



Physical exercise and quality of life in patients with cardiac disease

Herlina Wungouw

Department of Physiology, Sam Ratulangi University Faculty of Medicine, Manado

KEYWORDS *cardiac disease; psychological impact; exercise rehabilitation; quality of life*

ABSTRACT *Good quality of life (QoL) that includes physical function, mental and social functions is important for everyone. However, in human life, many things can affect QoL, such as physical and psychological impairments. The prevalent psychological impairments in cardiac patients are anxiety and depression. To overcome these impairments, comprehensive approaches need to be applied to enhance QoL of people, especially those who suffer from chronic diseases, such as cardiac survivors. Exercise rehabilitation, such as aerobic and resistance training, is one of the proper approaches to help cardiac patients overcoming the psychological deficit that accompanies cardiac diseases. It can reduce the level of anxiety and depression, reduce muscle tension, make the patient feel more relaxed, increase confidence and self-esteem in daily life. Physically, exercise contributes to the increase of maximum oxygen consumption, flexibility, strength and endurance of these patients. Training can maintain and enhance physical activity, ability to work and psychological well-being. All together, they are important factors determining the QoL.*

Changes in the management of patients with heart disease over time have given patients a chance to live longer. Therefore enhancing daily functioning and well-being tends to gain importance, relevance and meaning. Nowadays, the management of cardiac patients and other chronic diseases has shifted from quantity to quality of life (McEntee and Badenhop, 2000). This essay will focus on the quality of life (QoL) of cardiac patients who have been involved in exercise rehabilitation.

Definition of quality of life

Living longer has been an obsession of many people throughout history (Rooks and Kantrowitz, 2002). This should be accompanied by enhancing daily functioning and well-being. In recent years, the interest in the determination of QoL in people who suffer with chronic illness has increased significantly (Sintonen, 1994), such as in chronic pulmonary disease (Ries, 1995), multiple sclerosis (Sutherland, 2001) and cardiac disease (Rooks and Kantrowitz, 2002).

Currently, there are many concepts about the term QoL. Some define QoL as "the excellence of one's life as a whole". Ferrans and Powers defined QoL as "a person's sense of well-being that stems from satisfaction or dissatisfaction with the area of life that is important to him/her" (Shively and Wilson, 2001). QoL is a global construct with many objective and subjective dimensions, including the cultural, social, psychologic, interpersonal, spiritual,

economic, political and philosophical (Shively and Wilson, 2001).

Some authors prefer to focus the QoL on health. Oldridge defined health-related QoL as "multidimensional and incorporates the physical, psychological, and social domains with or without consideration of specific components, such as symptoms, role function, cognition, general health perception and economic factors" (Oldridge, 1997).

Factors that influence QoL

QoL is recognized as an important outcome in medical care (Santiago and Kaplan, 2004). Several factors can influence the patient's overall QoL such as personal perceptions, coping mechanisms and environmental constraints (Shepard, 2002). In addition, physical functions (mobility and ability for self-care), intellectual and emotional functions, opportunity for inter-personal contacts and intimacy; capability to perform a meaningful role in work place, the community and the home, feeling of well-being, comfort and self-efficacy, and the frequency and severity of symptoms are considered as other pertinent factors (Shepard and Franklin, 2001).

Correspondence :

Dr. Herlina Wungouw, Ms App Sc (Ex. Rehab), Department of Physiology, Sam Ratulangi University, Faculty of Medicine, North Sulawesi. Po Box 333 Manado 95115, Telephone 0431 841338, e-mail: herlinawungouw@yahoo.com

Assessment of QoL

Assessment of health status can be done objectively by using physiological measurement (fitness test, lung test, etc.). QoL, however, is based on an individual's expectation and belief about health, maximal functioning and ability to cope (Santiago and Kaplan, 2004).

Assessment of QoL is an important issue that needs to be addressed and it becomes important for measuring the impact of chronic diseases (Guyatt, Feeny *et al.*, 1993). Therefore several measurement techniques have been developed. The measurement techniques that will be chosen should have:

- (a) Reliability. This refers to the ability of an instrument to continuously differentiate between subjects (Guyatt, 1993). There are four methods that can be used to assess the reliability of an instrument; test-retest, alternative form, split halves and internal consistency method (DeVon and Ferrans, 2003).
- (b) Validity. This is an estimation of the extent to which a measurement tool accurately reflects what it intends to measure (Shepard, 2002; DeVon and Ferrans, 2003).
- (c) Sensitivity or responsiveness. This is the ability to detect small but important change (Guyatt, 1993; Sintonen, 1994) within subject over time (DeVon and Ferrans, 2003).

Reliability, validity and responsiveness provide a good response to subtle differences in a person's QoL. Unfortunately, no unified approach has been devised for measuring QoL and no ideal method has been found. Moreover, each approach has its strength and weakness (Guyatt, 1993; Gill and Feinstein, 1994). Generally speaking, QoL measure should include the assessment of physical function, psychological well-being, and social functioning (Pashkow, Ades *et al.*, 1995).

Instrument to determine QoL

Conceptual frameworks for the assessment of QoL have been developed by several authors. Ferrans proposed a model that includes health and functioning, psychological/spiritual, social and economic and family aspects in assessing QoL. A quite similar one was presented by Ferrel *et al.* that focused on physical well-being and symptoms, psychological well-being, and spiritual well-being. In psychological well-being they included sense of control, anxiety, depression, enjoyment or leisure, fear of recurrence, happiness, fear, cognition and attention. A conceptual model for QoL in the cardiovascular field was created by Wenger and

coworkers with an emphasis on functional capacity (daily routine, social, intellectual, emotional and economic), symptoms and perceptions (health status and life satisfaction) (DeVon and Ferrans, 2003).

In cardiac rehabilitation setting, instruments that have been used to determine QoL can be categorized as:

- (a). Gestalts-type measurement; early estimates of QoL such as *Karnofsky Index* expressed a single number finding (Shephard and Franklin, 2001) and *Standard Gamble* uses patient's perception to gain the description of QoL using a computer-generated tool (Shephard, Kavanagh *et al.*, 1998; Shephard and Franklin, 2001).
- (b). Disease/condition-specific measurement such as *Chronic heart failure questionnaire* (CHFQ) that examines dyspnea, fatigue and emotional function; *the Seattle Angina Questionnaire* for physical limitation, angina frequency, angina stability, satisfaction with the treatment and perceptions of the disease (Guyatt, 1993; Oldridge, 1997; Shephard and Franklin, 2001; DeVon and Ferrans, 2003); *the Minnesota Living with heart failure questionnaire* scores physical and emotional functions (Guyatt, 1993; Oldridge, 1997; Shephard and Franklin, 2001); *the Kansas City Questionnaire* measures physical limitation, symptoms, symptom stability, social limitation, self-efficacy, quality of life, overall functional status and clinical status (Shepard, 2002); and *the Mac New QoL after Myocardial Infarction Questionnaire (QLMI)* (Oldridge, 1997; DeVon and Ferrans, 2003).
- (c). Function specific instrument include *Profile of Mood State*, *Symptom-rating test*, *The psychological general well-being Index* (Shephard and Franklin, 2001).
- (d). Generic questionnaires (Shephard and Franklin, 2001; Shively and Wilson, 2001; Shepard, 2002) that explores a broad range of health elements and QoL such as *Medical Outcome Study Short-Form36* (MOS SF-36) questionnaire. It is a self administered questionnaire to survey health status and satisfaction (Brazier, Harper *et al.*, 1992; DeVon and Ferrans, 2003). MOS SF-36 measures 8 dimensions of health covering physical functioning, social functioning, role limitation due to physical problems, bodily pain, mental health, role limitation due to emotional problems, vitality and general health perception (Brazier, Harper *et al.*, 1992; Shephard and Franklin, 2001; DeVon and Ferrans, 2003); *the Sickness impact profile* consists of twelve categories

which are ambulation, mobility, body care, movement, social interaction, alterness behavior, communication, emotional, eating, work, home management and sleep (Guyatt, 1993); *the Nottingham scale* ; and *the QoL Index (QLI)* which is a comprehensive instrument designed to assess generic QoL in healthy population as well as those with illness. It consists of two parts which are satisfaction and importance and measures physical function such as ability to perform activities of daily living, the severity of symptoms, a visual analog assessment and psychological well-being aspect (Shephard and Franklin, 2001).

Documenting QoL changes require an appropriate instrument and needs better interpretation of QoL data (Engebretson, Clark *et al.*, 1999). The decision for choosing which instrument to use in a particular setting depends on the instrument's class, purposes and properties (Oldridge, 1997).

Psychological manifestation of cardiac diseases

People who suffer cardiac disease are faced with the prospect of changing their daily lives, depending on the severity and complexity of the disease (Pollock, Franklin *et al.*, 2000). The client may have a variety of physiological and clinical manifestations according to the kind of cardiac disease while the psychosocial manifestations are mostly the same for each cardiac disease. These cardiac conditions include acute myocardial infarction, angina pectoris, congestive heart failure, coronary artery by pass graft surgery (CABS), percutaneous transluminal coronary angioplasty pace maker and peripheral vascular disease (PVD) (Lavie and Milani, 1994).

The commonest physiological manifestation that may have a negative impact on the QoL of a cardiac client is the decreased functional capacity that occurs in all cardiac diseases (Shephard and Franklin, 2001). On the other hand, depression, anxiety, emotional distress, job strain, lack of energy, feeling of hopeless, loss of libido, helplessness, and hostility are psychological manifestations that are evoked in these specific clients (Blumenthal, 1985; Shephard and Franklin, 2001). Casen and Hackett used the term "ego-infarction" for these psychological impacts on cardiac patients (Blumenthal, 1985).

Anxiety is "the subjective experience of dread and foreboding that occurs in conjunction with unpleasant feelings of somatic tension, nervousness, apprehension and worry and activation of the autonomic nervous system" (Doerfler and Paraskos, 2004). Usually after acute myocardial infarction

(AMI) or other cardiac disease event, anxiety is the first emotional reaction evoked in patients. The causes of anxious thought include fear of death, apprehension of further damage, concern with the symptoms such as pain and dyspnea, and fear of being abandoned and isolated (Blumenthal, 1985). The signs of severe anxiety include chest discomfort or pain, dyspnea, cold sweat, upper body discomfort, lightheadedness or feeling faint (Santiago and Kaplan, 2004). Anxiety can be minimized with exercises that associated with increase in self- efficacy (Andersen and Sutherland, 2002).

Depression often persists and may last up to a year or more in cases where patients show fear of loss of income, loss of sexual function, and physical disability (Blumenthal, 1985). Depression is clearly having a detrimental effect on cardiac survivors even in minimal level. After an AMI, about 20-45% clients suffer from significant level of depression (Herridge, Stimler *et al.*, 2005). They had about four times increase in mortality (Milani and Lavie, 1998; Santiago and Kaplan, 2004) and higher rate of infarction and re-hospitalization (Milani, Littman *et al.*, 1993; Milani and Lavie, 1998), experience sexual difficulties and remain out of work (Milani, Littman *et al.*, 1993).

Moreover, depression can affect biological factors and is manifested as ventricle irritability, low heart rate variability and increase risk of cardiac events (Herridge, Stimler *et al.*, 2005; Pasternak, 2005). Herridge and colleagues stated that the impact of depression on QoL and productivity of patient after AMI is more impressive (Herridge, Stimler *et al.*, 2005).

In addition to anxiety, life stress, fatigue or vital exhaustion, lack of energy, feeling of hopeless, loss of libido and hostility, depression has been shown to influence cardiovascular disease outcome (Pasternak, 2005). In a rehabilitation program, the level of depression may affect the patient's ability to follow and adhere to the program.

Exercise, QoL and psychological changes in cardiac patients

A cardiac rehabilitation (CR) program is designed to enhance the psychological effects of cardiac disease, reduce the risk of sudden death or re-infarction, stabilize or reserve the atherosclerotic process and enhance the psychosocial states as well (Brannon, Foley *et al.*, 1998).

Some researchers pointed out that the major objective of CR is to enhance health related QoL (Oldridge, Guyatt *et al.*, 1988; Shephard and Franklin

2001; Todaro, Shen *et al.*, 2004) by improving work capacity, decreasing coronary risk factors and increasing the return to work rate (Pashkow, Ades *et al.*, 1995). Pasternak mentioned exercise remained a central part of modern CR. Additionally, exercise-based CR reduced both total and cardiac mortality by 20-25 % in 4500 patients (Pasternak, 2005).

Researchers have reported that psychological functioning improves when the client participates in CR. Specifically, investigators have demonstrated that exercise positively influences physical functioning, emotional well-being, life satisfaction and improves QoL. It is simply that when anxiety and depression decrease, the QoL may be enhanced (Moser and Dracup, 2001). According to Shephard, the QoL can be enhanced by decreasing specific symptoms, augmenting functional capacity, and enhancing mood state (Shephard, Kavanagh *et al.*, 1998).

Myocardial infarction

Measuring psychological variables in cardiac patients are important because of mental depression and social isolation related to an increase in mortality rate (Ades and Coello, 2000). The benefit of exercise training in reducing psychological symptoms in myocardial infarct patients has been reported in the late of 60s. In an uncontrolled study, the level of depression reduced 15% following active conditioning upon cardiac patients. Additionally, minimal-treatment swimming intervention changed favorably the mood, anxiety, and sense of well-being compared to the control group (Blumenthal and Emery, 1988).

Other investigators examined the different QoL outcomes between the comprehensive CR which includes exercise intervention and behavioral counseling and conventional care. After 8 weeks of the program, there was a significantly greater improvement in the emotion dimension, state of anxiety and exercise tolerance (Oldridge, Guyatt *et al.*, 1991).

Yu and associates found that QoL, measured by 6 of 8 MOS-SF 36 dimensions in 269 patients (193 with recent AMI, 76 with percutaneous coronary intervention), increased significantly by phase 2 of rehabilitation and was maintained during the study period compared with the control group (Yu, Lau *et al.*, 2004). The patients felt more relaxed and less depressed which led to commitment to attend exercise sessions and perform the exercise seriously.

Congestive heart failure

In congestive heart failure (CHF) patients, Belardinelli *et al* used Minnesota Living with HF

questionnaire as a measurement tool in their research. QoL of 99 patients (50 in training group and 49 in control group) was measured at baseline, 2, 14, 26 months in both groups. After two months, the finding showed significant increase of the questionnaire score for QoL in training group and remained stable until the last test. They concluded that sustained increase in functional capacity and quality of life in patient with CHF were caused by long-term moderate exercise training (Belardinelli, Georgiou *et al.*, 1999).

A randomized controlled trial study with three months follow up by Kostis *et al* found the group with multimodal non-pharmacology therapy (exercise, dietary control and cognitive-behavioral group therapy) has a better impact on QoL. It was characterized by 52% increase in depression and 39 % in anxiety scores measured by Beck depression Inventory and Hamilton Anxiety Depression Scale. The kinds of exercises performed in this study were walking, rowing, cycling and stair climbing, 3-5 times/week at heart rate 40-60% of functional capacity (Kostis, Smith *et al.*, 2001).

On the other hand, some investigations found controversial results regarding the effect of exercise on QoL domain. Tyne *et al* in hospital-based outpatient research investigated the effect of skeletal muscle endurance training in CHF women with regard to peripheral oxidative capacity, exercise tolerance and health-related QoL. They found there were no significant differences at baseline and during the study period between training and non-training groups in those matters (Tyni-Lenne, Gordon *et al.*, 1997; Moser and Dracup 2001). Another study reported no differences in Sickness Impact Profile score after three months randomized training programs in men (Moser and Dracup, 2001). Thirty three CHF clients with New York Heart Association (NYHA) class II (36%) and class III (64%) both sexes followed the supervised-graded aerobic exercise (cycling and treadmill) 3-5 times /week. Result failed to show significant change in QoL, depression or functional status score measured by Minnesota Living with HF questionnaire, CES-D (depression's measurement) and functional status assessment (Moser and Dracup, 2001). Whether the measurement tool, gender or number of subjects affected the results need to be explored further.

Most of the studies in exercise and heart failure were done in supervised-hospital rehabilitation settings. Recently, Oka *et al* evaluated the impact of home-based walking and resistance training programs on QoL in CHF patients. Forty CHF

volunteers were recruited and randomized into two groups. The test was conducted at baseline and after three months exercise intervention. The training group showed improve fatigue ($p=0.02$), emotional function ($p=0.01$) and mastery ($p=0.04$) (Oka, De Marco *et al.*, 2000). This research affirmed that stable CHF patients can perform exercise at home and gain the benefit in both physical and psychological domains.

Coronary artery disease and bypass graft surgery

Approximately 80% of all cardiac related deaths are due to arteriosclerosis that narrows the coronary arteries (Tirrell and Hart, 1980). Coronary Artery Bypass Graft Surgery (CABS) alleviates angina pectoris and improves life expectancy in coronary artery disease (CAD) patients (Engblom, Korpilahti *et al.*, 1997). According to Tirrel *et al.*, after cardiac by pass surgery, most of the patients will survive for at least six years (Tirrell and Hart, 1980). Unfortunately, anxiety and depression may accompany one third of them (Engblom, Korpilahti *et al.*, 1997). Other psychological findings in clients that have coronary artery bypass graft surgery include anxiety around the time of surgery, difficulty processing and retaining information during hospitalization, and a moderate decrease in sexual activity. Therefore, CR is arranged to relieve symptoms, increase physical capacity, working ability and psychosocial well-being (Engblom, Korpilahti *et al.*, 1997). In addition, exercise conditioning program becomes an important key to strengthening the cardiac muscle and maintaining maximum physical fitness (Tirrell and Hart, 1980). Other benefits that can be expected in long term graft survivors who were involved in CR include early return to activity in daily living and higher return to work rate (Engblom, Korpilahti *et al.*, 1997; Kostis, Smith *et al.*, 2001).

Other considerations

Women

Women with CAD have been reported as differing from their male counterparts with regard to exercise capacity and psychosocial characteristics (Todaro, Shen *et al.*, 2004). A gender-specific measurement for QoL in cardiac clients was investigated in some research. Lavie reported women were less likely to experience reductions in depression immediately after CR (Lavie and Milani, 1995). However, improvement in anxiety scores and somatisation scores are statistically significant (Lavie, Milani *et al.*, 1995).

Furthermore, McEntee et al proved despite men having higher QoL scores than women when starting CR, women showed greater improvement than men by the end of the thirty six therapy sessions (McEntee and Badenhop, 2000). The degree of benefit of exercise to QoL between the sexes, however, is difficult to conclude due to the limited number of study reporting QoL and sex differences in CR outcome (Todaro, Shen *et al.*, 2004).

Elderly

Recognition of depression in elderly cardiac clients has some degree of difficulty due to the similarity of symptoms of depression with organic illness. Milani and associates found some co morbidities condition that can be used to screen the cardiac survivors that suffer from depression. These co-morbidities that help to identify depression among cardiac patients include reduce functional capacity, lower high density lipoprotein, higher level of anxiety, hostility, somatization, pain, and decrease in QoL scores (Milani and Lavie, 1998).

Previously, data showed that elderly (≥ 65 years old) were not frequently referred to CR. In fact, Milani et al proved that following CR, there was a 57% reduction in depression and a 32 % increase in QoL (Milani and Lavie, 1998). Recent experiment conducted by Lavie and colleagues reported that 268 elderly had improvements in validated scores for anxiety, depression and somatization by 40%, 40%, and 33% respectively following CR (Lavie and Milani, 2004).

Very elderly clients categorized as > 75 or 80 years old were evaluated in one study. CHF men showed dramatic and statistical increase in anxiety score (66%), somatization (42%), depression (56%) hostility (65%) and the total QoL score (20%) (Lavie and Milani, 1995). The same issue was reported in women by Hung et al. Older women with CAD have 26-45% lower peak oxygen consumption (VO₂ peak) than age matched healthy sedentary or active women (Hung, Daub *et al.*, 2004). This can affect their independent daily living and overall QoL. Even, Kavagnah and colleagues reported that a 1ml/kg/min decrease of VO₂ peak related to 10% therefore increasing the mortality rate of older women with CAD (Hung, Daub *et al.*, 2004). Exercise intervention, however, will reverse the decrease in VO₂ peak and muscle strength and as a result there is an improvement in QoL. Combined strength and aerobic training led to significant increase in exercise capacity, lower extremity strength, emotional and

global QoL measured by the Mac New Heart Disease Health-related QoL (Hung, Daub *et al.*, 2004).

Mode of exercise

Exercise may be defined as "any form of leisure activity that is undertaken for a specific purpose, such as the improvement of health, the increase of physical fitness and the extension of life span" (Shepard, 2002). Even though aerobic exercise training is still the corner stone of most CR program, the new paradigm developed in recent years argues for the benefit of resistance training in cardiac survivors. The use of resistance in CR has been argued previously for fear of inducing adverse effects such as elevated blood pressure, heart rate, myocardial oxygen demand and adverse effect on ventricular remodeling and performance (Vescovi and Fernhall, 2000).

Much research, however, have demonstrated that weight training is safe and effective in well screened and low to moderate cardiac risk patients (Pollock, Franklin *et al.*, 2000). Research by Beniamini *et al.*, witnessed the strength-trained group increase their self-efficacy score for lifting, push-ups, climbing and jogging compared to flexibility-trained group. The latest group has lower score in total mood disturbance, depression and fatigue than strength group (Beniamini, Rubenstein *et al.*, 1999). Resistance training plays a significant role in improving and shaping patient's self esteem and ability to perform daily tasks.

Another issued in strength training is intensity. Low to moderate intensity of strength training is safe and effective in cardiac patients. Then, Beniamini and associates reported that supervised high-intensity strength training was also safe when it was performed together with aerobic training. This intervention resulted in a significant increase in strength and endurance as well as improved body composition and maximum treadmill exercise time (Beniamini, Rubenstein *et al.*, 1997).

Self efficacy

Self efficacy is an important determinant of behavior, including actual attempts and persistence of behavior before giving up (Santiago and Kaplan, 2004). It can be influenced by prior performance, vicarious experience, verbal persuasion, and physiological state (Vescovi and Fernhall, 2000). Low exercise efficacy may impair exercise compliance especially in a non-supervised exercise program. Together with social support, self-efficacy has been shown to be an important predictor of exercise

behavior in cardiac patients (Carlson, Norman *et al.*, 2001). Study indicated that exercise and self-efficacy may reduce the anxiety of patients (Andersen and Sutherland, 2002).

CONCLUSION

Quality of life is one important outcome in a CR program. It can be measured by gestalts measurement, disease/condition-specific measurement and general measurement. These measurements should have validity, reliability and sensitivity. The most prevalent psychological symptoms that accompany cardiac survivors are anxiety and depression that affect QoL in most cardiac patients. Exercise regimen, both aerobic and resistance training, have been proven increase fitness level and psychological well-being and so improve QoL of cardiac patients.

SUGGESTION

Rehabilitation practitioners who run the exercise program and handle these specific patients need to be aware of the psychological symptoms that are shown by patients. They also need to have basic knowledge to recognize earlier the psychological problems evoked in their patients so they can provide the appropriate program for their patients.

REFERENCES

- Ades PA and CE Coello 2000. "Effects of exercise and cardiac rehabilitation on cardiovascular outcomes." Med Clin North Am 84(1): 251-65, x-xi.
- Andersen M and G Sutherland 2002. Working out those tensions: exercise and the reduction of stress. Medical and Psychological Aspects of Sport and Exercise. D. Mostofsky and L. Zaichkowsky. Morgantown, Fitness Information Technology: 19-32.
- Belardinelli RD, Georgiou, *et al.* 1999. "Randomized, controlled trial of long-term moderate exercise training in chronic heart failure: effects on functional capacity, quality of life, and clinical outcome." Circulation 99(9): 1173-82.
- Beniamini Y, JJ Rubenstein, *et al.* 1999. "High-intensity strength training of patients enrolled in an outpatient cardiac rehabilitation program." J Cardiopulm Rehabil 19(1): 8-17.
- Blumenthal JA 1985. "Psychologic Assessment in Cardiac Rehabilitation." JCR 5: 208-215.
- Blumenthal JA and CF Emery 1988. "Rehabilitation of patients following myocardial infarction." J Consult Clin Psychol 56(3): 374-81.

- Brannon F, M Foley, *et al.* 1998. Cardiopulmonary rehabilitation. Philadelphia, FA Davis Company.
- Brazier JE, R Harper, *et al.* (1992). "Validating the SF-36 health survey questionnaire: new outcome measure for primary care." BMJ **305**(6846): 160-4.
- Carlson JJ, GJ Norman, *et al.* (2001). "Self-efficacy, psychosocial factors, and exercise behavior in traditional versus modified cardiac rehabilitation." J Cardiopulm Rehabil **21**(6): 363-73.
- DeVon HA and CE Ferrans 2003. "The psychometric properties of four quality of life instruments used in cardiovascular populations." J Cardiopulm Rehabil **23**(2): 122-38.
- Doerfler LA and JA Paraskos 2004. "Anxiety, posttraumatic stress disorder, and depression in patients with coronary heart disease: a practical review for cardiac rehabilitation professionals." J Cardiopulm Rehabil **24**(6): 414-21.
- Engblom E, K Korpilahti, *et al.* 1997. "Quality of life and return to work 5 years after coronary artery bypass surgery. Long-term results of cardiac rehabilitation." J Cardiopulm Rehabil **17**(1): 29-36.
- Engelbreton T, M Clark, *et al.* 1999. "Quality of life and anxiety in a phase II cardiac rehabilitation program." Medicine and Science in sport and exercise **31**(2): 216-22.
- Gill TM and AR Feinstein 1994. "A critical appraisal of the quality of quality-of-life measurements." JAMA **272**(8): 619-26.
- Guyatt GH 1993. "Measurement of health-related quality of life in heart failure." J Am Coll Cardiol **22**(4 Suppl A): 185A-191A.
- Guyatt GH, DH Feeny, *et al.* 1993. "Measuring health-related quality of life." Ann Intern Med **118**(8): 622-9.
- Herridge ML, CE Stimler, *et al.* (2005). "Depression screening in cardiac rehabilitation: AACVPR Task Force Report." J Cardiopulm Rehabil **25**(1): 11-3.
- Hung C, B Daub, *et al.* 2004. "Exercise training improves overall physical fitness and quality of life in older women with coronary artery disease." Chest **126**(4): 1026-31.
- Kinchla J and T Weiss 1985. "Psychologic and social outcomes following coronary artery bypass surgery." JCR **5**: 274-283.
- Kostis J, KM Smith, *et al.* 2001. "Changes in exercise capacity and lipids after clinic versus home-based aerobic training in coronary artery bypass graft surgery patients." J Cardiopulm Rehabil **21**(1): 31-6.
- Lavie CJ and R Milani 2004. "Benefits of cardiac rehabilitation in the elderly." Chest **126**(4): 1010-2.
- Lavie CJ and RV Milani 1994. "Patients with high baseline exercise capacity benefit from cardiac rehabilitation and exercise training programs." Am Heart J **128**(6 Pt 1): 1105-9.
- Lavie CJ and RV Milani 1995. "Effects of cardiac rehabilitation and exercise training on exercise capacity, coronary risk factors, behavioral characteristics, and quality of life in women." Am J Cardiol **75**(5): 340-3.
- Lavie CJ and RV Milani 1995. "Effects of cardiac rehabilitation programs on exercise capacity, coronary risk factors, behavioral characteristics, and quality of life in a large elderly cohort." Am J Cardiol **76**(3): 177-9.
- Lavie CJ, RV Milani, *et al.* (1995). "Cardiac rehabilitation, exercise training, and preventive cardiology research at Ochsner Heart and Vascular Institute." Tex Heart Inst J **22**(1): 44-52.
- McEntee DJ and DT Badenhop 2000. "Quality of life comparisons: gender and population differences in cardiopulmonary rehabilitation." Heart Lung **29**(5): 340-7.
- Milani R, AB Littman, *et al.* (1993). "Depressive symptoms predict functional improvement following cardiac rehabilitation and exercise program." JCR **13**: 406-411.
- Milani RV and CJ Lavie 1998. "Prevalence and effects of cardiac rehabilitation on depression in the elderly with coronary heart disease." Am J Cardiol **81**(10): 1233-6.
- Moser D and K Dracup 2001. Impact of Nonpharmacologic Therapy on Quality of Life in Heart Failure. Improving Outcomes in heart F References
- Oka RK, T De Marco, *et al.* 2000. "Impact of a home-based walking and resistance training program on quality of life in patients with heart failure." Am J Cardiol **85**(3): 365-9.
- Oldridge N, G Guyatt, *et al.* 1991. "Effects on quality of life with comprehensive rehabilitation after acute myocardial infarction." Am J Cardiol **67**(13): 1084-9.
- Oldridge NB 1997. "Outcome assessment in cardiac rehabilitation. Health-related quality of life and economic evaluation." J Cardiopulm Rehabil **17**(3): 179-94.
- Oldridge NB, GH Guyatt, *et al.* 1988. "Cardiac rehabilitation after myocardial infarction. Combined experience of randomized clinical trials." Jama **260**(7): 945-50.
- Pashkow P, PA Ades, *et al.* 1995. "Outcome measurement in cardiac and pulmonary rehabilitation. AACVPR Outcomes Committee. American Association of Cardiovascular and Pulmonary Rehabilitation." J Cardiopulm Rehabil **15**(6): 394-405.
- Pasternak R 2005. Comprehensive Rehabilitation of Patients with Cardiovascular disease. Braunwald's Heart Disease. D. Zipes, P. Libby, R. Bonow and E. Braunwald. Philadelphia, Elsevier Saunders. **7**: 1085-1100.
- Pollock ML, BA Franklin, *et al.* 2000. "AHA Science Advisory. Resistance exercise in individuals with and without cardiovascular disease: benefits, rationale, safety, and prescription: An advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine." Circulation **101**(7): 828-33.
- Ries A 1995. "Effects of pulmonary rehabilitation on physiologic and psychosocial outcomes in patients with chronic obstructive pulmonary disease." Annals of internal medicine **122**(11): 823-832.
- Rooks D and F Kantrowitz 2002. Exercise and longevity. Medical and Psychological Aspects of Sport and

- Exercise. D. Mostofsky and L. D. Zaichkowsky. Morgantown, Fitness Information Technology: 73-82.
- Santiago P and R Kaplan 2004. Cardiovascular and respiratory condition. Psychology in the physical and manual therapy. G. Kolt and M. Andersen. Sydney, Churchill Livingstone: 225-246.
- Shepard J 2002. Importance of sport and exercise to Quality of life and longevity. Medical and Psychological Aspects of Sport and Exercise. D. Mostofsky and L. Zaichkowsky. Morgantown, Fitness Information Technology: 1-19.
- Shephard RJ and B Franklin 2001. "Changes in the quality of life: a major goal of cardiac rehabilitation." J Cardiopulm Rehabil **21**(4): 189-200.
- Shephard RJ, T Kavanagh, *et al.* 1998. "On the prediction of physiological and psychological responses to aerobic training in patients with stable congestive heart failure." J Cardiopulm Rehabil **18**(1): 45-51.
- Shively M and I Wilson 2001. Health-Related Quality of Life Outcomes in Heart Failure: A conceptual Model. Improving Outcomes in heart Failure: An Inter-disciplinary Approach. D. Moser and B. Riegel. Maryland, Alpen Publisher: 18-30.
- Sintonen H 1994. The 15-D measure of health-related quality of life: reliability, validity, and sensitivity of its health state description system. Melbourne.
- Sutherland G 2001. The effect of exercise and autogenic training on the psychological well-being and health-related QoL of people with multiple sclerosis. Melbourne, Victoria University.
- Tirrell BE and LK Hart 1980. "The relationship of health beliefs and knowledge to exercise compliance in patients after coronary bypass." Heart Lung **9**(3): 487-93.
- Todaro JF, BJ Shen, *et al.* 2004. "Do men and women achieve similar benefits from cardiac rehabilitation?" J Cardiopulm Rehabil **24**(1): 45-51.
- Tyni-Lenne R, A Gordon, *et al.* 1997. "Skeletal muscle endurance training improves peripheral oxidative capacity, exercise tolerance, and health-related quality of life in women with chronic congestive heart failure secondary to either ischemic cardiomyopathy or idiopathic dilated cardiomyopathy." Am J Cardiol **80**(8): 1025-9.
- Vescovi J and B Fernhall 2000. "Cardiac Rehabilitation and resistance training: are they compatible?" Journal of strength and conditioning research **14**(3): 350-358.
- Yu CM, CP Lau, *et al.* 2004. "A short course of cardiac rehabilitation program is highly cost effective in improving long-term quality of life in patients with recent myocardial infarction or percutaneous coronary intervention." Arch Phys Med Rehabil **85**(12): 1915-22.