Cost-analysis of gym-based versus home-based cardiac rehabilitation programs

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Abstract

A cost-analysis of an existing gym-based program was compared with a proposed home-based program for delivering cardiac rehabilitation services in West Moreton, Queensland. Cost and baseline data were collected on 95 cardiac rehabilitation patients living in Ipswich and West Moreton. Cost data included costs to the program funders and patients. The average cost per patient rehabilitated was $1,933 in the gym-based program and $1,169 in the home-based program. Adopting the lower cost home-based program would allow the services to be provided to many more patients. The relevance of home-based rehabilitation programs for rural patients facing barriers accessing traditional hospital- or gym-based programs is significant.

Introduction

Cardiac rehabilitation following cardiac events that require hospital inpatient treatment is becoming widely accepted as an important approach to modify coronary risk factors. Cardiac rehabilitation usually includes a multidimensional program of exercise, health education and counselling to promote behaviour changes. Participation in cardiac rehabilitation programs has demonstrated improvements in physiological functioning (Haskwell *et al.*, 1994), quality of life and risk factor profiles (Oldridge *et al.*, 1991, Linen *et al.*, 1996), and reductions in cardiac mortality rates (O'Connor *et al.*, 1989), psychological stress (Dracup *et al.*, 1991), hospital readmissions and associated costs (Oldridge *et al.*, 1993, Ades et al., 1992). Recognised as best practice among national and international agencies cardiac rehabilitation should be routinely available to everyone with cardio-vascular disease (CVD) whom may benefit. However, outpatient cardiac rehabilitation is available to a relatively small proportion (15-32%) of eligible patients in both Australia and overseas (Bondestam *et al.*, 1995, Bunker *et al.*, 1999, King *et al.*, 1999). Reasons for this include a limited availability of places in cardiac rehabilitation programs and low referral rates from physicians (Scott *et al.*, 2000).

Hospitals, community health centres and Divisions of General Practice typically supply structured, cardiac rehabilitation outpatient services throughout Australia. Other researchers have suggested that alternative home-based cardiac rehabilitation models could be equally effective and more economical than hospital-based programs (Miller et al., 1996, Kugler *et al.*, 1990).

The aim of this analysis is to estimate the least-cost approach of providing cardiac rehabilitation services. This analysis is conducted on the Ipswich and West Moreton Cardiac Rehabilitation Service that provides an outpatient program for cardiac patients consisting of supervised exercise, education and counselling strategies

for risk factor modification. The least-cost method of delivering cardiac rehabilitation in West Moreton is estimated by comparing the costs and numbers of rehabilitated patients for the existing gym-based and a proposed home-based program.

Description of the programs

The Ipswich and West Moreton gym-based program is provided collaboratively by private and public organisations, and is directed by a multidisciplinary team of health professionals. This service was provided to a maximum of 95 patients during 1998. However, the need or demand for the service in the West Moreton District was far greater and conservatively estimated at 600 patients who could have potentially benefited (Smith, L.-A. personal communication, 12 March 1999). The Ipswich and West Moreton Division of General Practice (IWMDGP) manage the program and provide the majority of funds. There are three separate components of the gym-based program; the outpatient (phase II) gym program involving four 75 minute sessions per week, ongoing maintenance (phase III) gym, and walking programs of various timeframes. These components are offered upon completion of the inpatient (phase I) program conducted in hospital and are subject to medical assessment. Table 1 provides the structural details of the Ipswich and West Moreton gym-based program.

The home-based cardiac rehabilitation program used here is based on the MULTIFIT model, which has operated extensively in Northern California, USA (Miller et al., 1996). Five-year clinical results have shown it to be a feasible approach with similar outcomes to hospital-based cardiac rehabilitation in terms of functional cardiac capacity, smoking cessation and lowered cholesterol levels (Miller et al., 1996). In this study, we simulated a home-based program based on the MULTIFIT model and adapted it to West Moreton conditions for resource usage and patient characteristics.

Both gym-based and home-based modes of delivery offer comprehensive rehabilitative care by encompassing exercise, risk modification and psychosocial counselling (Table 1). Other similarities include having individualised patient management care plans for low-, moderate- and high-risk patients, the encouragement of family members and friends in outpatient rehabilitative processes, and a similar recommended time after hospital discharge to begin the alternative programs (i.e. three to four weeks). Both modes are thought to be considerably more effective than usual medical care, or General Practitioner (GP) visits, at restoring patient health and wellbeing (Miller et al., 1996).

Table 1. Structural Differences of the West Moreton Gym-Based Program and the Proposed Home-Based MULTIFIT Program

Features	West Moreton Program	MULTIFIT Program
Duration	8 weeks outpatient gym component, optional ongoing gym and/or walking components - total timeframe indeterminate	12 months
Personnel	Multidisciplinary team of GPs, rehabilitation co-ordinator, nurses, dietician, physiotherapist, psychologist, and exercise physiologist	Nurse Case Manager as the single caregiver making referrals to other health professionals where appropriate
Supervision	Direct monitoring by the attending health professional team during gym sessions e.g. one GP plus one nurse per 10 participants	Self-monitoring and indirect monitoring by nurse case manager
Location	Hospital-owned building	Patient's home
Exercise type	Gym-based cardiovascular exercises and weights	Walking program
Risk factor modification	Group education/support sessions and educational materials	Intensive nurse manager phone contacts and home visits, education materials, and videotapes
Computer technology	Used for monitoring a patient database and management	Used for managing patients, linking to hospital patient records, obtaining primary physician progress reports and generating nutritional menus, recipes and advice for monitoring patient diets
Exercise Test	Prerequisite	Prerequisite and second testing at 6 months

Sources: Miller et al., 1996, IWMDGP records

Method

A cost-analysis was undertaken to compare the existing gym-based program with a proposed home-based program. For the two programs, costs were identified from the perspectives of the service providers, the health care system and the patients attending. These costs included prerequisite costs (exercise stress test), program operating costs, program establishment costs and some patient costs. Information sources of these costs were provided in the financial records of the IWMDGP, consultation with the cardiac rehabilitation co-ordinator, private suppliers of medical and gym equipment, Royal Automobile Club of Queensland (RACQ) and health information managers located at a local university and hospital. Assumptions and judgements were made for some costs due to the uncertainty and unavailability of exact cost data. Therefore, the results in this analysis are tested over a range of plausible values based on combinations of the most to least conservative estimates in a sensitivity analysis.

Gym-based program

Over 20 randomised trials conducted throughout the world on gym-supervised cardiac rehabilitation programs were reviewed by Oldridge et al. (1988) and O'Connor et al. (1989). They concluded all-cause mortality, cardiac mortality and non-fatal reinfarction decreased by 20-25% over three-years. The consistency of findings from smaller and longer-term follow-up studies substantiate exercise-based rehabilitation in reducing mortality and have convinced the medical fraternity of enhanced survival and reduced morbidity following cardiac rehabilitation.

In the West Moreton gym-based program, an exercise stress test is a prerequisite for attending cardiac rehabilitation and is used by physicians and other health professionals as a management tool for assessing

individual risk levels and subsequent exercise prescriptions. The cost of this test was assumed to be equal to the scheduled fee paid by Medicare under the 1998 Medicare Benefits Schedule. Program operating costs include personnel, variable purchases of equipment, administration, production of educational materials and emergency pharmaceuticals. The health professionals involved in the program include a rehabilitation co-ordinator, nurses, GPs, a dietician, an exercise physiologist, physiotherapists, a psychologist, a manager and a cardiac rehabilitation advisory group. Administration and infrastructure inputs include the production of resource and educational materials, catering, insurances, professional development, printing, office administration support, telephone, rent of IWMDGP office, stationery, postage and other incidentals. The gym facility operates within a building owned by District Health Services (Queensland Health) and its rental cost including electricity was obtained from IWMDGP.

Total capital costs paid by IWMDGP when the program was established are apportioned to specific gym equipment, medical supplies and teaching apparatus and their values have been estimated including equipment loaned (at no charge) by District Health Services. Annual equivalent costs have been calculated which depreciate the initial capital costs over the useful life of the asset. The useful life of the assets were assumed here to be 5 years and, as recommended by the Australian Taxation Office, a 27% discount rate was used (ATO 1998, Drummond *et al*., 1997).

Patient costs involve costs incurred travelling to and from the gym facility plus the opportunity cost of time forfeited to attend the program. Travelling time to and from the gym facility was determined from RACQ data on travelling distances and road speed limits. Street directories and maps were used to estimate distance between the suburb/town centroid and gym to the closest 0.25 kilometre (km) (Hyndman *et al*., 1999). Outer city suburbs and rural location distances were estimated from road maps and confirmed with the RACQ. The cost per km travelled was obtained from the RACQ five-year average car running costs for Queensland (RACQ, personal communication 1999).

The opportunity cost of attending the program was assumed to be cost of leisure time forfeited. This assumption was used because the majority of patients are retired or unable to work because of their health. The quantity of leisure time allocated to the program during 1998 was estimated using patient attendance numbers and their time spent at outpatient and maintenance programs. Total time also accounts for patient non-completions and the proportion of patients who continue through into maintenance programs. For the purpose of this evaluation, a 12-week period for the maintenance gym and walking programs was assumed although these involve indeterminate durations depending on individual patient preferences or requirements. This assumption is tested over different time periods in the sensitivity analysis. Although productivity losses were not addressed here, incomes were used to value leisure time and acknowledge opportunity costs to patients. Using 1996 Census data on the Ipswich and West Moreton population, 50% of the average income listed for each age bracket was used. A proportion of average income was chosen because it is argued that average incomes are thought to be an overestimation of leisure time costs (Drummond et al., 1997).

Home-based program

Several studies have tested the efficacy of home-based programs and compared the home-based, gym-based and usual care alternatives. Home-exercise training was found to be as effective on aerobic fitness and cardiac function as hospital group-based exercise in several randomised control trials (Miller *et al*., 1984, De Busk *et al*., 1985, De Busk et al., 1994).

Using market values and converting to annual equivalent costs at the same rates used for the gym-based program, establishment costs for the proposed home-based program involved an office computer system with a modem to link into hospital and physician records, a nutritional software program, and heart rate monitors loaned to participants. Personnel costs included the salary of the nurse case manager and were based on the current Queensland nursing salary scales.

Administration costs were forecast to be more than the current gym-based program due to increased participants and use and production of written and video educational materials for home use. Maintenance and running costs of the nurse manager's vehicle for scheduled home visits is an additional administration cost

for this program and this was extrapolated from travelling costs established earlier. For practical reasons, the nurse manager would do 'rounds' on several patients living in neighbouring suburbs or outer areas to make the most efficient use of time and assumptions are made to include this factor. Some infrastructure costs including administration support, telephone, stationery and postage were increased to accommodate increased patient numbers.

In a home-based program, patients would not have to attend a gym facility, and therefore, no attendance costs would be incurred. Patients would need to travel to a medical facility (in Ipswich) for the second stress test and this cost, based on average distance travelled and travelling time, is factored into patient costs. An indeterminate quantity of time is required per patient to undergo exercising, educating and counselling (phone and home visits) components. The total investment of time per week for these activities was based on the MULTIFIT program and the existing program input time (Miller *et al.*, 1996). Like before, the dollar value used was 50% of the average wage rate for this local population.

Cost-savings from hospital readmissions averted

Several randomised control trials have found lower frequency of readmission to hospital, length of hospital stay and costs associated with patients attending cardiac rehabilitation (Picard *et al.*, 1989, Oldridge *et al.*, 1993, Ades *et al.*, 1992, Bondestam *et al.*, 1995). The value of hospital readmissions averted is a benefit to the health care system (through cost savings) and to patients of cardiac rehabilitation. The West Moreton Cardiovascular Outcomes Project (Westcop) involves a study organised by the West Moreton Public Health Unit to collect data on a cohort of patients who attended Ipswich and St Andrews Hospitals following myocardial infarction and/or unstable angina (Scott *et al.*, 2000). A group of 94 Westcop participants followed up at 18 months was available for analysing hospital readmissions averted. Selected variables from patient charts and computer records including specific details relating to admission history, length of stay, principal diagnosis and Australian Diagnostic Related Groups (AN-DRGs) were obtained.

Differences in readmission rates between rehabilitated and non-rehabilitated patients are unknown for a proposed home-based program. Therefore, readmission rates were extrapolated from a similar trial by Ades *et al.* (1992) and applied to these programs as the likely outcome. Ades *et al.* report results from a non-randomised home-based cardiac rehabilitation trial involving post-myocardial infarction patients followed up for approximately two years. They found a statistically significant association between participation in rehabilitation and lower hospital readmissions ($p=0.019$). An average value of cardiac and non-cardiac readmissions for rehabilitated and non-rehabilitated patients was calculated to determine potential cost savings. The average cost of hospital readmissions were obtained for each Westcop participant readmission using AN-DRGs from the 1996-1997 National Hospital Morbidity Database.

Results

Gym-based program

The total cost for a gym-based program for 95 patients over a minimum eight-week period was $183,597. The largest economic cost of the gym-based program was $123,568 for operating costs, followed by $72,279 for costs to patients. Program establishment costs were $22,508 and exercise stress tests were $10,949 (Table 2). Labour costs represent the greatest economic cost of the gym-based program (i.e. 38.2% of total costs). Total costs were partially offset by projected hospital readmissions averted of $45,707 (Table 2). Table 3 shows rehospitalisation data on the Westcop sample from which average cost per rehospitalisation was derived to determine rehospitalisations averted. A total of 95 patients were rehabilitated at an average cost of $1,933 per patient rehabilitated. This cost represents the value of the community resources that are sacrificed for the program to exist.

Home-based program

A projected figure of 208 rehabilitated patients was estimated from anticipated program resource levels. The total cost for a home-based program for 208 patients over a 12-month period was $243,157. The highest proportion of total costs for the home-based program was patient costs (Table 2). These were relatively high because patients are assumed to commit 4 hours/week over a period of 12 months as opposed to a minimum 8 weeks in the gym-based program. These costs amount to $185,410 and far outweigh operating costs of $95,200, $47,944 for the exercise stress tests and establishment costs of $14,678. Assuming the same rate of hospital readmissions averted based on the study by Ades et al. (1992) this equates to $100,075 in potential cost savings. The total average cost for rehabilitating a person in the home-based program proposed here was $1,169.

Table 2. Summary of Costs and Effects for the Gym-based and Home-based Cardiac Rehabilitation Programs over 12 Months

	Gym-based	Home-Based	Home-based (95 pts)
Costs			
Exercise Stress Tests	$10,949	$47,944	$21,898
Operating Costs- Personnel	$87,615	$42,318	$19,328
- Administration/consumables	$35,953	$52,882	$24,153
Establishment Costs	$22,508	$14,678	$6,704
Patient Costs	$72,279	$185,410	$84,682
Effects			
Rehospitalisation costs averted (cost-savings)	($45,707)	($100,075)	($45,707)
Numbers of patients rehabilitated	95	208	95
Total Costs	**$183,597**	**$243,157**	**$111,057**
Costs per patient rehabilitated			
Health care system costs per patient rehabilitated*	$1,172	$278	$278
Total cost per patient rehabilitated	$1,933	$1,169	$1,169

* patient opportunity costs are omitted

Overall, the results suggest the proposed home-based program is the least-cost option of the two models based on cost per rehabilitated patient (Table 2). This is notable because the home-based program would deliver constant care to 208 patients over 12 months while a gym-based program services 95 patients over a shorter term (minimum eight weeks). If we assumed that the same level of funding provided by the IWMDGP for the gym-based program was equal for the home-based program and the home-based program was provided to the same 95 patients in the gym-based program, the total costs are significantly lower again (Table 2 - 3rd column).

Establishment costs may be regarded as "sunk costs" and, if so, should not be included. When the establishment costs are omitted the cost of providing the home-based program to an additional 113 patients increases by $8,627. When the cost-savings from hospitalisations averted are included, the home-based program could reduce health care expenditure by $45,741. That is, the incremental cost-savings per patient in a home-based program are $405 (after the first 95 patients) compared with a gym-based program.

Table 3 Results on Hospital Readmissions of Westcop Patients Followed Up after 18 Months

	Rehabilitated Patients			Non-rehabilitated Patients(i)		
Parameter	Total	Cardiac	Other	Total	Cardiac	Other
Total number of patients	22	-	-	72	-	-
Number of patients readmitted(ii)	10	-	-	40	-	-
	(45.5%)			(55.5%)		
Number of readmissions	29	22	7	130	43	87
Average readmissions per patient readmitted	2.9	-	-	3.3	-	-
Number of patients with prior admissions	5	-	-	26	-	-
	(23.7%)			(36.1%)		
Length of stay (total days)	72	-	-	617	-	-
Average length of stay per patient readmitted	7.2	-	-	15.4	-	-
Total cost for readmissions(iii)	$47,378	$39,670	$7,708	$292,772	$112,059	$180,714
Average cost per readmission	$1,633	$1,808	$1,101	$2,252	$2,606	$2,077
Readmissions within 1 year of discharge	13	9	4	54	25	29
Readmissions between 1 and 2 years of discharge	6	6	0	44	8	36
Readmissions 2 or more years after discharge	10	7	3	23	10	13

Notes:

(i) Data for 9 readmissions are of unknown cause. These occurred during data collection and medical records were not yet updated.

(ii) The corresponding rates in the study by Ades et al. (1992) were 21.7% and 37.1% for rehabilitated and non-rehabilitated patients respectively. These rates are used in the calculations in this analysis.

(iii) Unit costs per admission include differentiated costs between both public and private admissions.

Sensitivity Analysis

A sensitivity analysis was carried out for seven variables over various ranges for which there was a degree of uncertainty (Table 4). The cost ratios in Table 4 show the magnitudes from changes in variables, but in most cases the relativities were unchanged. Overall, patient-related costs demonstrated the greatest variance and this reflects the substantial proportion of patient costs associated with both programs, particularly the home-based program. When patient opportunity costs are omitted, overall costs for the home-based program are $285 per patient and $1,598 for the gym-based program. This highlights the different durations of the programs and the relatively high labour costs of the gym-based program. Changes to the cost of establishing the programs, the discount rate and efficacy as measured by readmissions averted, had relatively little effect on the total cost per patient rehabilitated.

Table 4 Results of Sensitivity Testing

	Cost Ratios - $ per Patient Rehabilitated	
Variable	Gym-based Program	Home-based Program
% Establishment Costs		
75%	1873	1551
100% (base)*	1933	1169
125%	2092	1187
Discount rates of establishment costs:		
years of effective life discount rate		
6.66 - 10 20%	1865	1149
5 - 6.66(base) 27%(base)	1933	1169
3 - 5 40%	2081	1213
Travelling Costs ($/km)		
Small car $0.319	1815	1167
Medium car $0.4409 (base)	1933	1169
Large car $0.486	1976	1170
Patient Time - phase III program (gym-based program varied only)		
4 weeks	1687	1169
12 weeks (base)	1933	1169
24 weeks	2300	1169
Patient leisure time value ($/hr)		
$0	1598	285
$4.42(base)	1933	1169
$8.84	2267	2053
% readmission values		
75%	2053	1289
100%(base)	1933	1169
125%	1812	1049
Patient Time (home-based program varied only)		
4 hours (base)	1933	1169
6 hours	1933	1611
8 hours	1933	2053

* Variables used in the primary analysis are indicated by '(base)'.

Discussion

Home-based programs are regarded as less costly, more practical, convenient and have greater potential to promote independence and self-responsibility than hospital or gym-based programs. A major disadvantage of home-based programs is the lack of peer support, camaraderie and companionship associated with a group facility. This may be compensated by further involvement of Heart Support Australia community groups, family, friends and community nursing with the patient's rehabilitation.

A further challenge for cardiac rehabilitation programs is patient compliance. Patient compliance with cardiac rehabilitation may not be easily achieved for a variety of reasons including time constraints, work re-entry, lower

socio-economic status, poor social support, adverse health beliefs and transportation problems (Thornhill & Stevens 1998, Johnson & Heller 1998). Experience with a clinic-based program in Dubbo (NSW) found that long travelling distances for rural patients was a common reason for failing to attend as patients had to rely on others to transport them to the clinic (Thornhill & Stevens 1998). Therefore, home-based programs may have greater success with compliance. Service planning that attempts to understand consumer preferences, population characteristics and individual circumstances are likely to generate better quality care, patient satisfaction and enhanced compliance rates. For the growing range of patient profiles it is inevitable that different program models need to be available to maximise health outcomes. Older persons, for example, prefer home-based programs to clinic-based programs (Filip *et al.*, 1999). For rural-based patients, home-based models with regular physician/nurse follow-up may be the most feasible option.

Hospital readmissions averted is one important outcome. Because the chronic nature of heart disease, it is not uncommon for patients to return to hospital for further cardiac treatment. Lowering hospital readmissions and length of stay of readmissions are desired outcomes for the health care system because this may free-up resources and reduce costs. It is also an important outcome for patients and their relatives because of the trauma and disruption cardiac events cause to their lives.

A limitation of this analysis is the necessity to use effectiveness data based on overseas studies. This assumes the overseas programs are as beneficial within the West Moreton population that may not be the case. Other limitations of the study relate to the small sample of Westcop patients that may not be representative of all Queensland or Australia and the omission of differential timing for the duration of the program. Although readmission rates from the literature were used to take advantage of better quality data and to strengthen the study, local cost and resource data were used. The use of local data is a strength of this study. The resource and cost assumptions are based on the best available evidence from Westcop and have been tested within a sensitivity analysis to evaluate the strength of the results. In most cases these calculations in sensitivity testing did not alter results of the primary analysis. Caution should be taken when considering the higher prevalence of cardiovascular disease in this district compared to Queensland as a whole, the mix of private and public patients involved, the quality and mix of program resources described and the implications for costing, local prices applied to resources and the level of demand for rehabilitation places which characterise this program. Furthermore, we did not include the value of early return to work for those remaining in the labour force. Therefore, these results are conservative estimates of the true value of the benefits of cardiac rehabilitation.

To date, no cost-analysis studies were identified in the published literature on home-, hospital- or gym-based cardiac rehabilitation programs. In addition, there appear to be no published clinical evaluations on structured home-based cardiac rehabilitation programs in Australia. Overseas trials suggest similar clinical outcomes of home-based and gym-based programs for physiological, psychosocial and quality of life parameters. This analysis indicates the potential for increasing coverage from home-based cardiac rehabilitation programs in Australia and the potential cost-savings that may be achieved. However, to estimate the true potential of home-based cardiac rehabilitation in Australia a full community-based trial (or head-to-head trial) that studies a range of economic, social and clinical effectiveness of cardiac rehabilitation programs is needed.

The home-based program proposed here indicates there are potential advantages to the community including lower health care costs and greater access to cardiac rehabilitation services. In addition, other benefits such as patient independence and empowerment may be gained. Expansion of cardiac rehabilitation services may facilitate a decline in the massive economic and human costs of heart disease in Australia by, among other things, reducing repeat hospitalisations of chronic sufferers. Development of home-based programs in rural Australia will also assist in addressing inequalities from the barriers of accessing health care services in these communities.

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References

Ades PA, Huang D & Weaver SO 1992, 'Cardiac rehabilitation participation predicts lower rehospitalisation costs', *American Heart Journal*, vol 123, no 4, pp 916-921.

Australian Taxation Office 1998, *Guide to depreciation*, ATO, Canberra.

Blumenthal JA & Levenson RM 1987, 'Behavioural approaches to secondary prevention of coronary heart disease', *Circulation*, vol. 76 (Suppl I), pp. I130 - I137.

Bondestam E, Breikss A & Hartford M 1995, 'Effects of early rehabilitation on consumption of medical care during the first year after acute myocardial infarction in patients ≥ 65 years of age', *American Journal of Cardiology*, vol 75, no 12, pp 767-771.

Boudrez H, De Backer G & Comhaire B 1994, 'Return to work after myocardial infarction: results of a longitudinal population based study', *European Heart Journal*, vol 15, pp 32-36.

Bunker S, McBurney H, Cox H & Jelinek M 1999, 'Identifying participation rates at outpatient cardiac rehabilitation programs in Victoria, Australia', *Journal of Cardiopulmonary Rehabilitation*, vol 19, pp 334-8.

DeBusk RF, Haskwell WL, Miller NH, Berra K, et al. 1985, 'Medically directed at home rehabilitation soon after clinically uncomplicated acute myocardial infarction: a new model for patient care'. *American Journal of Cardiology*, vol 55, no 4, pp 251-257.

DeBusk RF, Miller NH, Superko HR, Dennis CA, et al. 1994, 'A case-management system for coronary risk factor modification after acute myocardial infarction', *Annals of Internal Medicine*, vol 120, no 9, pp 721-729.

Dracup K, Moser DK, Marsden C, Taylor SE & Guzy PM 1991, 'Effects of a multidimensional cardiopulmonary rehabilitation program on psychosocial function', *American Journal of Cardiology*, vol 68, pp 31-34.

Drummond MF, O'Brien B, Stoddart GL & Torrance GW 1997, *Methods for the Economic Evaluation of Health Care Programmes*, 2nd edn, Oxford Medical Publications, Oxford.

Filip J, McGillen C & Mosca L 1999, 'Patient preferences for cardiac rehabilitation and desired program elements', *Journal of Cardiopulmonary Rehabilitation*, vol 19, pp 339-43.

Gordon NF & Haskell WL 1997, 'Comprehensive cardiovascular risk reduction in a cardiac rehabilitation setting', *American Journal of Cardiology*, vol 80(8B), pp 69H-73H.

Haskwell WL, Alderman EL, Fair JM, Maron DJ, et al. 1994, 'Effects of Intensive Multiple Risk Factor Reduction on Coronary Atherosclerosis and Clinical Cardiac Events in Men and Women with Coronary Artery Disease The Stanford Coronary Risk Intervention Project (SCRIP)', *Circulation*, vol 89, no 3, pp 975-990.

Hedbäck B, Perk J & Wodlin P 1993, 'Long-term reduction of cardiac mortality after myocardial infarction: 10-year results of a comprehensive rehabilitation programme', *European Heart Journal*, no 14, pp 831-835.

Hyndman JCG, D'Arcy CD, Holman J & de Klerk NH 1999, 'A comparison of measures of access to child health clinics and the implication for modelling the location of new clinics', *Australian and New Zealand Journal of Public Health*, vol 23, no 2, pp 189-195.

Johnson NA & Heller RF 1998, 'Prediction of patient nonadherence with home-based exercise for cardiac rehabilitation: the role of perceived barriers and perceived benefits'. *Preventive Medicine*, vol 27, pp 56-64.

King KM, Humen DP & Teo KK 1999, 'Cardiac rehabilitation: the forgotten intervention', *Canadian Journal of Cardiology*, vol 15, pp 979-85.

Kugler J, Dimsdale JE, Hartley LH & Sherwood J 1990, 'Hospital supervised vs home exercise in cardiac rehabilitation: effects on aerobic fitness, anxiety, and depression', *Archives of Physical and Medical Rehabilitation*, vol 71, no 5, pp 322-5.

Linden W, Stossel C & Maurice J 1996, 'Psychosocial interventions for patients with coronary heart disease: a meta-analysis', *Archives of Internal Medicine*, vol 156, no 7, pp 745-752.

Miller NH, Haskell WL, Berra K & DeBusk FR 1984, 'Home versus group exercise training for increasing functional capacity after myocardial infarction'. *Circulation*, vol 70, no 4, pp 645-649.

Miller NH, Warren D & Myers D. 1996, 'Home-based cardiac rehabilitation and lifestyle modification: The MULTIFIT Model', *Journal of Cardiovascular Nursing*, vol 11, no 1, pp 76-87.

National Heart Foundation 1998, 'Recommendations for Cardiac Rehabilitation 1998' National Heart Foundation of Australia URL: http://www.heartfoundation.com.au/docs/ppld.htm (access date 29/1/99).

Noy K. 1998, 'Cardiac rehabilitation: structure, effectiveness and the future', *British Journal of Nursing*, vol 7, no 17, pp 1033-40.

O'Connor GT, Buring JE, Yusuf S, et al. 1989, 'An Overview of Randomised Trials of Rehabilitation with Exercise After Myocardial Infarction', *Circulation*, vol 80, pp 234-244.

Oldridge N, Guyatt G, Jones MD, Crave J, et al. 1991, 'Effects on Quality of Life with Comprehensive Rehabilitation After Acute Myocardial Infarction', *The American Journal of Cardiology*, vol 67, pp 1084-1089.

Oldridge NB, Furlong W, Feeny D, Torrance G, et al. 1993, 'Economic Evaluation of Cardiac Rehabilitation Soon After Acute Myocardial Infarction', *The American Journal of Cardiology*, vol 72, pp 154-161.

Oldridge NB, Gottlieb M, Guyatt G, Jones N, et al. 1998, 'Predictors of Health-Related Quality of Life with Cardiac Rehabilitation after Acute Myocardial Infarction', *Journal of Cardiopulmonary Rehabilitation*, vol 18, no 2, pp 95-103.

Oldridge NB, Guyatt GH, Fischer ME & Rimm AA 1988, 'Cardiac Rehabilitation After Myocardial Infarction', *Journal of the American Medical Association*, vol 260, no 7, pp 945-950.

Petrie KJ, Weinman J, Sharpe N & Buckley J. 1996, 'Role of patients' view of their illness in predicting return to work and functioning after myocardial infarction: longitudinal study', *British Medical Journal*, vol 312, pp 1191-94.

Picard MH, Dennis C, Schwartz RG, Ahn DK, et al. 1989, 'Cost-Benefit Analysis of Early Return to Work After Uncomplicated Acute Myocardial Infarction', *The American Journal of Cardiology*, vol 63, pp 1308-1314.

Scott IA, Eyeson-Annan M, Huxley SL & West MJ 2000, 'Optimising care of acute myocardial infarction: results of a regional quality improvement project', *Journal of Quality Clinical Practice*, vol 20, pp 12-9.

Siegal D, Grady D, Browner WS & Hulley SB 1988, 'Risk factor modification after myocardial infarction', *Annals of Internal Medicine*, vol 109, pp 213-18.

Thompson DR & Bowman GS 1998, 'Evidence for the effectiveness of cardiac rehabilitation', *Intensive and Critical Care Nursing*, vol 14, no 1, pp 38-48.

Thornhill M & Stevens JA 1998, 'Client perceptions of a rural-based cardiac rehabilitation program: a grounded theory approach'. *Australian Journal of Rural Health*, vol 6, pp 105-11.