

# Cardiac Rehabilitation: Future of Heart Health in Saudi Arabia, a Perceptual View

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## Abstract

**Objective:** Having a heart healthy life is one of the most rewarding gifts that you can own yourself in the modern lifestyle practices. Cardiac rehabilitation (CR) is the next step to recover and reverse the limitations experienced by patients who have undergone all the adverse pathophysiological and psychological consequences of cardiac events. **Design:** This is a review article. **The need for cardiac rehabilitation:** CR describes all the methods and measures used to prevent recurrent cardiac attacks and to return people with heart diseases to an active and a satisfying lifestyle. CR services should be offered by all health professionals who are in direct contact with the patient, like cardiac specialist, general practitioner, and other health care providers. The success rate of the CR program improves dramatically when it comes in parallel with limiting modifiable risk factors of cardiovascular diseases. The CR programs not only manage episodes of cardiac events, but also it is a comprehensive tool for preventing future heart problems and improving the patients' life standard. **Goals of Cardiac rehabilitation (CR):** CR program has been evolved with a wide range of indications that aims to regain autonomy and maximize the physical, psychological and social activities. This makes people with cardiac diseases more confident and inspires behaviors that may minimize risk of further cardiac events. **The vision to improve CR in Saudi Arabia:** This article will focus on the methods and parameters that will lead to an improvement in the CR services in the Kingdom of Saudi Arabia.

## Keywords

Cardiac Rehabilitation, Preventive Cardiology, Lifestyle Change

## 1. Introduction

Having a heart healthy life is one of the most rewarding gifts that you can own yourself in the modern lifestyle practices. Cardiac rehabilitation (CR) is the next

step to recover and reverse the limitations experienced by patients who have undergone all the adverse pathophysiological and psychological consequences of cardiac events. CR improves the cardiopulmonary functions of cardiac patients by adopting a heart-healthy lifestyle to improve the quality of life. This program is designed as a multi-factorial and comprehensive interventions in secondary prevention, which is intended to control the psychological and physiological effects of cardiovascular diseases, manage symptoms, and reduce the risk of future events, by a group of medical and paramedical professionals. CR has to be comprehensive in nature, but it must be also individualized in its functions and activities [1].

The utility of scientific evidence-based practice concepts recognizes importance of CR. There are research studies that reveal the help of CR in decreasing rate of mortality, morbidity, and recurrence of the cardiac events along with lifestyle modification practices, activity improvement and psychosocial wellness. This review analyzes evidence of cardiac rehabilitation benefits and utilization of this service [1] [2].

#### **The Need for Cardiac Rehabilitation**

CR describes all the methods and measures used to prevent recurrent cardiac attaches and to return people with heart diseases to an active and a satisfying lifestyle CR services should be offered by all health professionals who are in direct contact with the patient, like cardiac specialist, general practitioner, and other health care providers [2] [3] [4].

Increasing number of deaths from cardiovascular diseases made a pressing need to search for a life-saving approach, which could prevent incidence of cardiac diseases and reduce rate of mortality related to heart problems. Recent evidence shows that, people who follow the proper CR services may decrease up to 30 percent of fatal cardiac events in patients, who are also less likely to die compared to those cardiac patients following standard management regimens. Clients who are managed with CR have a benefit of lowering the chance of contracting a second cardiac event [5].

#### **Inception and Progression of Cardiac Rehabilitation**

By 1980s, CR developed from a simple exercise program to a multidisciplinary approach, which speeds up the recovery and improves the quality of life of cardiac patients. This approach involves the utilization of a medical and a lifestyle modification model. A systematic review by the American Heart Association (AHA) [3] [4] stated that the CR program should not be based solely on an exercise training, but also should cover multiple individual strategies aimed at reducing modifiable risk factors for coronary heart disease [3] [4].

Development of standardized guidelines sponsored jointly by the Agency for Health Care Policy and Research and the National Institute of Health, helps to broaden the opportunity of CR programs. They recommended to add the assessment of patient's current status and risk factor modification by various strategies to improve the overall health. Various guidelines for the clinical practice of cardiac rehabilitation has been formed by agencies of health care, and

currently the program functions as an important tool in primary and secondary prevention of cardiac events [5].

### **Goals of Cardiac Rehabilitation (CR)**

This program has been evolved with a wide range of indications that aims to regain autonomy and maximize the physical, psychological and social activities. This makes people with cardiac diseases more confident and inspires behaviors that may minimize risk of further cardiac events [6] [7].

The CR program prevents the recurrent hospital admissions by offering a lot of goals that help reducing duration of hospital stay including: speed recovery time after an acute cardiac event motivates patients to follow a healthy lifestyle, maintains the achieved behavior change and self-management. All these goals should be in parallel with the prescribed medications and professional advice [8].

### **Indications**

CR should be provided to the following patient groups irrespective to age, sex, ethnic and clinical condition.

According to the British association for cardiovascular prevention and rehabilitation (BACPR), the major groups of patients must benefit from the program are: [8]

- Acute coronary syndrome, Class I, level of Evidence: B
- Coronary revascularization, Class I, level of Evidence: B
- Heart failure, Class I, level of Evidence: B

Other clinical indications of the program include: [8] patients with stable angina, peripheral arterial disease, post-cerebrovascular event, post-implantation of cardiac defibrillators and resynchronization devices, post-heart valve repair/replacement, post-heart transplantation and ventricular assist devices, Adult Congenital Heart Disease (ACHD) and Recent stable myocardial infarction.

The CR program can be started upon hospital admission and after discharge with regular continues visits.

### **Phases of Cardiac Rehabilitation**

Cardiac rehabilitation program consists of three phases. Phase I is intended to be both preventive and diagnostic and typically an inpatient service., It encompasses early mobilization, patient and family education, the treatment, safe discharge, risk factors modifications, and follow-up planning. Phase II is mainly directed to ambulatory outpatient program. Phase III is a lifetime maintenance phase, where the goal is to continue the risk factors, lifestyle change and exercise training. There is another way of CR delivery including home-based programs and e-health programs; such as those using Internet and mobile phones applications [5] [6] [7] [8] [9].

### **Core Components**

Cardiac rehabilitation program's end benefit is based on the combination of all its components. The principle elements of CR includes: 1) patient selection and good assessment; 2) physical activity counseling; 3) nutritional counseling;

4) risk factors control; 5) patient education; 6) psychosocial management, and 7) vocational advice, with physical exercise being a central component [6]-[11].

## 2. Patient Assessment with Medical Control

Assessment is an important tool to make the client aware of concepts on cardiac rehabilitation and to optimize the benefits. Assessment starts with completing medical history sheets by asking well-framed questions about cardiovascular risk factors, other co-morbidities (psychological stress), and the extent of compliance to medical treatment. A clinical examination and diagnostic test results should be also obtained as a part of the assessment [10] [11].

### **Physical activity counseling:**

Physical activity has many associated benefits like; weight loss, lowering blood pressure, and improvement of lipid profiles. A minimum of two hours/week of moderate intensity aerobic activity in a good weather, in multiple bouts (each lasts  $\geq 10$  minutes), on 5 days a week is recommended. The prescription of these activities should be concordant with the patient's age, habits, co-morbidities, preferences and goals [12] [13] [14].

### **Exercise:**

One of the most important components of the CR program is the exercise. The development of exercise protocol is a key element for patients who are undergoing CR. The assessment of exercise capacity by symptom-limited stress testing, either on a treadmill or on bicycle ergometer should be considered. Exercise protocol must be developed on personalized basis according to the outcomes of the physical capacity tests. In this respect, the intensity of exercise could be moderate or high intensity interval aerobic training [15] [16].

### **Dietary Modifications/Nutritional Counseling:**

The modification of dietary habits is one of the best approaches that can be adopted for fighting cardiovascular diseases and promoting wellbeing of patients. A healthy diet is based on the assessment of the daily caloric intake, consumption of dietary fat, especially the amount of saturated fat, the amount of sodium, and quantities of other nutrients.

Education on healthy diet and encouragement for coping with the modified dietary patterns has got a key role in management and prevention of cardiac events. Studies revealed that the occurrence of cardiovascular events is less among people whom diet is low in saturated fat and cholesterol and rich in fiber and fish contents. High content of saturated fat not only increases serum cholesterol levels, but also increases the activity of clotting factor VII, which correlates with the risk of cardiovascular events [17] [18] [19].

### **Risk factors control:**

- Smoking cessation

Avoiding smoking is the most single lifestyle modification in smokers with coronary disease. It reduces angiographic progression of pre-existing and new lesions.

- Weight management

The concept of reducing obesity and proper weight management has a great importance in health promotion. The motivation to maintain an appropriate balance of physical activity and caloric intake is a fulfilled characteristic in CR program. Therefore, a healthy body mass index (BMI; 20 - 25 kg/m<sup>2</sup>) for an adult is recommended. Also, measurement of waist circumference is another indicator (reference is ≥80 cm for women and ≥94 cm for men), to initiate lifestyle modifications and consider management strategies for metabolic syndrome [20] [21].

- Low cholesterol level

Assessment of the lipid profiles and modifying diet, physical activity, and medication as appropriate may help to achieve the target reference level of low-density lipoprotein cholesterol (LDL-c), which is <1.8 mmol/l (<70 mg/dL) [22] [23] [24].

- Blood pressure management

The main advice here is to measure the blood pressure at rest on a regular basis. According to the guidelines if resting systolic blood pressure is 140 mmHg or diastolic blood pressure is 90 mmHg, lifestyle changes are recommended. Then continue monitoring of blood pressure if it rises more than the guidelines limits despite lifestyle changes, initiate drug therapy [21] [22] [23].

**Vocational advice:**

It is better to arrange patient's relative meeting before discharge, in order to discuss and encourage return to prior activities, and to help them to overcome barriers to return to work; such as re-training, capacity-building and reasonable adjustments [25] [26].

### 3. Impact of CR on CVD

CR data in recent studies showed more than 20% reduction in all causes of death and about 25% in cardiovascular disease-related death. Both, regular exercise and physical fitness are associated with a reduced risk of coronary events and sudden death due to cardiac issues [8] [27].

**Exercise and cardiovascular diseases:**

Physical activity is a key lifestyle behavior with numerous beneficial effects on exercise competence, and acts as a tool for prevention of coronary artery disease. In recent public health recommendations, all people should be physically active for 30 min. of moderate strength exercise on most days of the week. These recommendations are agreed by the American College of Sports Medicine [28] [29].

For the past 30 years, exercise was started to be used for cardiac patients' rehabilitation gradually and has also been recommended for cardiac patients upon discharge [29].

In normal physiology, the heart rate (HR) response during exercise is linear; it increases with exercise because of the balance between the vagal and the sympathetic tone, whereby increasing the sympathetic stimulation and reducing the vagal tone, the patient achieves a higher HR during exercise. In recovery, the HR decreases because of the vagal tone, which causes a rapid decrease of the HR.

The phenomenon of abnormal heart rate recovery is defined as a delayed decrease in heart rate of  $\leq 12$  beats per minute at 1 min, and  $\leq 22$  beats per minute at 2 min. The presence of either chronotropic incompetence or abnormal heart rate recovery during exercise is partly due to abnormalities of the sympathetic and the parasympathetic tone and known predictors of higher cardiovascular morbidity and mortality. With CR training protocols, the achievement of increased vagal tone and decreased sympathetic tone is documented, resulting in a lower resting HR and improvement in chronotropic incompetence [29] [30] [31].

During the time of exercise, in normal responders, the systolic blood pressure (SBP) is progressively increasing with the strength and amplitude of exercise of about  $10 \pm 2$  mmHg/metabolic equivalent (MET); this can reach a possible plateau at peak exercise. Whilst in cardiac patients, the response of SBP during exercise could be normal, or it may increase or decrease abnormally. During stress test, when the SBP reaches more than 250 mmHg with exercise, the term exertional hypertension is coined. Exertional hypertension may harm the patient and indicate termination of the test. On the other hand, failure of SBP to rise during exertion is referred to exertional hypotension. This drop may be below the resting or the initial blood pressure. If the SBP decreased by  $\geq 10$  mmHg during an exercise stress test, the test should be stopped. This may be endorsed to heart failure, a large area of ischemia induced by exercise or papillary muscle dysfunction with mitral regurgitation, and in this case, there is increased risk of future cardiac events. During the CR program, there is a significant reduction in both SBP and DBP. This reduction in blood pressure has a great value in patients with mild-to-moderate hypertension with average values of 6-8mmHg for SBP and 3 - 5 mmHg for DBP [31] [32].

The oxygen uptake increases by 8 to 10 folds during sustained exercise, which will help the heart to maintain normal cardiac output and muscles contraction. In this regard, the CR program helps the patient to increase the oxygen uptake up to 20% to 30%.

In cardiac patients, the cardiac output may be reduced either due to chronotropic incompetence or due to causes of left ventricular failure. These include myocardial infarction or ischemia, resulting in a decrease in both heart rate and stroke volume. This reduction in cardiac output will be improved by rehabilitation [32] [33].

The improvement of the modifiable risk factors by the personalized rehabilitation plan, side by side with the pharmaco-therapy, is associated with a rapid improvement in physical function. However, the recovery period may extend from six weeks to six months or longer to manage the medical condition and build up healthier habits.

In addition, CR program helps the physician and the patient to improve lipid profile, control blood pressure, and may also help to treat and prevent diabetes mellitus Type -II. Also, the inflammatory markers (C-reactive protein, for ex-

ample) are reduced during the rehabilitation, which also leads to weight loss, and possibly ischemic preconditioning. Exercise is also associated with improved endothelial function with a more favorable fibrinolytic balance. It also decreases emotional distress and depression allowing the patient to have a higher quality of life.

Such benefits of CR noticeably occur only if the patient attends and completes an appropriate program. A susceptibility matched analysis stated that the survival was higher in completers, so, The Adherence of patients to exercise maximizes the benefits of CR [32] [33].

#### **4. CR in Guidelines and its Application in the Middle East: [34] [35] [36] [37]**

CR program is implemented in a wide variety of models. These are based on well-framed and standardized guidelines. Different levels of valid programs had been used by many cardiology societies.

The American Heart Association (AHA) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) afford more detailed guidelines. It was entitled “Putting More Patients on the Road to Recovery”, the working group reported that better health outcomes from cardiac rehabilitation were associated with reduced hospitalizations and hence can control the financial load.

The British Association for Cardiovascular Prevention and Rehabilitation (BACPR) group updated their guidelines which based on the six standard strategies summarized in a simple pathway to deliver high quality medical and educational plans for all cardiac patients as follows: [8] [37] [38]

The six standards for cardiovascular prevention and rehabilitation are:

- 1) The delivery of six core components by a qualified and competent multi-disciplinary team, led by a clinical coordinator.
- 2) Prompt identification, referral and recruitment of eligible patient populations.
- 3) Early initial assessment of individual patient needs which informs the agreed personalized goals that are reviewed regularly.
- 4) Early provision of a structured cardiovascular prevention and rehabilitation program (CPRP), with a defined pathway of care.
- 5) Upon program completion, a final assessment of individual patient needs and demonstration of sustainable health outcomes.
- 6) Registration and submission of data in a specific program.

The Canadian Association of Cardiac Rehabilitation (CACR) has also developed detailed guidelines, their study resulted in a 31% reduction in hospital readmissions and a 26% drop in cardiovascular mortality for a 7% return on investment.

In Asia, English-language cardiac rehabilitation guidelines have only been published in Japan [39] [40].



All the mentioned guidelines and statements recommend the use of a medical protocol parallel to an exercise protocol when applicable, and also they reported limitations for referral to CR unit including, the elderly, women, minority populations, lack of knowledge about CR and patients with lower socioeconomic status, and unfortunately, the mentioned group are less likely to take that first critical step to enroll after referral. This is of great concern because women and minorities are far more likely to die within five years after a first heart attack as compared to their white male patient counterparts.

In spite of the worldwide burden of cardiovascular diseases and increasing need for rehabilitation programs, Arab countries are lacking specific CR programs and guidelines. There are a limited number of centers that provide and maintain the CR services. Some of the research evidence available at present can be the steppingstone in the identification, the need and implementation of CR programs in the Middle east [40].

Turk-Adawi and colleagues studied the CR program in Canada and Arab countries; the research was on the comparison of availability of cardiac rehabilitation services and its important features in different Arab countries (all together Eight CR programs were identified in Arab countries: 4 in Gulf region (1 in Bahrain, 1 in Qatar, and 2 in United Arab Emirates), 4 in African areas (2 in Egypt, 1 in Algeria, and 1 in Tunisia) and 128 CR programs in Canada. Hence, they concluded that in all 22 Arab countries there are only 8 valid and accredited CR programs, that indicate the increasing need for more accreditation of CR programs. The CR services in both areas of research unveil that the most common risk factors and the core areas of the CR programs are similar, however, CR programs in the former countries do not often provide exercise testing, depression screening and counseling. The other vital area of comparison was the factors that cause reluctance of clients and hinder their participation in CR programs in the Arab Region and Canada. The prime area of perceived barriers in the study was the lack of proper cardiac rehabilitative program framework, which lacks human, physical, and financial resources. The authors recommended the increased need for tailoring CR guidelines to fit the Arab setting, as well as, a significant improvement of training and CR services [33].

In Riyadh, the capital city of the Kingdom of Saudi Arabia (KSA), there is an established CR program in the King Faisal specialist hospital research center, which pioneered the service and implemented the first CR program in KSA. Of note, this service is offered by the Physical therapy department.

Another imminent center in the Eastern province is Prince Sultan Cardiac Centre in AL Ahssa, which offered the CR services for cardiac patients, but with no specific information about the characteristics and duration of the program.

Einas Aleisa and colleagues studied two rehabilitation programs (not specific for CR) in King Khalid University Hospital (KKUH) and King Abdul-Aziz University Hospital (KAUH), they explained the facilities available and difficulties facing both programs. The authors concluded that there are several obstacles re-



garding patient safety standards, the limited capacity and staff qualifications; those elements are still below the standard. The authors also noticed a limited communication between the rehabilitation staff and other departments. In addition, there is a noticeable lack of research in the rehabilitation field.

## 5. The Vision to Improve CR in Saudi Arabia

Both awareness of CR programs and patient referrals are considered the main corners of these programs. There is a noticeable effort used to increase the patient's participation in CR programs, along with subsequent program enrollment and completion. Patients must be referred to participate in CR. This step takes place before or soon after hospital discharge following a cardiac event. Many factors are associated with limited referral and enrollment such as:

- Female sex, old age, comorbidities including depression and musculoskeletal diseases. The arrangement of regular home visits with well trained personnel will add in helping those people to engage the CR program with the feasibility of choosing appropriate scheduled times and date.
- Lack of awareness of CR program should be eliminated by the assigned treatment council and discussing the importance of CR program with patients clearly before discharge through different types of communications.
- Lack of referral to participate from the patient's physician. This point is the limiting step in the program and should be avoided by changing each Hospital policy to include the CR referral form within the discharge papers of the patient and scheduling the appointment.
- The cooperation between cardiology, cardiothoracic and physiotherapy departments should be achieved to handle the cardiac patients in the CR program.
- The highly qualified physicians should be available in different regions to help in providing the appropriate CR services by creating small training groups in each Hospital and mastering the service.
- Establishing a link between the college of Medicine, college of Applied Medical Sciences and college of Nursing to provide the manpower of the CR unit.
- The cooperation between governmental and the private centers that provide CR program. The financial, academic and equipment support will give a great help in such cooperation.
- Increase the number of CR units.
- Distance to CR facility from patient's home.
- Work or home responsibilities towards patients doing CR.
- Male gender-dominated programs and little female staff.
- The Lack of specific Arab countries guidelines.
- Language problems and cultural believes.

All the above factors are considered obstacles in the future of the CR program in the Kingdom. Healthcare policy is a critically important part of the solution to fill the gap in delivery of cardiac rehabilitation.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- [1] Piepoli, M.F., Corrà, U. and Dendale, P. (2016) Challenges in Secondary Prevention after Acute Myocardial Infarction: A Call for Action. *European Journal Preventive Cardiology*, **23**, 1994-2006. <https://doi.org/10.1177/2047487316663873>
- [2] Bethell, H.J. (2000) Cardiac Rehabilitation: From Hellerstein to the Millennium. *International Journal Clinical Practice*, **54**, 92-97. <https://doi.org/10.1054/chech.2000.0072>
- [3] Brown, T.M., Hernandez, A.F., Bittner, V., *et al.* (2009) Predictors of Cardiac Rehabilitation Referral in Coronary Artery Disease Patients: Findings from the American Heart Association's Get with the Guidelines Program. *Journal of the American College of Cardiology*, **54**, 515-521. <https://doi.org/10.1016/j.jacc.2009.02.080>
- [4] Grace, S.L., Tan, Y., Simpson, C., *et al.* (2012) Perceptions of Cardiac Specialists and Rehabilitation Programs Regarding Patient Access to Cardiac Rehabilitation and Referral Strategies. *Journal of Cardiopulmonary Rehabilitation and Prevention*, **32**, 135-140.
- [5] Gaziano, T.A., Bitton, A., Anand, S., *et al.* (2010) Growing Epidemic of Coronary Heart Disease in Low- and Middle-Income Countries. *Current Problems in Cardiology*, **35**, 72-115. <https://doi.org/10.1016/j.cpcardiol.2009.10.002>
- [6] Wenger, N.K. (2008) Current Status of Cardiac Rehabilitation. *Journal American College Cardiology*, **51**, 1619-1631. <https://doi.org/10.1016/j.jacc.2008.01.030>
- [7] Ades, P.A. (2001) Cardiac Rehabilitation and Secondary Prevention of Coronary Heart Disease. *New England Journal of Medicine*, **345**, 892-902. <https://doi.org/10.1056/NEJMra001529>
- [8] The BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation (2017) The Six Core Components for Cardiovascular Disease Prevention and Rehabilitation Supported by the British Association for Cardiovascular Prevention and Rehabilitation Is an Affiliated Group. 3rd Edition.
- [9] National Institute for Health and Care Excellence (2014) Cardiovascular Disease: Risk Assessment and Reduction, Including Lipid Modification: CG181. NICE, London. <https://www.nice.org.uk/guidance/cg181>
- [10] Clark, R.A., Conway, A., Poulsen, V., *et al.* (2015) Alternative Models of Cardiac Rehabilitation: A Systematic Review. *European Journal Preventive Cardiology*, **22**, 35-74. <https://doi.org/10.1177/2047487313501093>
- [11] Piepoli, M.F., Corrà, U., Adamopoulos, S., *et al.* (2014) Secondary Prevention in the Clinical Management of Patients with Cardiovascular Diseases. Core Components, Standards and Outcome Measures for Referral and Delivery: A Policy Statement from the Cardiac Rehabilitation Section of the European Association for Cardiovascular Prevention & Rehabilitation. Endorsed by the Committee for Practice Guidelines of the European Society of Cardiology. *European Journal Preventive Cardiology*, **21**, 664-681. <https://doi.org/10.1177/2047487312449597>
- [12] Beatty, A.L., Fukuoka, Y. and Whooley, M.A. (2013) Using Mobile Technology for Cardiac Rehabilitation: A Review and Framework for Development and Evaluation. *Journal of the American Heart Association*, **2**, e000568. <https://doi.org/10.1161/JAHA.113.000568>

- [13] Taylor, R.S., Dalal, H., Jolly, K., *et al.* (2015) Home-Based versus Center-Based Cardiac Rehabilitation. *Cochrane Database of Systematic Reviews*, **8**, CD007130. <https://doi.org/10.1002/14651858.CD007130.pub3>
- [14] Steg, G., James, S.K., Atar, D., *et al.* (2012) ESC Guidelines for the Management of Acute Myocardial Infarction in Patients Presenting with ST-Segment Elevation: The Task Force on the Management of ST-Segment Elevation Acute Myocardial Infarction of the European Society of Cardiology (ESC). *European Heart Journal*, **33**, 2569-2619. <https://doi.org/10.1093/eurheartj/ehs215>
- [15] Arena, R., Myers, J. and Guazzi, M. (2010) The Future of Aerobic Exercise Testing in Clinical Practice: Is It the Ultimate Vital Sign? *Future Cardiology*, **6**, 325-342. <https://doi.org/10.2217/fca.10.21>
- [16] Montalescot, G., Sechtem, U., Achenbach, S., *et al.* (2013) ESC Guidelines on the Management of Stable Coronary Artery Disease. *European Heart Journal*, **34**, 2949-3003. <https://doi.org/10.1093/eurheartj/ehs296>
- [17] NHS Improvement Heart (2013) Making the Case for Cardiac Rehabilitation: Modelling Potential Impact on Readmissions.
- [18] Mendis, S., Puska, P. and Norrving, B. (2011) Global Atlas on Cardiovascular Disease Prevention and Control. World Health Organization, Geneva. [http://whqlibdoc.who.int/publications/2011/9789241564373\\_eng.pdf](http://whqlibdoc.who.int/publications/2011/9789241564373_eng.pdf)
- [19] Lichtman, J.H., Bigger, J.T., Blumenthal, J.A., *et al.* (2009) AHA Science Advisory. Depression and Coronary Heart Disease. Recommendations for Screening, Referral, and Treatment. A Science Advisory from the American Heart Association Prevention Committee to the Council on Cardiovascular Nursing, Council on Clinical Cardiology, Council on Epidemiology and Prevention, and Interdisciplinary Council on Quality of Care Outcomes Research. *Progress in Cardiovascular Nursing*, **24**, 19-26.
- [20] Naci, H. and Ioannidis, J.P. (2013) Comparative Effectiveness of Exercise and Drug Interventions on Mortality Outcomes: Meta Epidemiological Study. *BMJ*, **347**, f5577. <https://doi.org/10.1136/bmj.f5577>
- [21] Selim, G. (2013) Cardiac Rehabilitation in Egypt. *Lancet Glob Health*, **1**, 72.
- [22] Ghisi, G.L., Polyzotis, P., Oh, P., *et al.* (2013) Physician Factors Affecting Cardiac Rehabilitation Referral and Patient Enrollment: A Systematic Review. *Clinical Cardiology*, **36**, 323-335. <https://doi.org/10.1002/clc.22126>
- [23] Balducci, S., Zanuso, S., Nicolucci, A., *et al.* (2010) Effect of an Intensive Exercise Intervention Strategy on Modifiable Cardiovascular Risk Factors in Subjects with Type 2 Diabetes Mellitus: A Randomized Controlled Trial: The Italian Diabetes and Exercise Study (IDES). *Archives of Internal Medicine*, **170**, 1794-1803. <https://doi.org/10.1001/archinternmed.2010.380>
- [24] Ades, P.A., Savage, P.D., Toth, M.J., *et al.* (2009) High-Calorie-Expenditure Exercise: A New Approach to Cardiac Rehabilitation for Overweight Coronary Patients. *Circulation*, **119**, 2671-2678. <https://doi.org/10.1161/CIRCULATIONAHA.108.834184>
- [25] Hammill, B.G., Curtis, L.H., Schulman, K.A., *et al.* (2010) Relationship between Cardiac Rehabilitation and Long-Term Risks of Death and Myocardial Infarction among Elderly Medicare Beneficiaries. *Circulation*, **121**, 63-70. <https://doi.org/10.1161/CIRCULATIONAHA.109.876383>
- [26] Janszky, I., Ahnve, S., Lundberg, I., *et al.* (2010) Early-Onset Depression, Anxiety, and Risk of Subsequent Coronary Heart Disease: 37-Year Follow-Up of 49,321 Young Swedish Men. *Journal of the American College of Cardiology*, **56**, 31-37.

- <https://doi.org/10.1016/j.jacc.2010.03.033>
- [27] Suaya, J.A., Stason, W.B., Ades, P.A., *et al.* (2009) Cardiac Rehabilitation and Survival in Older Coronary Patients. *Journal of the American College of Cardiology*, **54**, 25-33. <https://doi.org/10.1016/j.jacc.2009.01.078>
- [28] Eder, B., Hofmann, P., von Duvillard, S.P., Brandt, D., *et al.* (2010) Early 4-Week Cardiac Rehabilitation Exercise Training in Elderly Patients after Heart Surgery. *Journal of Cardiopulmonary Rehabilitation and Prevention*, **30**, 85-92. <https://doi.org/10.1097/HCR.0b013e3181be7e32>
- [29] Menezes, A.R., Lavie, C.J., Milani, R.V., *et al.* (2011) Psychological Risk Factors and Cardiovascular Disease: Is It All in Your Head? *Postgraduate Medicine*, **123**, 165-176. <https://doi.org/10.3810/pgm.2011.09.2472>
- [30] Milani, R.V. and Lavie, C.J. (2009) Reducing Psychosocial Stress: A Novel Mechanism of Improving Survival from Exercise Training. *The American Journal of Medicine*, **122**, 931-938. <https://doi.org/10.1016/j.amjmed.2009.03.028>
- [31] Milani, R.V., Lavie, C.J., Mehra, M.R., *et al.* (2011) Impact of Exercise Training and Depression on Survival in Heart Failure Due to Coronary Heart Disease. *The American Journal of Cardiology*, **107**, 64-68. <https://doi.org/10.1016/j.amjcard.2010.08.047>
- [32] World Health Organization. WHO Regional Office. <http://data.worldbank.org/region/ARB>
- [33] Turk-Adawi, K., Sarrafzadegan, N., *et al.* (2014) Global Availability of Cardiac Rehabilitation. *Nature Reviews Cardiology*, **11**, 586-596. <https://doi.org/10.1038/nrcardio.2014.98>
- [34] Australian Commission on Safety and Quality in Health Care (2016) Indicator Specification: Acute Coronary Syndromes Clinical Care Standard. ACSQHC, Sydney.
- [35] Wingham, J., Dalal, H.M., Sweeney, K.G., *et al.* (2006) Listening to Patients: Choice in Cardiac Rehabilitation. *European Journal of Cardiovascular Nursing*, **5**, 289-294. <https://doi.org/10.1016/j.ejcnurse.2006.02.002>
- [36] Buck, H.G., Harkness, K., Wion, R., *et al.* (2015) Caregivers' Contributions to Heart Failure Self-Care: A Systematic Review. *European Journal of Cardiovascular Nursing*, **14**, 79-89. <https://doi.org/10.1177/1474515113518434>
- [37] British Heart Foundation. European Cardiovascular Disease Statistics 2012. <http://www.bhf.org.uk/publications/statistics/european-cardiovascular-disease-statistics-2012>
- [38] Worldbank, Arab World. <http://data.worldbank.org/region/ARB>
- [39] Jabbour, S., Giacaman, R., Khawaja, M., *et al.* (2012) Public Health in the Arab World. Cambridge University Press, Cambridge.
- [40] Nooruddin, T., Matoon, A., Mansoor, F., *et al.* (2013) Effectiveness of Cardiac Rehabilitation Program in Reducing Cardiovascular Risk Factor and Improving Functional Capacity among Cardiac Patients in Kingdom of Bahrain. [Conference Abstract]. *The 23rd Australian Annual Cardiovascular Health and Rehabilitation Conference*, Melbourne, 12-14 August 2013.