The exercises should also be done twice daily at home.

Circuit exercises

Stationary cycle

Starting at 200 kg m/min (33 W) for 2 minutes, workload and duration of exercise should increase progressively.

Rowing

This exercise should be undertaken only by patients with no history of back pain or injury. Starting with 1 minute of low-resistance rowing, duration of exercise should increase by 1-2 minutes per class.

Pulley

The patient sits on a chair, back to the wall, with a 2.5 kg (5 lb) weight on both left and right pulleys, and pulls down repeatedly with both arms for 1 minute. Duration of the exercise is increased progressively to 4 minutes; weights are then increased to 5 kg (or 10 lb).

[1] Similar to those in Annex 2.

Weights

Weights of 1, 2, 3, 5 or 7 kg (or 2, 5, 7, 10, or 15 lb) are lifted anteriorly from thigh level to above the head. Each of the following exercises is performed initially for 1 minute:

- unilateral (left arm) lift
- unilateral (right arm) lift
- bilateral lift
- rising from sitting to standing position, arms extended laterally, returning to sitting position.

Duration of exercise is increased progressively, followed by an increase in the weights used.

Steps

Using a set of steps each 15 cm (6 inches) high, patients take six steps up then six down (using handrails if necessary). The exercise is repeated three times initially, increasing to 15 times at a comfortable pace.

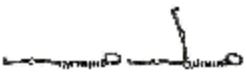
Home walking

Patients should walk at home, at a comfortable place, for a daily minimum of 30 minutes (which may be split into a series of shorter periods). They should start on level ground or by walking slowly uphill. Duration and speed of walking should be increased progressively, but should always remain within the limits of comfort. Walking with a companion increases the pleasure of the exercise; the pace should always be such that talking with ease is possible.

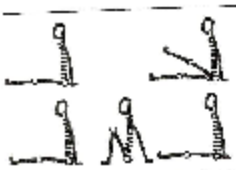
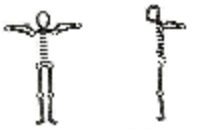
Annex 2

Energy expenditure in various exercises [a]

Exercise description	Frequency (per min)	Energy consumption kcal$_t$/min	kJ/min	Heart rate beats/min
Patient lies supine, hands behind head. Crosses right elbow to left knee, and then vice versa.	23	2.7	11.3	93
Patient lies supine with knees bent. Holding both knees with hands, lifts knees by bending elbows.	12	2.8	11.7	97
Patient lies supine with one knee bent. Holding one knee with both hands, lifts knee by bending elbows.	14	3.2	13.4	101
Patient lies supine. Lifts right leg, straigh., fingers of right hand touching toes. Lifts head. Return slowly to supine position, sliding hand along body.	8a	3.3	13.8	102
Patient sits, fingers touching toes. Moves upper body backwards, increasing angle with each repetition, until lying flat.	5	3.7	15.5	104
Lying on side, patient performs half push-ups, eight times each side.	24	3.5	15.1	110

Exercise	Description	Frequency (per min)	Energy consumption kcal$_t$/min (kJ/min)	Heart rate beats/min
	Patient lies supine, arms by the sides. Lifts one straight leg vertically, then repeats with the other.	40	3.2 (13.4)	100

[a] Adapted and translated from:
Nellemann J... Riabilitazione dei pazienti coronaropatici. In: Puddu V, Angiuscia A A, eds. Cardiologia dello sport. Vol. III. Turin, Edizioni Medico Scientifiche, 1976: 259–282.

Exercise	Description	Frequency (per min)	Energy consumption kcal/min (kJ/min)	Heart rate beats/min
	Patient lies supine, arms by the sides. Pulls both knees up towards chest, then straightens legs again.	40	3.2 (13.4)	105
	Patient sits. Touches toes of right foot with left hand, then vice versa.	66	4.3 (18.0)	117
	Patient sits, hands behind back. Lifts first one straight leg, then the other. Bends both knees, straightens legs again.	56	4.7 (19.7)	116
	Patient stands, legs apart, hands on hips. Bends body first left then right.	66	3.7 (15.4)	101
	Patient stands, hands on shoulders. Pulls elbows back repeatedly.	112	3.2 (13.4)	113
	Patient stands, legs apart, hands on shoulders. Straightens arms sideways while turning body left and right.	80	3.9 (16.3)	111
	Patient stands, legs apart, hands on shoulders. Straightens arms upwards while bending body left and right.	66	4.2 (17.6)	119

Annex 3

Exercise therapy guidelines using risk stratification definitions[1]

Guidelines for low risk patients

This category includes asymptomatic patients with uncomplicated coronary history. Functional capacity: 8 METs[2]

- Heart rate guidelines should be based on the results of a treadmill exercise test.
- Perceived exertion should be consistent with moderate exercise.
- Symptom guidelines should be based on a patient's self-reported history and on the results of cardiovascular examination.
- There should be continuous self-monitoring.
- ECG monitoring is necessary only as indicated.
- Exercise guidelines should be consistent with a patient's functional capacity.
- Recreational guidelines should be consistent with a patient's functional capacity and appropriate goals.

Guidelines for intermediate risk patients

This category includes patients who are at risk of a recurrent coronary event: patients who have experienced shock, congestive heart failure, or abnormal exercise ECG, and those who are unable to self-monitor. Functional capacity < 8 METs

- Heart rate guidelines should be based on the results of a treadmill exercise test.
- Perceived exertion should be consistent with moderately low-level exercise.
- Symptom guidelines should be based on a patient's self-reported history and on the results of cardiovascular examination.
- There should be continuous self-monitoring.
- There should be intermittent monitoring of ECG in order to establish cardiovascular response to therapeutic exercise.
- Guidelines for moderate exercise should be consistent with functional capacity and symptoms. Exercise sessions should be more frequent, with a slower progression of exercise intensity.
- Recreational guidelines should be consistent with functional capacity and with the estimated energy costs of activities; other variables such as the weather, and the competitiveness of the activity should be taken into consideration.

[1] Adapted from: Brown K, Fry S. Community resources for rehabilitation. In: Wenger NK, Hellerstein HK, eds. *Rehabilitation of the coronary patient*. 3rd ed. New York, Churchill Livingstone, 1992: 567.

Guidelines for high risk patients

This category includes patients with severely depressed left ventricular function (ejection fraction < 30%); resting complex arrhythmias; arrhythmias that increase with exercise; demonstrable exercise-induced fall in systolic blood pressure; marked exercise-induced ischaemia (> 2 mm S-T depression); and survivors of sudden cardiac death.

- Heart rate guidelines should be based on the results of a treadmill exercise test.
- Perceived exertion should be consistent with low-level exercise.
- Symptom guidelines should be based on a patient's self-reported history and on the results of cardiovascular examination.
- There should be continuous self-monitoring.
- There should be continuous or intermittent monitoring of ECG according to the cardiovascular signs, symptoms, and history; continuous monitoring can be reduced to intermittent monitoring as soon as usual cardiovascular responses are documented.
- Guidelines for low-level exercise should be consistent with functional capacity and symptoms; exercise type, intensity, frequency, and duration should be modified to provide low-level stimulus.
- Recreational activities should not be resumed until cardiovascular responses to exercise are established and functional capacity has reached a level consistent with the desired activity.

Annex 4
Oxygen uptake during two-step exercise[a]

Note: Height of step is 23 cm; $n = 12$.

Number of steps/3 min	Oxygen uptake (± s.d. deviation) ml/min per kg	Energy cost W/Th
10	10.2 ± 1.3	3
20	13.0 ± 1.5	4
30	16.1 ± 1.5	5
40	20.0 ± 1.9	6
50	22.4 ± 2.3	7
60	26.6 ± 2.7	8

[a] Source: Toshima, H., personal communication to Guenter, W.

Annex 5

Comparison of modified Naughton and Bruce protocols for treadmill exercise testing

Note: Duration of test = 3 minutes.

Energy cost	Modified Naughton protocol				Bruce protocol			
	Stage	Speed		Slope	Stage	Speed		Slope
METs*		miles/h	km/h	%		miles/h	km/h	%
3	1	2.0	3.2	3.5	—			—
4	2	2.0	3.2	7.0	—	—	—	
5	3	2.0	3.2	10.5	1	1.7	2.7	10.0
6	4	2.0	3.2	14.0	—			
7	5	2.0	3.2	17.5	2	2.5	4.0	12.0
8	6	3.0	4.8	12.5			—	
9	7	3.0	4.8	15.0	—	—	—	—
10	8	3.0	4.8	17.0	3	3.4	5.4	14.0

Annex 6

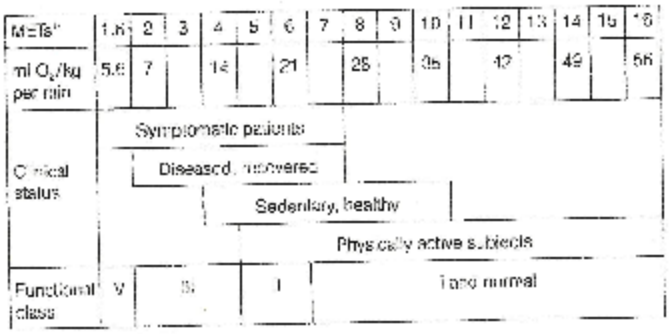
Approximate energy requirements during bicycle ergometry for different body weights

Note: Bicycle ergometry is usually performed against a brake set at a predetermined load. Most protocols start at a workload of 25 W (150 kg-m/min) and increase by 25 W (150 kg-m/min) every 2 or 3 minutes.

		Workload									
W		25	50	75	100	125	150	175	200	250	300
kg-m/min		150	300	450	600	750	900	1050	1200	1550	1800
Body weight		Energy requirements, METs*									
lb	kg										
88	40	4.3	6.4	8.6	10.7	12.9	15.0	17.1	19.3	23.6	27.9
110	50	3.4	5.1	6.9	8.6	10.3	12.0	13.7	15.4	18.9	22.3
132	60	2.9	4.3	5.7	7.1	8.6	10.0	11.4	12.9	15.7	18.5
154	70	2.4	3.7	4.9	6.1	7.3	8.6	9.9	11.0	13.4	15.8
176	80	2.1	3.1	4.3	5.4	6.4	7.4	8.6	9.7	11.7	14.0
198	90	1.9	2.9	3.8	4.8	5.7	6.7	7.6	8.6	10.5	12.4
220	100	1.7	2.6	3.4	4.3	5.1	6.0	6.9	7.7	9.4	11.1
242	110	1.5	2.3	3.1	3.9	4.7	5.4	6.3	7.0	8.6	10.1
264	120	1.4	2.1	2.9	3.6	4.3	5.0	5.7	6.4	7.9	9.3

Annex 7

Relationship between functional class, clinical status, and maximal oxygen consumption



Annex 8

Borg scale of rate of perceived exertion

Perceived exertion	Rating
Very, very, light	6 7 8
Very light	9 10
Light	11 12
Somewhat hard	13 14
Hard	15 16
Very hard	17 18
Very, very hard	19 20

Annex 9

Energy requirements of various occupations

Occupation or activity	Energy requirement		
	kJ/min	kcal$_4$/min	VETs[b]
Bakery, general	11.7	2.8	2.3
Bookbinding	11.7	2.8	2.3
Carpentry, general	15.9	3.8	3.2
Carrying heavy loads, e.g. bricks	36.8	8.8	7.3
Carrying moderate loads (16–40 kg, 35–88 lb) upstairs	35.3	8.5	7.1
Chambermaid	11.7	2.8	2.3
Coal mining, drilling	29.7	7.1	5.9
Coal mining, general	27.6	6.6	5.5
Coal mining, shovelling coal	32.2	7.7	6.4
Construction work, outdoor	25.1	6.0	5.0
Electrical work, plumbing	16.9	3.9	3.2
Farming, baling hay, cleaning barn	30.6	8.5	7.3
Farming, chopping cattle	16.0	3.5	3.2
Farming, driving harvester tractor	11.7	2.5	2.3
Farming, feeding animals	18.4	4.4	3.7
Farming, hand-milking	14.6	3.5	2.5
Farming, machine milking	7.1	1.7	1.4
Farming, shovelling grain	25.1	6.0	5.0
Fire-fighter	20.9	5.0	4.2
Forestry, chopping with axe, fast	79.3	19.0	15.9
Forestry, carrying logs	23.0	5.5	4.6
Forestry, carrying logs	50.2	12.0	10.0
Forestry, felling trees	36.8	8.8	7.3
Forestry, hoeing	23.0	5.5	4.6
Forestry, planting by hand	27.6	6.6	5.5
Forestry, sawing by hand	32.2	7.7	6.4
Forestry, sawing, power	20.9	5.0	4.2
Forestry, trimming trees	41.4	9.9	8.3
Forestry, weeding	18.4	4.4	3.7
Horse-grooming	27.6	6.6	5.5
Horse riding, galloping	36.8	8.8	7.3
Horse riding, walking	11.7	2.8	2.3

Occupation or activity	Energy requirement		
	kJ/min	kcal/min	METs
Locksmith	16.3	3.9	3.3
Machine tooling, machining, working sheet metal	11.7	2.8	2.3
Machine tooling, operating lathe	14.5	3.5	2.9
Machine tooling, operating punch press	23.0	5.5	4.6
Machine tooling, tapping and drilling	18.4	4.4	3.7
Machine tooling, welding	14.6	3.5	2.9
Masonry, concrete work	32.2	7.7	6.4
Moving, pushing heavy object >75 kg (165 lb)	32.2	7.7	6.4
Operating heavy-duty equipment	11.7	2.8	2.3
Orchard work	20.9	5.0	4.2
Painting (standing)	10.5	2.5	2.1
Road-surfacing	27.6	6.6	5.5
Shoe repair work	11.7	2.8	2.3
Shovelling, double-digging	39.3	9.4	7.8
Shovelling, heavy, >16 kg/min (35 lb/min)	41.4	9.9	8.3
Shovelling, light, <10 kg/min (22 lb/min)	27.6	6.6	5.5
Shovelling, moderate, 10–15 kg/min (22–33 lb/min)	32.2	7.7	6.4
Sitting, light work (assembly/repair, desk/phone work, driving car)	7.1	1.7	1.4
Sitting, moderate work (operating heavy levers, forklift, crane)	11.7	2.8	2.3
Standing, light work (store work, bartender, assembly work, filing)	11.7	2.8	2.3
Standing, moderate work (fast assembly work, lifting 50 kg/110 lb)	16.3	3.9	3.3
Standing, moderate/heavy work (masonry, lifting >50 kg/110 lb)	18.4	4.4	3.7
Steel mill work, forging	25.1	6.0	5.0
Steel mill work, hand rolling	36.8	8.8	7.3
Steel mill work, removing slag	50.2	12.0	10.0
Steel mill work, tending furnace	24.3	5.2	4.8
Steel mill work, tapping moulds	25.1	6.0	5.0
Talking, general	11.7	2.8	2.3
Tailoring, pressing	18.4	4.4	3.7
Typing	7.1	1.7	1.4
Using heavy power tools (pneumatic drills, pile hammers, etc.)	27.6	6.6	5.5

Occupation or activity	Energy requirement		
	kJ/min	W/m^2	METs
Using heavy tools (shovel, pick, spade, tunnel bar, etc.)	35.8	8.6	7.3
Walking, 5 km/h (3 miles/h)	16.3	3.9	3.3
Walking briskly, or standing, carrying < 25 kg (55 lb)	20.9	5.0	4.2
Walking or standing, carrying 25–49 kg (55 to 108 lb)	23.0	5.5	4.6
Walking or standing, carrying 50–74 kg (110–163 lb)	29.7	7.1	5.9
Watch repairing	7.1	1.7	1.4

Annex 10

Energy requirements of common daily activities, including housework

Activities	Mean energy requirement		
	kJ/min	kcal$_{th}$/min	METs[b]
Household chores			
Making beds	17.2	4.1	3.4
Showering	6.8	2.1	1.8
Dressing	8.8	2.1	1.5
Simple house-cleaning	11.3	1.8	2.3
Occupational therapy activities			
Light activities, sanding, polishing, basket-weaving	12.6	3.0	2.5
Light mechanical	11.7	2.8	2.3
Walking			
Walking 2 km/h (1.3 miles/h), 3 km (2 miles) daily	9.6	2.3	1.9
Excursions at 3.5 km/h (2.2 miles/h)	11.7	2.8	2.3
Excursions at 5 km/h (3 miles/h)	15.9	3.8	3.2
Gardening			
Watering with hose	7.5	1.8	1.5
Watering with can	10.0	2.4	2.0
Digging	7.5	1.8	1.5
Raking	8.8	2.1	1.8
Sowing flowers and vegetables	10.5	2.5	2.1
Picking flowers and vegetables	11.7	2.8	2.3
Hoeing with 2.5 kg (5.5 lb) hoe, light to medium soil	13.8	3.3	2.8
Pruning	13.6	3.3	2.5

Annex 11

Indications to terminate an exercise test

Exercise testing should be terminated if serious dysrhythmia, e.g. ventricular tachycardia or supraventricular tachycardia, is observed or detected by ECG monitoring. It should also be terminated if any of the following potentially hazardous signs, symptoms, or situations arise:

- pain, headache, dizziness, syncope, excessive dyspnoea, and fatigue precipitated by exercise;
- pallor, clamminess of the skin, inappropriate affect;
- excessive rise in blood pressure, with systolic pressure exceeding 240 mmHg (32 kPa) and diastolic pressure exceeding 120 mmHg (16 kPa);
- progressive fall in blood pressure;
- failure of ECG monitoring system;
- S–T segment depression or elevation greater than 3 mm during exercise;
- dysrhythmia precipitated or aggravated by exercise, e.g. premature ventricular contractions with increasing frequency, supraventricular tachycardia;
- ventricular tachycardia (three or more consecutive beats);
- recognized types of intracardiac block precipitated by exercise.

Annex 12

Contraindications and special considerations for exercise testing

Exercise testing is contraindicated in patients with the following conditions:

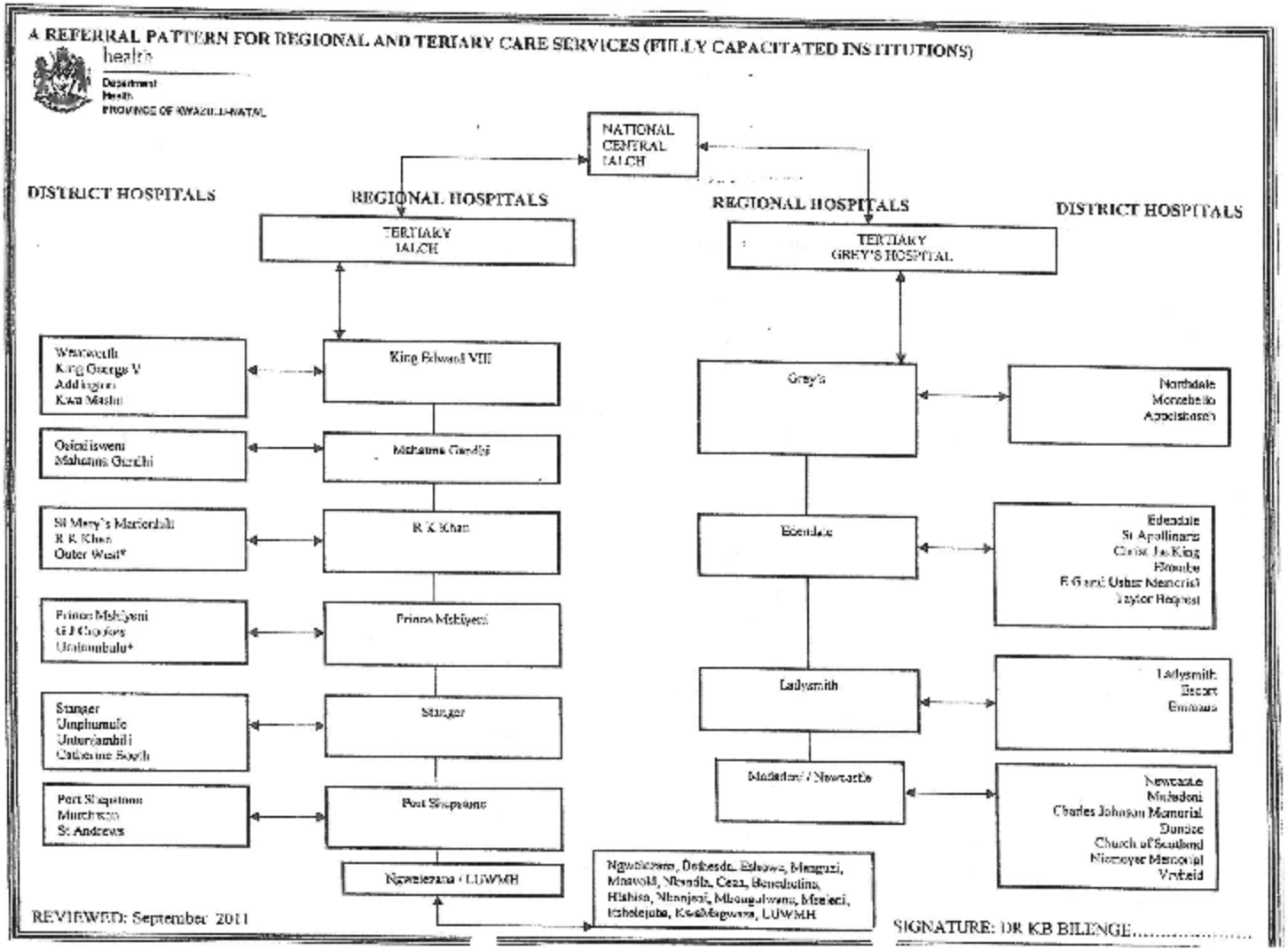
- acute inflammatory cardiac disease
- uncontrolled congestive heart failure
- acute myocardial infarction
- acute pulmonary disease (acute asthma, pneumonia)
- blood pressure greater than 200/110 mmHg (26.7/14.7 kPa)
- acute renal disease (acute glomerulonephritis)
- acute hepatitis
- drug overdose affecting cardiorespiratory response to exercise (digitalis toxicity).

Special consideration must be given to the increased risks of and the benefits to be derived from exercise testing in patients with the following conditions:

- severe aortic stenosis
- severe pulmonary stenosis
- serious ventricular dysrhythmia, especially in association with significant cardiac disease
- coronary artery disease
- severe pulmonary vascular disease
- metabolic disorders (glycogenolysis types I and V)
- haemorrhagic diseases
- orthostatic hypotension.

The risk of exercise testing in patients with these diseases and conditions is greater than normal. If testing is performed, experienced personnel and proper monitoring equipment are essential to minimize risks.

Annexure 13



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APPENDICES

Appendix A

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

Research Office, Govan Mbeki Centre
Westville Campus
Private Bag x54001
DURBAN, 4000
Tel No: +27 31 260 3587
Fax No: +27 31 260 4609
mohunp@ukzn.ac.za

26 August 2011

Ms M Rabilal (9324340703)
School of Physiotherapy
Faculty of Health Sciences
Westville Campus

Dear Ms Rabilal

PROTOCOL REFERENCE NUMBER: HSS/0759/011M
PROJECT TITLE: A survey to determine the need and scope for a cardiac rehabilitation programme at Greys Hospital – A multidisciplinary perspective

In response to your application dated 18 August 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.
PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor: Dr SS Maharaj
cc: Mr S Reddy, Faculty of Health Sciences , Westville Campus

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Appendix B

GREY'S HOSPITAL
OFFICE OF THE CHIEF EXECUTIVE OFFICER
Private Bag X9001, Pietermaritzburg, 3200
Town Bush Road, Chase Valley, Pietermaritzburg
Tel.: 033 897 3321, Fax.: 033 3422 324
Email.: sandy.sivrathan@kznhealth.gov.za
www.kznhealth.gov.za

Reference: Research
Enquiries : Dr K B Bilenge
Telephone : (033) 897 3321

20 September 2011

Ms Melisha Rabilal
Masters Student – Physiotherapy

Dear Melisha,

RE : PERMISSION TO CONDUCT RESEARCH STUDY WITH STAFF AT GREY'S HOSPITAL

I have pleasure in informing you that permission has been granted to you by the Hospital CEO to conduct research Study with Staff at Grey's Hospital.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. **This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.**
3. Please ensure this office is informed before you commence your research.
4. The Hospital will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the Hospital CEO

Regards,

DR K. B. BILENGE
ACTING CHIEF EXECUTIVE OFFICER
GREYS HOSPITAL

Appendix C

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel.: 033 – 3953189
Fax.: 033 – 394 3782
Email.: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM144/11
Enquiries : Mrs G Khumalo
Telephone : 033 – 3953189

11 October 2011

Dear Ms M Rabilal

Subject: Approval of a Research Proposal

1. The research proposal titled '**A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital-Pietermaritzburg, KwaZulu-Natal – A multi-disciplinary perspective**' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby approved for research to be undertaken at Greys Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051**, PIETERMARITZBURG, **3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mrs G Khumalo on 033-3953189.

Yours Sincerely

Dr E Lutge,
Chairperson, Health Research Committee
KwaZulu-Natal Department of Health
Date: 12/10/2011

Appendix D

Information Sheet

Date : _____

Dear Colleague

My name is Melisha Rabilal (PT 0063959), and I am a Chief Physiotherapist in the Department of Physiotherapy at Greys Hospital – Contact nos. (w) 0338973194/3201, (cell) 0824506753, (email) melisha.rabilal@gmail.com.

You are being invited to consider participating in a study that involves research to determine the need and scope for a cardiac rehabilitation programme at Greys hospital. A multidisciplinary perspective is being sought as a multi-disciplinary approach to cardiac rehabilitation is holistic. The study objectives are as follows :-

- To establish the need and scope for a cardiac rehabilitation programme at Grey's Hospital
- To establish current practice among health workers
- To establish the current number of patients accessing the cardiac units at Grey's Hospital
- To establish whether there exists the potential for a cardiac rehabilitation programme at Grey's Hospital

The study is expected to enrol healthcare workers involved with cardiac patients in the disciplines of nursing and medicine (wards D1, CCU and the cardiac clinic). Other departments included in the survey are dietetics, physiotherapy, occupational therapy and psychology.

Staff with work experience of a minimum of 3 years will be included in the study. It will involve the following procedures : Questionnaires will be issued to healthcare workers. The survey questionnaire will include open and closed ended questions. After 2 weeks the questionnaires will be collected.

We hope that the study will create the following benefits; an increase in the referral to the cardiac rehabilitation programme, an interest in a multi-disciplinary approach to cardiac rehabilitation and the establishment of a multi-disciplinary cardiac rehabilitation programme at Greys Hospital.

In the event of any problems or concerns/questions you may contact the researcher at Greys Hospital, Department of Physiotherapy – X3194/3201 or
The Head of School of Physiotherapy-UKZN, Westville Campus
Private Bag X54001
Durban
4000
Kwa Zulu-Natal, South Africa
Tel : (031) 260 7817 Fax : (031) 2608106

Participation in this research is voluntary and you may withdraw your participation at any point and in the event of refusal/withdrawal of participation you will not incur any penalty. There will be no prejudice following withdrawal from the study. For orderly withdrawal, the researcher requests verbal notification immediately or latest upon collection of the questionnaires.
Names of participants will only be written on the consent form and not on the questionnaire. Consent forms will be kept separately from questionnaires. The questionnaires will be coded and no names will appear on the sheets. This will ensure anonymity. Collected questionnaires will be stored in a locked cupboard at the university and be discarded after 3 years.

Appendix E

Consent

I _____have been informed about the study entitled "A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – a multidisciplinary perspective" by Melisha Rabilal.

I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without prejudice. I understand that there are no monetary rewards for my participation.

If I have any further questions /concerns related to the study I understand that I may contact the researcher at The Department of Physiotherapy at Greys Hospital – 0338973194/3201.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researcher then I may contact :

The Head–School of Physiotherapy
UKZN, Wesville Campus
Private Bag X54001
Durban
4000
Kwa Zulu-Natal, South Africa
Tel : (031) 260 7817 Fax : (031) 260 8106

_____ _____

Signature of Participant Date

Appendix F

University of Kwa Zulu-Natal - Westville Campus

A Survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg- a Multidisciplinary Perspective

Questionnaire

Nurse's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (if applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. Which unit do you work in ?

☼Medical admissions ward ☼Cardiac Clinic
☼Ward D1 ☼Coronary Care Unit

---

2. How many cardiac patients have you interacted with in the unit in the last year ? _____

---

3. Have nurses in the unit attended courses/seminars in cardiac rehabilitation?

☼yes
☼no

---

4. Are you trained in Adult Cardiopulmonary Rehabilitation (CPR)

☼yes
☼no

---

5. Are you trained in the use of the cardiac defibrillator ?

☼yes
☼no

---

6. Is there a booklet in circulation for cardiac patients ?

☼yes
☼no

---

7. As nursing personnel, indicate the alternatives where nurses will be able to assist with achieving the goals for cardiac rehabilitation

☼improve functional capacity ☼alleviate/lessen activity-related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

---

8. What is the average length of stay of cardiac patients in the your ward?

☼1-2 weeks ☼2-4 weeks
☼4-6 weeks ☼>6 weeks

---

9. (a) Would it be beneficial for patients to have a multi-disciplinary cardiac rehabilitation programme at Greys Hospital ?

☼yes
☼no

(b) Please explain your response above

_____
_____

_____
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10. (a) Do you offer advice to cardiac patients on discharge ?
    - ☼yes
    - ☼no

    If the response is yes in the above, please answer the following :

    (b) By which method is information imparted to the patient on discharge ?

    (i) ☼counselling

    (ii)☼pamphlet/booklet

    (c) What information is given by the unit to the patient on discharge ?

    ☼diet ☼exercise

    ☼lifestyle modification ☼medication

    ☼awareness of medical condition

_____

11. Would it be beneficial to have a booklet in circulation for cardiac rehabilitation for patients ?
    - ☼yes
    - ☼no

_____

12. On discharge from Greys Hospital where are patients sent ?
    - ☼homes
    - ☼referral/base hospitals

_____

13. (a) Do you recommend that cardiac rehabilitation be continued at base hospitals?
    - ☼yes
    - ☼no

    (b) Please explain your response above

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Appendix G

University of Kwa Zulu-Natal – Westville Campus

A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg – a Multidisciplinary Perspective

Questionnaire

Doctor's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (is applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. (a) In which unit do you work ?

☼Medical Admissions Ward ☼Cardiac clinic

☼Ward D1 ☼Coronary Care Unit

---

2. How many cardiac patients do you see on average per month ?

☼10 ☼10-30 ☼30-50 ☼>50

---

3. Indicate which cardiac medical conditions patients present with at Greys Hospital

☼Coronary Artery Bypass Graft ☼Myocardial Infarct

☼Pacemaker Implantation ☼Cardiac Transplantation

☼Valve Replacement ☼Coronary Angioplasty

☼Positive stress test ☼Angina pectoris

☼Evidence from radionuclide study ☼Cardiac catheterization

☼other – specify

_____

_____

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_____

_____

_____

4. What is the average length of stay of cardiac patients in your unit ?

☼1-2 weeks ☼2-4weeks

☼4-6weeks ☼>6weeks

---

5. (a) Do you refer cardiac patients to physiotherapy ?

☼yes

☼no

(b) If yes how many patients are referred for physiotherapy per month?

☼<10 ☼10-30 ☼>30

---

6. For which physiotherapy treatment modalities are patient referrals done ?

☼chest physio ☼exercise and mobilisation ☼other

specify_____

_____

_____

7. As a medical practitioner, indicate which of the cardiac rehabilitation goals you may be able to assist a patient achieve.

☼improve functional capacity ☼alleviate/lessen activity related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

_____

8. (a) Do you offer advice to cardiac patients ?

☼yes

☼no

If response is yes in the above, please answer the following

(b) By which method is information imparted to the patient during their stay and/or on discharge ?

☼counselling

☼pamphlet/booklet

(c) What information do you/unit give to the patient ?

☼diet ☼exercise ☼lifestyle modification ☼medication ☼awareness of medical condition

_____

9. (a) Would it be beneficial to have a multi-disciplinary Cardiac Rehabilitation programme at Greys Hospital ?

☼yes

☼no

(b) Please explain the response above

_____
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10. (a) Should cardiac rehabilitation programmes continue at base/referral hospitals ?

☼yes

☼no

(b) Please explain your response above

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Appendix H

University of Kwa Zulu-Natal – Westville Campus

A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg – a Multidisciplinary Perspective

Questionnaire

Occupational Therapist's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (is applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. (a)Are cardiac patients referred for occupational therapy interventions at Greys Hospital ?
   ☼yes
   ☼no

If response is yes to the above please answer the following

(b) In which unit do you interact with cardiac patients ?

☼Medical Admissions Ward ☼Cardiac Clinic
☼Ward D1 ☼Coronary Care Unit
☼Out Patients in the Occupational Therapy Department

If response is no to 1(a) please supply reasons for the situation

_____
_____
_____
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_____

2. How many cardiac patients do you see on average per month ?
   ☼nil ☼<10 ☼10-20 ☼>20

_____

3. As an occupational therapist, indicate which of the cardiac rehabilitation goals you may be able to assist a patient achieve.
   ☼improve functional capacity ☼alleviate/lessen activity related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

_____

4. Within your professional scope of practice, what occupational therapy interventions do you/would you use with cardiac patients.

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5. (a) Do you offer advice to cardiac patients ?
   ☼yes
   ☼no

   If response is yes in the above, please answer the following

   (b) By which method is information imparted to the patient during their stay and/or on discharge ?
   ☼counselling
   ☼pamphlet/booklet

   (c) What information do you/unit give to the patient ?
   ☼diet ☼exercise ☼lifestyle modification ☼medication
   ☼awareness of medical condition ☼other - specify

_____
_____
_____

6. (a) Would it be beneficial to have a multi-disciplinary Cardiac Rehabilitation programme at Greys Hospital ?
   ☼yes
   ☼no

   (b) Please explain the response above

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7. (a) Should cardiac rehabilitation programmes continue at base/referral hospitals ?
   - ☼yes
   - ☼no

   (b) Please explain your response above

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Appendix I

University of Kwa Zulu-Natal – Westville Campus

A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg – a Multidisciplinary Perspective

Questionnaire

Dietician's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (is applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. (a) Are cardiac patients referred for dietetic interventions at Greys Hospital ?

☼yes

☼no

If response is yes to the above please answer the following

(b) In which unit do you interact with cardiac patients ?

☼Medical Admissions Ward ☼Cardiac Clinic

☼Ward D1 ☼Coronary Care Unit

☼Out Patients in the Dietetics Department

If response is no to 1(a) please supply reasons for the situation

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2. How many cardiac patients do you see on average per month ?

☼nil ☼<10 ☼10-20 ☼>20

_____

3. As a dietician, indicate which of the cardiac rehabilitation goals you may be able to assist a patient achieve.

☼improve functional capacity ☼alleviate/lessen activity related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

_____

4. Within your professional scope of practice, what dietetic interventions do you/would you use with cardiac patients?

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5. (a) Do you offer advice to cardiac patients ?
   ☼yes
   ☼no

   If response is yes in the above, please answer the following

   (b) By which method is information imparted to the patient during their stay and/or on discharge ?
   ☼counselling
   ☼pamphlet/booklet

   (c) What information do you/unit give to the patient ?
   ☼diet ☼exercise ☼lifestyle modification ☼medication
   ☼awareness of medical condition ☼other - specify

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6. (a) Would it be beneficial to have a multi-disciplinary Cardiac Rehabilitation programme at Greys Hospital ?
   ☼yes
   ☼no

   (b) Please explain the response above

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7. (a) Should cardiac rehabilitation programmes continue at base/referral hospitals ?
   ☼yes
   ☼no
   (b) Please explain your response above

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Appendix J

University of Kwa Zulu-Natal – Westville Campus

A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg – a Multidisciplinary Perspective

Questionnaire

Psychologists's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (is applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. (a) Are patients with cardiac conditions referred for psychological interventions at Greys hospital ?

☼yes

☼no

If response is yes to the above please answer the following

(b) In which unit do you interact with cardiac patients ?

☼Medical Admissions Ward ☼Cardiac Clinic

☼Ward D1 ☼Coronary Care Unit

☼Out Patients in the Psychology Department

If response is no to 1(a) please supply reasons for the situation

_____

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_____

2. How many cardiac patients do you see on average per month ?

☼nil ☼<10

☼10-20 ☼>20

_____

3. As a psychologist, indicate which of the cardiac rehabilitation goals you may be able to assist a patient achieve.

☼improve functional capacity ☼alleviate/lessen activity related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

_____

4. Within your professional scope of practice, what psychological interventions do you/would you use with cardiac patients?

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5. (a) Do you offer advice to cardiac patients ?
   - ☼yes
   - ☼no

   If response is yes in the above, please answer the following

   (b) By which method is information imparted to the patient during their stay and/or on discharge ?
   - ☼counselling
   - ☼pamphlet/booklet

   (c) What information do you/unit give to the patient ?
   - ☼diet ☼exercise ☼lifestyle modification
   - ☼medication ☼awareness of medical condition
   - ☼other - specify

_____
_____
_____
_____

6. (a) Would it be beneficial to have a multi-disciplinary Cardiac Rehabilitation programme at Greys Hospital ?
   - ☼yes
   - ☼no

   (b) Please explain the response above

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7. (a) Should cardiac rehabilitation programmes continue at base/referral hospitals ?
   - ☼yes
   - ☼no

   (b) Please explain your response above

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Appendix K

University of Kwa Zulu-Natal – Westville Campus

A survey to determine the need and scope for a Cardiac Rehabilitation Programme at Greys Hospital – Pietermaritzburg – a Multidisciplinary Perspective

Questionnaire

Physiotherapist's Particulars

1. Gender _____
2. Age _____
3. No. of years employed _____
4. Speciality (is applicable) _____
5. Race (optional) _____

Kindly complete the questionnaire attached. Please mark with a cross the alternatives that apply.

1. (a) Do doctors refer cardiac patients to physiotherapy ?

☼yes

☼no

(b) If yes in what setting do you interact with cardiac patients ?

☼Medical Admissions Ward ☼Cardiac Clinic

☼Ward D1 ☼Coronary Care Unit

☼Out Patients

---

2. How many cardiac patients do you see on average per month in wards?

☼nil ☼<10 ☼10-30 ☼>30

---

3. What modalities are used in the treatment of cardiac patients ?

☼chest physio ☼exercise and mobilisation ☼other

specify _____

_____

_____

_____

_____

_____

4. (a) Have staff in the physiotherapy department been briefed on the principles of cardiac rehabilitation ?

☼yes

☼no

(b) if yes indicate the training intervention

☼undergraduate training ☼postgraduate courses ☼journal articles

---

5. Are the physiotherapy staff trained in adult CPR

☼yes

☼no

---

6. Are the physiotherapy staff trained in the use of the cardiac defibrillator ?

☼yes

☼no

---

7. Is there a resuscitation trolley in the department of physiotherapy ?

☼yes

☼no

---

8. Does the cardiac rehabilitation programme include exercises ?

☼yes
☼no

---

9. (a) Does the programme include equipment ?

☼yes
☼no

(b) Is this sufficient ?

☼yes
☼no

(c) If no please specify

_____
_____
_____
_____

10. Does the programme include music ?

☼yes
☼no

---

11. As a physiotherapist, indicate which of the cardiac rehabilitation goals you may be able to assist a patient achieve.

☼improve functional capacity ☼alleviate/lessen activity related symptoms ☼reduce unwanted invalidism ☼enable the cardiac patient to return to a useful and personally satisfying role in society

---

12. (a) Would it be beneficial to have a multi-disciplinary Cardiac Rehabilitation programme at Greys Hospital ?

☼yes
☼no

(b) Please explain the response above

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_____
_____
_____
_____
_____
_____

13. Would it be beneficial to have a booklet for physiotherapy cardiac rehabilitation patients?
    - ☼yes
    - ☼no
14. (a) Should cardiac rehabilitation programmes continue at base/referral hospitals ?
    - ☼yes
    - ☼no

    (b) Please explain your response above

_____
_____
_____
_____
_____
_____