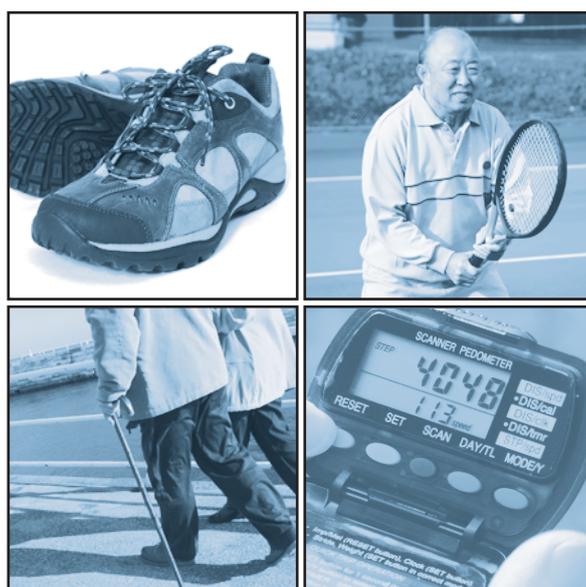


New South Wales Health Promotion Demonstration Research Grants Scheme

THE EFFICACY OF A PEDOMETER BASED INTERVENTION



IN INCREASING PHYSICAL ACTIVITY
IN PEOPLE REFERRED TO OUTPATIENT
CARDIAC REHABILITATION

Produced by:
Centre for Health Advancement
Population Health Division

NSW DEPARTMENT OF HEALTH
73 Miller St
North Sydney NSW 2060 Australia
Tel. (02) 9391 9000
Fax. (02) 9391 9101
TTY: (02) 9391 9900
www.health.nsw.gov.au

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Principal investigators

Lyra Butler, Susan Furber, Philayrath Phongsavan, Andy Mark and Adrian Bauman

Qualitative study

Susan Furber, Erica Gray and Lyra Butler

Data management support

Darren Mayne and Tania Starr

Exercise physiologists

Joel Penson, Shane Rose and Susan Downes

Cardiac rehabilitation services

Barbara James, Fiona Love, Bronia Kandl and Scott Lang

Cardiologists

Dwain Owensby and Mark Ryan

Steering Committee

Lyra Butler, Susan Furber, Andy Mark, Adrian Bauman, Dwain Owensby, Barbara James, Fiona Love, Joel Penson, Bronia Kandl, Susan Downes, Andrew Milat, Robyn Newson, Ming Lin, Mark Ryan, Scott Lang

Organisations

South Eastern Sydney & Illawarra Area Health Service
NSW Centre for Physical Activity and Health
Heart Foundation (NSW Division)

The principal investigators thank the study participants

Abbreviations

Acute Coronary Syndrome	ACS
Cardiac Rehabilitation Program	CRP
Coronary Artery Bypass Graft Surgery	CABGS
Cardiovascular Disease	CVD
Myocardial Infarction	MI
Percutaneous Coronary Intervention	PCI
Social Cognitive Theory	SCT

Executive summary

Issue addressed

Within Australia, cardiac rehabilitation attendance is poor and the majority of cardiac patients are not receiving the support required to increase physical activity participation after hospitalisation. As physical activity is important in the prevention and treatment of heart disease, there could be substantial benefits to the individual and cost savings for the health system if cardiac patients were more active.

The aims of this project were to:

- n Determine the proportion of cardiac patients who attend cardiac rehabilitation in the north Illawarra and the Shoalhaven area, and identify any differences in age, gender, diagnosis and socio-economic status between cardiac rehabilitation attendees and non-attendees
- n Determine the efficacy of a pedometer based physical activity intervention on self-reported physical activity level and cardio-respiratory fitness of cardiac patients who attended a cardiac rehabilitation program
- n Determine the efficacy of a pedometer based physical activity intervention on self-reported physical activity level of cardiac patients who were referred to, but chose not to attend, a cardiac rehabilitation program
- n Explore the perceptions of north Illawarra and Shoalhaven residents referred to cardiac rehabilitation on the usefulness of a pedometer based intervention to promote physical activity

Intervention

The six week intervention included self-monitoring of daily physical activity using a pedometer and step calendar, and two behavioural counselling and goal setting sessions delivered via telephone.

Methods

This project consisted of four related studies: a cross sectional analysis of the characteristics of cardiac rehabilitation attendees and non-attendees; two randomised controlled trials – one with patients who had attended cardiac rehabilitation (Cardiac Rehabilitation Trial)

and the other with patients who did not attend cardiac rehabilitation (Community Trial); and focus group discussions with participants from both Trials.

Self-reported physical activity levels and psychosocial factors affecting physical activity participation were collected at baseline, six weeks and six months. The exercise capacity of the participants in the Cardiac Rehabilitation Trial was objectively measured at baseline, six weeks and six months.

Results

The uptake rate of cardiac rehabilitation was 28.8 per cent of referred patients. Cardiac rehabilitation attendees were significantly younger than non-attendees (65 years versus 67 years) and there were also significant differences in diagnoses between attendees and non-attendees. In the cardiac rehabilitation attendees group, coronary artery bypass graft surgery (CABGS) (31.6%) was the most common procedure, followed by percutaneous coronary intervention (PCI) (29.4%). In the non-attendees group, myocardial infarction (MI) (26.8%) was the most common diagnosis, followed by PCI (21.1%) procedure. There was a significantly greater proportion of attendees than non-attendees who had undergone CABGS and PCI and a significantly smaller proportion of attendees than non-attendees had a MI or acute coronary syndrome (ACS) diagnosis.

In the Cardiac Rehabilitation Trial, improvements in total physical activity sessions, walking time and walking sessions in the intervention group were significantly greater than the change in the control group at the end of the six week intervention. At six months, improvements in the intervention group remained significantly greater than the control group in total physical activity time, total physical activity sessions and walking sessions. These changes were corroborated by improvements in cardio-respiratory fitness at six months in the intervention group. Improvements in the intervention group in behavioural and cognitive self-management strategy use were significantly greater than the controls at six weeks. The improvement in cognitive strategy use remained significantly greater in the intervention group compared to controls at six months. Self-efficacy, outcome expectancies and psychological

distress were not significantly different between groups at six weeks or six months.

In the Community Trial, improvements in total physical activity time, total physical activity sessions, walking time and walking sessions in the intervention group were significantly greater than the control group at six weeks. At six months, improvements in total physical activity time, total physical activity sessions, walking time and walking sessions in the intervention group remained significantly greater than the control group. Improvements in outcome expectancies and cognitive self-management strategy use in the intervention group were significantly greater than the change in the control group at six weeks but did not remain significant at six months.

The findings from the focus group discussions indicate that the pedometer based intervention was well-received by participants and that each of the components of the multi-strategic intervention was considered to be useful in promoting physical activity. Most participants felt that people would benefit from receiving a pedometer when they attend a cardiac rehabilitation group.

Conclusion

These findings suggest the pedometer based intervention could be offered as an effective and accessible option for those who do not attend cardiac rehabilitation to increase their physical activity levels. This intervention could also be promoted as an important adjunct to existing cardiac rehabilitation programs to promote adherence to physical activity after cardiac rehabilitation attendance. The findings of this project have importance in advocating a public health approach to cardiac rehabilitation.

SECTION 1

Introduction

Cardiovascular disease (CVD) remains the leading cause of death in Australia and thus a significant contributor to the burden of chronic disease.¹ In 2002, 37.6 per cent of all deaths in Australia were related to CVD,² and the estimated direct cost of CVD to the health care system in 2000 to 2001 was \$5.4 billion.³ CVD accounted for 21.9 per cent of the total attributable burden of disease within Australia in 1996, significantly impacting on years of life lost to premature death and years of life lived with ill health or disability.⁴

To reduce the burden of CVD within the community, secondary prevention programs such as outpatient cardiac rehabilitation services are offered. These programs are evidence based and the benefits of participation, including improvements in CVD risk factors and reduced cardiac mortality, are well documented.^{5,6} However, studies have consistently shown that these programs are underutilised, with only 20 to 30 per cent of eligible patients participating.⁷⁻⁹ The provision of these programs has improved dramatically since they were first introduced in Australia over 40 years ago, and alternative models such as home based programs have been developed, however the reach continues to be limited and the majority of cardiac patients are not receiving the support they may need when recovering from a cardiac event.¹⁰⁻¹¹

To further compound this public health problem, many patients with CVD are not achieving the recommended targets for physical activity.¹²⁻¹³ This is particularly apparent among those who do not attend cardiac rehabilitation,¹⁴ however, it also applies to those who do attend a cardiac rehabilitation program (CRP), as physical activity levels among this group are also insufficient and typically decline after the program.¹⁵⁻¹⁶ This is of considerable concern as physical inactivity is a major risk factor for CVD and associated complications, at a primary and secondary prevention level.¹⁷ Clearly, there are many cardiac patients who would benefit from increased physical activity participation who are not accessing cardiac rehabilitation services or exercising independently.¹⁸

This project addresses the entire population of referred cardiac patients, including patients who attend cardiac rehabilitation and those who do not access cardiac rehabilitation but who are eligible to do so. This population represents a group that could potentially benefit from lifestyle and physical activity interventions.

Physical activity participation is vital in the secondary prevention of CVD and could be promoted to cardiac patients through home based behavioural change interventions. Physical activity interventions based on the social cognitive theory (SCT)¹⁹ have demonstrated success in promoting increased physical activity in patients with chronic illnesses such as type 2 diabetes²⁰⁻²¹ and aspects of SCT have been used in interventions for people with heart disease.²²

A pedometer is an ideal tool to use with interventions based on SCT as pedometers are a self-monitoring tool and provide immediate and objective feedback which may enhance self-efficacy.²³ In the past decade, studies have reported on the use of pedometers for motivating and monitoring physical activity levels in individuals with disabilities and chronic illnesses.^{20,24} For example, The First Step Program was a 16 week intervention for type 2 diabetes patients and involved monitoring of daily physical activity using a pedometer and step diary, and counselling sessions based on SCT.²⁵ A controlled evaluation of this program showed it significantly increased physical activity in patients by an average of 3000 steps per day, approximately equal to 30 minutes walking.²⁰

In Australia, there is a distinct lack of physical activity interventions evaluated within cardiac patient populations. To extend the reach of secondary prevention programs, minimal contact, behavioural change interventions need to be trialled in semi-clinical settings such as the maintenance phase of existing CRPs and more importantly in community settings where the program could have the potential to reach a wider population of cardiac patients.

As people who have been hospitalised for CVD have a high risk of further cardiac events and are insufficiently active,¹² interventions to increase physical activity in this population are needed. The efficacy of a pedometer-based intervention for people with CVD, irrespective of their participation in CRPs, is investigated in the studies conducted for this project. Hence the findings of this project have importance in advocating a public health approach to cardiac rehabilitation.

The population of cardiac patients who do not attend CRPs represent a population group at great risk as they are underserved and hard to reach. The research conducted for this project demonstrates a population based approach to the promotion of physical activity among all cardiac patients referred to cardiac rehabilitation and thus addresses this significant gap in public health practice.

SECTION 2

Aim and objectives

Aim

To determine the efficacy and acceptability of a pedometer-based intervention in increasing physical activity in people referred to outpatient cardiac rehabilitation.

Objectives

- n Determine the proportion of cardiac patients who attend cardiac rehabilitation in the north Illawarra and the Shoalhaven area and identify any differences in age, gender, diagnosis and socio-economic status between cardiac rehabilitation attendees and non-attendees.
- n Determine the efficacy of a pedometer based physical activity intervention on the self-reported physical activity level and cardio-respiratory fitness of cardiac patients who attended a CRP.
- n Determine the efficacy of a pedometer based physical activity intervention on the self-reported physical activity level of cardiac patients who were referred to, but chose not to attend, a CRP.
- n Explore the perceptions of north Illawarra and Shoalhaven residents referred to outpatient cardiac rehabilitation on the usefulness of a pedometer based intervention to promote physical activity.

SECTION 3

The Intervention

The six week intervention included self-monitoring of daily physical activity using a pedometer and step calendar, and two behavioural counselling and goal setting sessions delivered via telephone. The intervention was based on SCT.¹⁹

Key features of the intervention included use of verbal reinforcement, individualised goal setting and objective feedback from the pedometer to support the adoption and maintenance of a physically active lifestyle. Outcome expectancies were addressed by asking participants to think about what they might gain by reaching their physical activity goals and counselling participants on the benefits of physical activity.

Participants were asked to identify any barriers to increasing their physical activity and strategies to overcome these were discussed. Participants were also asked about their past experiences with physical activity and were encouraged to draw on positive experiences, or talk through negative experiences and develop strategies to deal with a relapse.

After the baseline questionnaire was completed participants were given a pedometer, pedometer instruction sheet (Appendix 1), step calendar (Appendix 2) and a walking safety sheet. These intervention materials were given to the Study 2 participants when they met with the researcher, while Study 3 participants received them by mail. The pedometer was a Yamax Digiwalker 700B which has been found to be reliable and accurate.^{26,27}

Participants were told not to change their physical activity patterns during the following week to allow a baseline step count to be obtained. Following the baseline data collection period, participants were instructed to record daily steps for six weeks. The step calendar was used for recording steps and weekly and long term goals.

Participants received behavioural counselling and goal setting sessions via telephone at one and three week(s). The calls lasted approximately 15 minutes.

Participants were encouraged to set their own goals with guidance from the researcher; they could set either step count or walking minute goals but were counselled to aim for 30 minutes of moderate-intensity activity on all or most days of the week, as per national guidelines.²⁸ They received 'booster' telephone calls at weeks 12 and 18 which were shorter and were designed to provide additional support and advice regarding physical activity.

Research methods

Study design

Four separate studies were conducted corresponding to each of the four objectives of the research as follows:

Study 1: Uptake of cardiac rehabilitation and characteristics of cardiac rehabilitation attendees and non-attendees

Study 2: Effects of a pedometer based intervention on physical activity levels after cardiac rehabilitation (Cardiac Rehabilitation Trial)

Study 3: Effects of a pedometer based intervention on physical activity levels in cardiac patients not attending cardiac rehabilitation (Community Trial)

Study 4: Perceptions of people with CVD on the usefulness of a pedometer based intervention to promote physical activity.

A cross-sectional analysis was conducted for Study 1. Two randomised controlled trials were conducted simultaneously for Studies 2 and 3. Focus groups discussions were conducted for Study 4.

The project was approved by the University of Wollongong/Illawarra Area Health Service Human Research Ethics Committee and the University of NSW Human Research Ethics Committee.

Study participants

The target population was cardiac patients who had been referred to an outpatient CRP in the north Illawarra or Shoalhaven area over a 10 month period (October to mid-November 2005 and mid-January to September 2006). The outpatient cardiac rehabilitation referral list was obtained from the former Illawarra Area Health Service centralised referral database and included the patient's name, contact details and referral date. The contact details of patients on the cardiac rehabilitation referral list were used to invite patients to participate in the two randomised controlled trials conducted for this project. Patients that indicated interest in participating were sent an information package consisting of a participant information letter, participant information sheet and a cardiorespiratory fitness assessment information sheet (Appendix 3). The package for the Community Trial (Study 3) was similar to the Cardiac Rehabilitation Trial (Study 2).

Patients were eligible to participate in Study 2 if they attended the first session of CRP and could speak English. Patients were excluded if they had co-morbidity affecting physical activity participation. Patients who did not attend an outpatient CRP were eligible to participate in Study 3. Written informed consent was collected from participants (Appendix 4) and medical clearance from a general practitioner was obtained. In both Studies 2 and 3, patients were randomised into an intervention or control group. For Study 2, to detect a difference of 0.5 METs (metabolic equivalents) at an anaerobic threshold between the intervention and control group, with a power of 80%, and assuming a 20% loss to follow-up, a sample size of 49 in each group was required. For Study 3, to detect a difference of 2.5 total physical activity sessions per week between the intervention and control group, with a power of 80%, and assuming a 20% loss to follow-up, a sample size of 108 in each group was required.

Four focus groups were conducted (Study 4) with people who had recently been involved in either Study 2 or 3.

Data collection & measurement instruments

STUDY 1: The number of cardiac admissions was obtained from the Health Information Exchange database of South Eastern Sydney & Illawarra Area Health Service. This data was used to calculate the referral rate of patients during the study period.

Date of birth, gender and diagnosis were recorded by the cardiac rehabilitation centre staff at the time of receiving the referral. Prior to analysis, the patient's final diagnosis or procedure was coded and classified into the following groups: myocardial infarction (MI); acute coronary syndrome (ACS); coronary artery bypass graft surgery (CABGS); percutaneous coronary intervention (PCI); arrhythmia; valve repair; investigation (eg angiogram); other (eg increased risk factors, heart failure). Socio-economic status was determined using the socio-economic index for areas (SEIFA) of the addresses of patients on the cardiac rehabilitation referral list. Data were geocoded to patients' addresses and census collection

district levels using MapData Science's QuickLocate 3 Geocoder software.

STUDIES 2 & 3: Data was collected from participants at baseline, six weeks and six months. For Study 2 participants, data was collected face-to-face and included administration of a questionnaire (Appendix 5) and collection of sub-maximal cardiorespiratory fitness and anthropometric data. The same questionnaire was administered to Study 3 participants via telephone but cardiorespiratory fitness was not measured.

The questionnaire collected data on physical activity, psychosocial factors affecting physical activity and demographic information. The main outcome measure was total physical activity. Physical activity was assessed via the Active Australia Survey, a set of questions asking participants to recall weekly sessions and minutes of walking, vigorous activity, vigorous gardening or yard work and moderate activity.²⁹ Psychosocial status was a secondary outcome and data included self-efficacy for exercise, assessed using the Self-Efficacy for Exercise (SEE) scale.³⁰

Outcome expectancies for participation in physical activity were assessed using a scale adapted from Kobau and Dilorio's research.³¹ Behavioural and cognitive self-management strategy use was assessed using scales adapted from Saelens and colleagues.³² Psychological distress was assessed using a Kessler 6 (K6) scale adapted from the NSW Health Older Peoples Survey.³³ The questionnaire was trialled in a pilot study of cardiac patients to assess comprehension as well as the reliability and construct validity of the items.

For Study 2, participants' exercise capacity was a secondary outcome, represented by METs at anaerobic threshold. To obtain this, participants performed a sub-maximal cardiorespiratory fitness assessment on a Monark bicycle ergometer and a step protocol was used to increase the workload each minute. METs were calculated by dividing the litres of oxygen consumed at anaerobic threshold by the participant's weight in kilograms and then dividing this by 3.5mls. Anthropometric measures were recorded prior to the assessment.

STUDY 4: An interview guide was developed and included questions on all aspects of the intervention such as the pedometer, the step recording calendar, follow-up telephone calls, and goal setting. Socio-demographic characteristics of participants were obtained from the quantitative study. Participants were asked to sign a consent form and received an information sheet about the focus group discussions. Interviews were conducted with a moderator and an observer/recorder and lasted

between 60 and 90 minutes. The focus groups were tape-recorded and notes were also taken during the discussions.

Statistical analysis

STUDY 1: Descriptive tables for the variables of age, gender, diagnosis and SEIFA scores were generated using SPSS Version 15.0. To compare variables, confidence intervals were calculated using the confidence interval analysis program CIA.exe.³⁴

STUDIES 2 & 3: Intention-to-treat analyses were performed using SPSS Version 15.0 (SPSS Inc, Chicago: Illinois) and two tailed p values <0.05 were considered significant. Independent t-tests and Mann-Whitney U tests were used to compare continuous variables between groups. Paired t-tests and Wilcoxon rank tests were used to detect changes in continuous variables within groups. For categorical variables, Pearson chi-square analyses were conducted to determine any differences between groups.

An analysis of variance (ANOVA) was conducted to compare the change variables within groups and determine any differences between change in the intervention group compared to change in the control group, adjusted for baseline differences. Cohen's effect sizes for significant between group changes in physical activity variables were calculated by dividing the change between the intervention and control groups by the pooled standard deviation.³⁵

STUDY 4: The moderator and observer (SF & EG) independently coded the themes that arose from the focus group transcripts and then compared their coding. For the purpose of triangulation, the moderator and observer discussed the themes that arose with the principal investigator (LB).

Results

Study 1: Uptake of cardiac rehabilitation and characteristics of cardiac rehabilitation attendees and non-attendees

During the 10 month study period (October to mid-November 2005 and mid-January to September 2006), there were 4503 cardiac admissions in the north Illawarra and Shoalhaven areas. Of these admissions, 944 patients were referred to cardiac rehabilitation, representing a 21.0 per cent referral rate. Of the 944 referrals, 272 (28.8%) attended a CRP.

There were significantly less patients who attended CRP than those who did not attend. Cardiac rehabilitation attendees were significantly younger than non-attendees (65 years versus 67 years) and there were also significant differences in diagnosis between attendees and non-attendees. In the cardiac rehabilitation attendees group, CABGS (31.6%) was the most common procedure, followed by PCI (29.4%). In the non-attendees group, MI (26.8%) was the most common diagnosis, followed by PCI (21.1%) procedure. There was a significantly greater proportion of attendees than non-attendees who had undergone CABGS and PCI and a significantly smaller proportion of attendees than non-attendees had a MI or ACS diagnosis. There was a trend toward cardiac rehabilitation attendees being less disadvantaged than non-attendees; however the difference in SEIFA scores did not reach significance. There were no significant differences in gender between cardiac rehabilitation attendees and non-attendees.

Study 2: Effects of a pedometer-based intervention on physical activity levels after cardiac rehabilitation (Cardiac Rehabilitation Trial)

Response rate

During the 10-month recruitment period, 272 referred patients attended an outpatient CRP. Of these, 220 (80.9%) were contacted and invited to participate in the study (the remaining 19.1% did not attend the first class of CRP where recruitment took place). Of the 220 contacted, 122 (55.5%) agreed to be in the study and 110 (50.0%) completed the baseline questionnaire. The follow-up

rates for participants completing the questionnaire were 90.2% at six weeks and 81.8% at six months.

Baseline characteristics

There were no significant differences in socio-demographic or clinical characteristics between study groups at baseline, except for a significant difference in occupation with more people in the intervention group unemployed ($p=0.017$).

Physical activity

At six weeks, improvements in the intervention group were significant for all physical activity variables, including total physical activity minutes and number of sessions and walking minutes and number of sessions (Table 1). Improvements in total physical activity sessions ($p=0.002$; effect size = 0.33), walking time ($p=0.013$; effect size = 0.54) and walking sessions ($p<0.001$; effect size = 0.78) in the intervention group were significantly greater than the control group after adjusting for baseline differences (data not shown in Table).

At six months, within group changes in total physical activity minutes remained significant for the intervention group (Table 1). Improvements in total physical activity time ($p=0.044$; effect size = 0.43), total physical activity sessions ($p=0.016$; effect size = 0.52) and walking sessions ($p=0.035$; effect size = 0.46) in the intervention group were significantly greater than the control group after adjusting for baseline differences (data not shown in Table).

Psychosocial status

At six weeks, there was a significant improvement in outcome expectancies ($p=0.001$), behavioural self-management strategies use ($p=0.004$), cognitive self-management strategies use ($p=0.003$) and psychological distress ($p=0.004$) in the intervention group. In the control group, there was a significant improvement in outcome expectancies ($p=0.049$) and psychological distress ($p=0.003$). After adjusting for baseline differences, the changes in behavioural and cognitive self-management strategies use in the intervention group were significantly greater than the change in control group (behavioural strategies $p=0.039$; cognitive strategies $p=0.024$).

At six months, the improvement in cognitive self-

Table 1: Self-reported changes in physical activity at six weeks and six months for participants of the cardiac rehabilitation trial

6 week changes								
Physical activity outcomes	Intervention n = 48				Control n = 50			
	Baseline [§]	6 weeks	Δ	P value	Baseline	6 weeks	Δ	P value
Total physical activity								
Mean minutes (SD)	324.3 (271.3)	410.9 (308.3)	86.7 (277.5)	.036*	365.8 (272.6)	307.6 (309.6)	4.8 (244.2)	.891
Median minutes ^a	260.0	335.0	57.5	.022*	315.0	280.0	7.5	.821
Mean sessions (SD)	8.5 (5.1)	11.4 (7.0)	2.9 (6.5)	.003**‡	10.1 (6.5)	9.2 (5.1)	-0.9 (5.4)	.226
Median sessions	7.0	11.0	2.0	.004**	9.0	9.0	0.0	.237
Walking								
Mean minutes (SD)	227.7 (178.7)	308.4 (229.0)	80.7 (219.8)	.014*‡	303.1 (232.4)	276.9 (229.9)	-26.2 (199.2)	.356
Median minutes	182.5	270.0	57.5	.017*	245.0	237.5	-5.0	.686
Mean sessions (SD)	7.1 (4.2)	9.4 (5.6)	2.3 (5.5)	.007**‡	8.8 (6.1)	7.0 (4.2)	-1.7 (4.7)	.012*
Median sessions	6.5	9.5	1.0	.011*	8.0	7.0	-0.5	.015*
6 month changes								
Physical activity outcomes	Intervention n = 44				Control n = 46			
	Baseline	6 months	Δ	P value	Baseline	6 months	Δ	P value
Total physical activity								
Mean minutes (SD)	343.3 (275.0)	455.5 (361.0)	112.2 (319.9)	.025*‡	367.3 (267.9)	355.2 (271.2)	-12.1 (254.8)	.749
Median minutes	282.5	390.0	90.0	.028*	315.0	270.0	-20.0	.459
Mean sessions (SD)	8.7 (5.3)	9.6 (5.8)	0.9 (5.8)	.315‡	10.3 (6.7)	8.0 (4.4)	-2.3 (6.4)	.019*
Median sessions	7.0	9.50	1.0	.401	9.0	8.0	-2.0	.008**
Walking								
Mean minutes (SD)	238.0 (182.4)	262.5 (199.2)	24.6 (164.2)	.327	297.4 (224.1)	257.1 (214.3)	-40.4 (191.8)	.160
Median minutes	207.5	230.0	17.5	.498	242.5	190.0	-40.0	.056
Mean sessions (SD)	7.14 (4.3)	7.3 (5.1)	0.2 (5.0)	.811‡	8.9 (6.3)	6.5 (4.4)	-2.4 (6.4)	.014*
Median sessions	6.5	7.5	0.0	.761	8.5	5.5	-2.0	.003**

[§] Baseline data compared to 6 weeks is different to baseline data compared to 6 months as values are paired for analysis.

^a The median change is not necessarily equal to the mathematical difference between the median baseline value and the median 6 week value because the median baseline, 6 weeks, and change values represent the midpoints of 3 distinct distributions.

* Significant at P<.05; ** Significant at P<.01

‡ Change in the intervention group was significantly different to change in control group at P<.05 after adjusting for baseline differences (only applicable to mean values, not median)

management strategy use ($p=0.001$) and psychological distress ($p<0.001$) remained significant in the intervention group. Within the control group, changes in behavioural self-management strategy use ($p=0.017$) and psychological distress ($p=0.002$) were significant. After adjusting for baseline differences, the change in cognitive self-management strategy use in the intervention group remained significantly greater than the control group change ($p=0.001$).

Cardiorespiratory fitness and anthropometric measures

No significant changes were detected at six weeks within or between groups in cardiorespiratory fitness. At six months, the intervention group had significantly increased cardiorespiratory fitness at anaerobic threshold by 9.5% from baseline ($p=0.01$), however this improvement was not significantly greater than the control group. There was a significant decrease in waist circumference among males in the intervention group at six weeks ($p=0.030$), however no other significant changes were observed in waist circumference in either study group at six months. No significant changes were detected within or between groups in body mass index at six weeks or six months.

Study 3: Effects of a pedometer-based intervention on physical activity levels in cardiac patients not attending cardiac rehabilitation (Community Trial)

Response rate

There were 672 cardiac patients who were referred to, but did not attend a CRP during the 10-month recruitment period (2005-2006). Of these, 482 (71.7%) were contacted and assessed for eligibility into the trial. Sixty-three did not meet the inclusion criteria and 197 refused to participate in the trial. A total of 222 (46.1% of those contacted) consented to participate in the trial and were randomly allocated into the intervention or control group. Two hundred and fifteen participants completed the baseline questionnaire. The response rates for the six week and six month questionnaires were 94.9% and 93.5%, respectively.

Baseline characteristics

There were no significant differences between the intervention and control groups at baseline.

Physical activity

At six weeks, improvements in the intervention group were significant for all physical activity variables, including total physical activity minutes and number of sessions and walking minutes and number of sessions (Table 2). Improvements were significantly greater in the intervention group than the control group for total physical activity

minutes ($p=0.027$; effect size = 0.31), total physical activity sessions ($p=0.003$; effect size = 0.41), walking minutes ($p=0.013$; effect size = 0.35) and walking sessions ($p=0.002$; effect size = 0.43) after adjusting for baseline differences (data not shown in Table).

At six months, improvements in the intervention group were significant for all physical activity variables, including total physical activity minutes and number of sessions and walking minutes and number of sessions (Table 2). Improvements in total physical activity minutes ($p=0.015$; effect size = 0.35), total physical activity sessions ($p=0.019$; effect size = 0.32), walking minutes ($p=0.002$; effect size = 0.45) and walking sessions ($p=0.026$; effect size = 0.33) were significantly greater in the intervention group than in the control group after adjusting for baseline differences (data not shown in Table).

Psychosocial status

There were significant improvements in self-efficacy ($p<0.001$), outcome expectancies ($p=0.001$), cognitive self-management strategy use ($p=0.003$), and behavioural self-management strategy use ($p=0.022$) within the intervention group at six weeks, with the increase in self-efficacy ($p=0.001$) and outcome expectancies ($p=0.032$) remaining significant at six months. There was a significant decrease in psychological distress within the control group at six weeks ($p=0.021$) and six months ($p=0.009$), however there was no change in psychological distress in the intervention group. After adjusting for baseline differences, the change in the intervention group was significantly greater than the change in the control group in outcome expectancies ($p=0.038$) and cognitive self-management strategy use ($p=0.028$) at six weeks.

Study 4: Perceptions of people with cardiovascular disease on the usefulness of a pedometer-based intervention to promote physical activity

A total of 21 people (13 men and 8 women) attended the four focus groups; two of the women who attended were partners. Each group had a mix of men and women. The groups included people who attended an outpatient CRP and those who did not attend a CRP. The findings described below include information that arose directly from the interview guide as well as other issues that arose during the discussions.

Pedometer

The pedometer was seen as a motivator and an objective measure.

"Keeps you going – do better next day"

"It keeps you honest"

Table 2: Self-reported physical activity changes at six weeks and six months for participants of the Community Trial

Six week changes								
Physical activity outcomes	Intervention n = 97				Control n = 107			
	Baseline [§]	Six weeks	Δ	P value	Baseline	Six weeks	Δ	P value
Total physical activity								
Mean minutes (SD)	271.8 (238.4)	366.5 (270.8)	94.7 (213.9)	<0.001 ^{**‡}	239.7 (229.6)	270.9 (244.4)	31.2 (193.5)	0.099
Median minutes ^a	210.0	300.0	90.0	<0.001 ^{**}	180.0	190.0	10.0	0.072
Mean sessions (SD)	6.6 (4.5)	9.0 (5.7)	2.4 (6.2)	<0.001 ^{**‡}	6.9 (5.6)	7.1 (5.6)	0.2 (4.4)	0.696
Median sessions	6.0	8.0	2.0	<0.001 ^{**}	6.0	6.0	0.0	0.696
Walking								
Mean minutes (SD)	169.8 (165.3)	249.9 (196.0)	80.1 (176.1)	<0.001 ^{**‡}	180.5 (164.7)	202.6 (189.5)	22.0 (154.0)	0.142
Median minutes	120.0	210.0	80.0	<0.001 ^{**}	147.0	150.0	0.0	0.233
Mean sessions (SD)	5.3 (4.1)	7.2 (5.0)	1.9 (5.5)	0.001 ^{**‡}	5.6 (3.9)	5.5 (4.0)	-0.1 (3.5)	0.824
Median sessions	5.0	7.0	2.0	0.001 ^{**}	5.0	5.0	0.0	0.774
Six month changes								
Physical activity outcomes	Intervention n = 95				Control n = 106			
	Baseline [§]	Six months	Δ	P value	Baseline	Six months	Δ	P value
Total physical activity								
Mean minutes (SD)	272.3 (240.2)	358.7 (260.0)	86.4 (225.3)	<0.001 ^{**‡}	241.4 (230.0)	250.9 (250.6)	9.4 (218.5)	0.658
Median minutes	210.0	315.0	91.0	<0.001 ^{**}	180.0	150.0	0.0	0.965
Mean sessions (SD)	6.6 (4.5)	8.6 (5.7)	1.9 (5.4)	0.001 ^{**‡}	6.9 (5.6)	7.0 (6.4)	0.1 (5.8)	0.920
Median sessions	6.0	7.0	1.0	0.001 ^{**}	6.5	5.0	0.0	0.667
Walking								
Mean minutes (SD)	168.9 (166.4)	231.5 (189.1)	62.5 (172.3)	0.001 ^{**‡}	181.7 (165.1)	168.3 (171.8)	-13.7 (167.3)	0.397
Median minutes	120.0	200.0	60.0	<0.001 ^{**}	148.5	120.0	0.0	0.325
Mean sessions (SD)	5.4 (4.1)	6.8 (5.0)	1.4 (4.8)	0.006 ^{**‡}	5.6 (3.9)	5.5 (4.9)	-0.2 (5.0)	0.741
Median sessions	5.0	6.0	1.0	0.015 [*]	5.0	4.0	0.0	0.197

[§] Baseline data compared to six weeks is different to baseline data compared to six months as values are paired for analysis.

^a The median change is not necessarily equal to the mathematical difference between the median baseline value and the median six week value because the median baseline, six weeks, and change values represent the midpoints of three distinct distributions.

* Significant at p < 0.05; ** Significant at p < 0.01

[‡] Change in the intervention group was significantly different to change in control group at p < 0.05 after adjusting for baseline differences (only applicable to mean values, not median)

However, there were concerns about the accuracy of the pedometer.

"Registered while driving but not on treadmill"

"Okay on flat, but not steep incline"

Several participants felt the pedometer was limited as it only measured steps and not other types of activities. Problems with wearing the pedometer were discussed. Some participants commented that it did not work on tracksuits or shorts and it slid off some types of fabric. A clip and elastic band had been attached to the pedometer that was given to participants to reduce the chance of it falling off. However some people on anticoagulant drugs had bleeding problems when they were scratched by the clip.

Step recording calendar

Recording the steps in the calendar was a motivator for some participants.

"Wrote it down, felt like an achievement"

Participants varied in whether they still used the calendar; some recorded their steps in a notebook or on a computer spreadsheet.

"When started, very good but now waste of time,

now know if good day or not a good day"

"Mainly for [project manager] records, so filled in, looking back would like to see what has been done"

While most participants felt the calendar was well-designed, one participant felt that there was not enough room to record other activities.

Follow-up telephone calls

Over the 6-month study period, participants received five calls from the project manager. Participants found the calls to be motivational and supportive.

"When you know phone calls are coming, you get motivated"

"Good to have someone who talks positively, too many people have negative comments"

Goal setting

Setting goals was motivational for several participants, however some were not interested in having goals.

"Having an external person setting goals helps"

"Goal setting becomes natural after a while. When first start, good to get there but cannot keep breaking records all the time."

Who should give out pedometers?

Most participants felt that people with cardiac disease would most benefit from receiving a pedometer when they attend a cardiac rehabilitation group.

"Good in rehab...you're more relaxed"

"Pedometer and calendar should be integrated into cardiac rehab"

While one participant thought that the hospital might be a good place to reach people who are not planning to attend cardiac rehabilitation, several thought that people were not ready to use a pedometer immediately after their hospital stay.

"You would not know what to do. Not ready to take on a pedometer in hospital"

"You can hardly walk"

The possibility of getting a pedometer from the general practitioner or cardiac specialist was raised.

"The doctor only wants to see you for a brief time"

"Would be good if GP gave it, specialist may be too aloof, prefer someone more at my level"

"Cardiac specialist is up to knowing if you can use it, not GP or hospital"

Other themes and issues that emerged

The health benefits of walking were raised:

"Wonders if just walking around the house or a flat walk is of value"

"Some people can walk 10,000 steps but doesn't work out the heart"

Some participants described how they changed their behaviour and used specific strategies to maintain their exercise regime.

"Now will walk at work instead of using ute or bike"

"To save getting bored, take different routes and see different people"

The importance of support was highlighted.

"Being in the program keeps you motivated"

"Something like this focus group gives you incentive to continue"

"Need regular follow-up like Medibank Private every month"

Some participants suggested that their motivation to exercise might be increased if they had regular weight checks or had a fitness test every six months. Most participants spoke highly of the value of attending a cardiac rehabilitation group, however the need for evening classes was raised.

Several participants discussed how depressed they felt after their heart condition.

"Psychological garbage – a problem that individual has to deal with. Having to admit is crook. All well but knows will die. People trying to be nice."

However, one person said that the big incentive for them to exercise was that they had almost died.

Discussion

Study 1: Uptake of cardiac rehabilitation and characteristics of cardiac rehabilitation attendees and non-attendees

Less than a third of all patients referred to a CRP in north Illawarra and Shoalhaven attended a formal outpatient CRP. This proportion is similar to other reports within Australia.^{7,8} This low uptake of CRP is of considerable concern and highlights an obvious gap in public health practice, as many cardiac patients are not receiving the benefits of participation in secondary prevention programs needed to improve their prognosis after a cardiac event.

In the present study, cardiac rehabilitation attendees were significantly younger than non-attendees. This is similar to other studies.³⁶⁻⁴⁰ Patients who are older may have more co-morbidities and experience greater transport difficulties than those who are younger,³⁶ therefore making it more difficult for them to attend.

The high proportion of CABGS patients that attended cardiac rehabilitation in the current study is not unusual. An Australian study has reported that patients who have undergone CABGS or PCI were more likely to be referred to cardiac rehabilitation than those with ACS, including MI.⁷ As well as being referred more often, CABGS patients may also perceive a greater need for rehabilitation after surgery, enhancing their motivation to attend a program.⁷ However, the high proportion of PCI patients who attended cardiac rehabilitation in our study contrasts with previous findings in Australia that have generally reported poor attendance rates among PCI patients.^{7,36,40} Authors have speculated that PCI patients are less likely to perceive a great need for rehabilitation, and are younger and return to work earlier, making them less available to attend daytime programs.⁷ A possible explanation for the high proportion of PCI patients who attended cardiac rehabilitation in the current study is the slightly older age of patients referred to cardiac rehabilitation in this study when compared with other Australian research.⁴⁰ The lower proportion of attendees than non-attendees having ACS or MI diagnoses reflects the findings of other Australian studies.^{8,40} Patients diagnosed with MI or ACS may perceive their illness as less severe than those who have had a surgical

procedure, therefore making them less inclined to attend formal rehabilitation.³⁶

Gender has been reported as an important predictor of cardiac rehabilitation attendance^{36,41} with women significantly less likely to attend cardiac rehabilitation than men.^{36,40-42} However we found no significant differences in distribution of males and females attending CRP. Our finding correlates with that of Cooper et al who also found no significant differences in gender.³⁸

Socioeconomic status was not different between attendees and non-attendees at cardiac rehabilitation in our study; however there was a trend toward greater disadvantage among non-attendees. This is consistent with previous research that has identified a lower uptake of cardiac rehabilitation in those with lower socioeconomic status.³⁸

Study 2: Cardiac Rehabilitation Trial

The Cardiac Rehabilitation Trial showed that a pedometer based intervention was successful in increasing physical activity in cardiac patients after they had attended a CRP, and led to sustained levels of physical activity at six months. Participants in the intervention group significantly increased total physical activity from baseline by 87 minutes per week at six weeks and 112 minutes per week at six months; this improvement was significantly greater than the control group after adjusting for baseline differences. There was a significant decrease in physical activity at six months in the control group, which is often observed following the completion of a CRP.

^{9,15,16}

In the present study, no significant change in cardio-respiratory fitness was detected at six weeks; however a significant increase in cardiorespiratory fitness was detected at six months in the intervention group. This is most likely due to the time it takes for physiological adaptations to occur as a result of the increase in physical activity.⁴⁴ Cardio-respiratory fitness improvements in the intervention group at six months were significant enough to translate into significant and meaningful health benefits,^{43,44} as well as corroborating the self-reported physical activity changes in this group. The only

significant change in anthropometric measures was a decline in waist circumference among males at six weeks.

Although the intervention was designed to increase participant's self-efficacy for exercise, this outcome did not change following the intervention. As the self-efficacy scores were high at baseline in our study, it is possible that there were ceiling effects in this measure. In the present study, outcome expectancies improved significantly in the intervention group at six weeks, but not at six months. The improvement in outcome expectancies at six weeks corresponded with an increase in self-reported physical activity. However, in the present study there was no significant change in outcome expectancies at six months, despite a further increase in self-reported physical activity. The decline in psychological distress in this study may have been due to the participants engaging in a high level of physical activity throughout the study period, regardless of group allocation.

A limitation of the study was the high proportion of eligible patients who chose not to participate (98 out of 220). It is possible that those who did participate were highly motivated and interested, and may not have been representative of the population of CR attendees, therefore limiting the generalisation of our findings.

Study 3: Community Trial

The present study's findings that a pedometer based intervention was successful in increasing physical activity levels in cardiac patients who do not attend CRP are important as these people receive minimal support and information on cardiac rehabilitation. While recent research has identified the need for interventions for people living with heart disease who do not attend CRP,^{13,14} this is the first study, to our knowledge, to offer a physical activity intervention to this population of cardiac patients.

There was a significant increase from baseline in the total physical activity reported in the intervention group by 95 minutes per week at six weeks and 86 minutes per week at six months. An increase of this magnitude resulted in the intervention group participants achieving 367 and 359 minutes of weekly activity at six weeks and six months respectively. Participation in this amount of activity is well above the recommended national physical activity guidelines for cardiac patients²⁸ and could result in major health benefits such as slowing the progression of CVD.⁴³

This study showed that participation in the pedometer-based intervention enhanced self-efficacy for exercise for participants within the intervention group. Other studies investigating the effectiveness of physical activity

interventions based on the self-efficacy component of Bandura's SCT⁴⁵ have reported mixed results.⁴⁶⁻⁴⁸

Outcome expectancies related to physical activity participation increased significantly within the intervention group. Outcome expectancies were significantly greater in the intervention group than control group at six weeks, however no significant differences between groups were observed at six months, indicating that the effect of the intervention on outcome expectancies was not as strong at medium-term follow-up. The improvement in outcome expectancies in the intervention group at six weeks occurred concurrently with an increase in self-reported physical activity.

Self-management strategies to increase physical activity were promoted to intervention group participants, and there was a significant increase in the use of behavioural and cognitive self-management strategies in the intervention group at six weeks, but not at six months. The lack of strategy use at six months may have been because changes in physical activity had already been made at six weeks and participants may not have been consciously aware of the strategies they were using at six months.

We expected that the intervention group would have a lower level of psychological distress due to their increased participation in physical activity⁴⁹⁻⁵⁰ however we found a significant decrease in psychological distress in the control group, but not in the intervention group. There were no significant differences between the two study groups at any time point.

A limitation of this study was the reliance on self-report measures for physical activity. However, the Cardiac Rehabilitation Trial (Study 2), which used objective measures of cardiorespiratory fitness with patients attending a CRP, found that self-reported physical activity changes were corroborated by improvements in cardiorespiratory fitness in the intervention group. Second, a possible sample bias could exist due to the self-selection of participants who volunteered to be in the study.

Among the 672 participants who were referred to a CRP during the 10 month period and chose not to attend, only two thirds could be contacted, and half of these people refused to participate in the trial. Thus, the study participants may have been a more motivated and interested group than those who refused or could not be contacted. However, a strength of this study was the excellent follow-up rate during the study period.

Study 4: Acceptability of pedometer-based intervention

The findings from our qualitative study indicate that the pedometer based intervention was well-received by participants and that each of the components of the multi-strategic intervention was considered to be useful in promoting physical activity. Most participants felt that people would most benefit from receiving a pedometer when they attend a cardiac rehabilitation group.

However as a significant number of cardiac patients do not attend CRPs, the patient's general practitioner or cardiac specialist might also be able to suggest that their cardiac patients use a pedometer.

SECTION 7

Conclusion & recommendations

Both the Cardiac Rehabilitation Trial and the Community Trial showed that participation in a pedometer-based intervention was associated with significant improvements in physical activity levels and psychosocial health in people who are referred to a CRP. This project demonstrated the success of a behavioural change physical activity intervention based on SCT for a population in great need of support. These findings suggest the pedometer-based intervention could be offered as an effective and accessible option for those who do not attend cardiac rehabilitation to increase their physical activity levels. This intervention could also be promoted as an important adjunct to existing CRPs to promote adherence to physical activity after cardiac rehabilitation attendance.

The findings from this project contribute significantly to the evidence base for best practice interventions that support this population group to be more physically active, thus having the potential to reduce the CVD burden within the community. In addition, this project has addressed a significant gap in health promotion practice as it reaches a population within the community who are generally underserved and hard to reach. This project has the potential to inform nation wide and local policy development around services for people with cardiac disease referred to rehabilitation programs.

Further research in the form of replication and dissemination studies is needed to determine the effectiveness of this intervention with other communities within Australia, for example in rural or remote communities, or urban communities with different demographic characteristics.

SECTION 8

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Appendices



Appendix 1: Pedometer Instruction Sheet

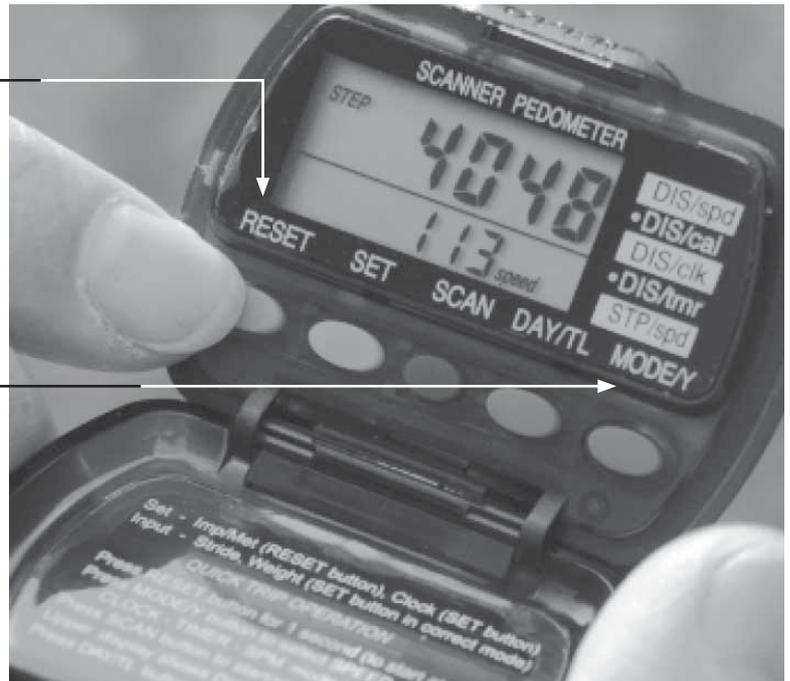
Using your pedometer

Step 1. Press the **yellow reset button** to return the number of steps to zero.

Step 2. Wear your pedometer **from when you get up in the morning until you go to bed at night** (except when showering or swimming).

Step 3. Record the **number of steps** on your calendar when you take the pedometer off before you go to bed.

Note: If the pedometer does not display steps, press the **MODE** button until the step count is displayed (the small black bar will be under the word **STEP** at the top of the screen).



Wearing your Pedometer

- Clip the pedometer onto **your belt or waistband** using the black plastic clip at the back of the pedometer.
- Position the pedometer as close to your hip bone as possible, over the midline of your thigh. Keep it parallel to the ground.
- If you have a large belly, wear the pedometer on the side of your hip, or clip it to your shirt pocket.
- Fasten the silver **safety clip** to ensure you don't lose the pedometer.

Be careful!

The pedometer is NOT waterproof.

Pedometers are fragile, try not to drop it or put excess pressure on it.

It is important that you understand how to use the pedometer and the step calendar.

For HELP Please call Lyra Butler on 4221 XXXX

Appendix 2: Step calendar

My Step Calendar

Name: _____

Part 1: Completing the one week step calendar

- Start wearing your pedometer the day after you receive it. Write the name of the day you start under the **BLUE** box for DAY 1. For example, if you receive your pedometer on Wednesday, start wearing it on Thursday and write Thursday in the box that says Day 1, Friday in the box that says Day 2 and so on, for the next week.
- Wear your pedometer from when you get up in the morning, until you go to bed at night (except when showering or swimming). When you take the pedometer off at night, record the number of steps in the **PURPLE** STEP COUNT box that corresponds with the day. If you forget to wear your pedometer for a day, that's OK, just leave that day blank and start again the next day.
- If you go for a walk or do any other physical activity for at least 10 minutes continuously, record the activity in the **GREEN** ACTIVITY box. **Keep doing what you would do in a normal week. Do not change your physical activity this week.**

Week One	Example Day 1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Step Count	Thurs 2/7/09							
Activity	Write step number here							
	Walk 20 mins, Golf 2 hours							

Part 2: Using the six week step calendar

Please do not start filling out the six week step calendar over the page until I have called you.

- I will call you before you start the six week step calendar to help you set a physical activity goal for the first two weeks.
- We can also think about your long-term physical activity goals. These can be written in the space provided on the step calendar.

For help, please call Lyra Butler at the SESIAHS Health Promotion Service on 4221 6757.

Six Week Step Calendar for Part 2

Week	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Weekly Goal	Weekly Goal Met? Y/N
One	Goals								
	Step Count								
Two	Goals								
	Step Count								
Three	Goals								
	Step Count								
Four	Goals								
	Step Count								
Five	Goals								
	Step Count								
Six	Goals								
	Step Count								

I will call you towards the end of week two to help you set goals for the coming weeks.

Next telephone appointment:
 Date: _____
 Time: _____

I will make a copy of the step counts on this calendar for weeks 5 & 6 when I contact you at the end of week 6.

Next telephone appointment:
 Date: _____
 Time: _____

Long term physical activity goals: _____

Six weeks: _____ Six months: _____

South Eastern Sydney Illawarra Area Health Service

Division of Population Health & Planning

Locked Bag 9 Unanderra NSW 2526

Tel (02)4221 6700 Fax (02)4221 6722

October, 2006

Hello,

Thank you for your interest in participating in the Illawarra and Shoalhaven Healthy Heart Project.

Your participation will help us to gather important information on the best ways to promote cardiovascular health when recovering from a heart condition. It is important in research projects to have a large number of people as this gives the results more meaning. Should you decide to be a part of this research, your participation will be extremely valuable and much appreciated.

Please read the Participant Information Sheet and the Cardiorespiratory Assessment Information Sheet for more details about the project.

I will call you in the next fortnight to confirm that you are still interested in participating. Please do not hesitate to contact me on 4221 6757 should you require further information.

Please consider participation in this project as an opportunity to make a difference to people recovering from the effects of heart disease.

I look forward to speaking with you soon.

Lyra Butler

Project Officer

South Eastern Sydney and Illawarra Area Health Service

*The Illawarra and Shoalhaven Healthy Heart Project is a partnership with NSW Health,
South East Sydney Illawarra Area Health Service, NSW Centre for Physical Activity and Health and the
National Heart Foundation.*





Participant Information Sheet

What do I have to do?

Your participation will be required for six months. During this time you will be asked to meet with the researchers three times at Port Kembla Hospital or Shoalhaven Memorial Hospital. If you have transport difficulties please talk to Lyra Butler as she may be able to arrange transport for you. Written consent will be obtained from you before you begin participation.

At the start of the project, you will be asked to answer a questionnaire and have your cardiorespiratory fitness measured. The measurements will be done by an exercise physiologist from the Illawarra Health Cardiac Rehabilitation program in either the Illawarra or Shoalhaven.

Your cardiorespiratory fitness will be measured using a gas analysis system. This system collects information on every breath you take and calculates how much oxygen you are consuming. You will be fitted with a mask over your nose and mouth through which you will breathe normally during the fitness test. The test will be very simple and should not be uncomfortable at any stage. The exercise physiologist will also record your height, weight, resting blood pressure and heart rate.

Six weeks after the first set of measurements, you will be asked to:

- Answer another questionnaire
- Have your cardiorespiratory fitness measured again

In six months time you will be asked to:

- Answer another questionnaire
- Have your cardiorespiratory fitness measured again

The questionnaires will be read to you and should take about 30 minutes to answer. The questions have been trialled with other cardiac patients and are generally easy to answer.

What's in it for me?

You will have the opportunity to receive individualised feedback on your fitness level. The measurements taken over the six month period will provide you with accurate and valuable information regarding improvements in your fitness. You will also receive some helpful information about healthy lifestyle choices to make when recovering from a heart condition.

Your participation in the study will follow on from the cardiac rehabilitation program. Regular contact with the researchers over the next six months may help you to maintain any lifestyle changes you may have been thinking about during your time in the cardiac rehabilitation program.

What if I say yes and then change my mind?

Participation in this study is entirely voluntary and you are free to withdraw from the study at anytime without any penalty or loss of benefits to which you are otherwise entitled. All you need to do is let Lyra know you have decided to withdraw.

All data collected will be confidential.

To ensure confidentiality of data and results, your name on the questionnaires and cardiorespiratory fitness measurements will be changed to a code. All data will be securely kept in locked filing systems and electronic databases will be password protected. At no time will your personal details be divulged. Every effort will be made to maintain confidentiality of all information received by you.

This project has been approved by the University of Wollongong / Illawarra Area Health Service Human Research Ethics Committee. If you have any concerns of an ethical nature or complaints about the manner in which the project is conducted you may contact the University of Wollongong Complaints Officer on (02) 4221 4457.

What happens now?

Lyra will call you within the next fortnight. If you have decided you would like to participate, a meeting time will be arranged with you to have your first cardiorespiratory assessment and to answer the first questionnaire. Prior to this meeting you will be mailed out the consent forms to sign and bring with you to the meeting. You will be given a copy of these forms to keep. If you have decided you do not want to participate, just let Lyra know when she calls you.

If you have any concerns or questions, please contact Lyra Butler at South Eastern Sydney and Illawarra Area Health on (02) 4221 6757.

Cardiorespiratory Fitness Assessment Information Sheet

Explanation of the cardiorespiratory fitness assessment

To measure your cardiorespiratory fitness you will be required to perform a graded exercise test on a bicycle ergometer. The workload will begin at an exercise level that is easy for you to achieve and will be advanced in stages depending on your present fitness. At no time will you be required to exercise at a level that is very uncomfortable for you. To measure your cardiorespiratory fitness accurately, you will be fitted with a mask to wear during the assessment. You will be able to breathe normally through the mask and we will make sure it is fitted comfortably. Your blood pressure and heart rate will be recorded and monitored closely throughout the assessment. The exercise physiologist will also measure your height, weight and waist and hip circumferences.

Benefits

The cardiorespiratory assessment will provide valuable information to you about your current fitness level and stage of recovery from your heart condition. You will gain a greater understanding of your capacity to perform physical activity. This information could assist you in making choices about how much physical activity you are capable of doing. Performing three assessments over a period of six months will allow your recovery progress to be monitored, providing you with valuable feedback.

Risks and discomforts

Risks of the cardiorespiratory assessment procedure are minimal and rare and include abnormal blood pressure, dizziness, fainting and irregularities of the heart beat. Every effort will be made to minimise the possibility of these changes occurring. The assessment will be supervised by a professional exercise physiologist who will monitor your progress throughout the test. Prior to the assessment you will be asked some questions about your medical history, current medications and any present health conditions that may affect your ability to exercise. Your heart rate and blood pressure will be monitored throughout the assessment by the exercise physiologist. In the unlikely event that these precautions are insufficient, emergency treatment will be summoned.

Participant responsibilities

To ensure your safety during the assessment please let the researchers know of any pre-existing health problems that could affect your physical activity. We would also like to know about any past experiences of unusual feelings associated with physical exertion. If you begin to feel unwell or experience any pain during the assessment it is essential that you immediately report this to the researchers.

What to bring on the day...

- Wear comfortable clothing and footwear
- Water bottle
- Your current medication list
- Towel (optional)

Before the assessment...

- Do not do any exercise
- Do not eat for at least two hours
- Do not ingest caffeine for at least two hours
- If you are a smoker, do not smoke for one hour prior to the assessment

Freedom of consent

Your participation in the cardiorespiratory assessment is entirely voluntary. You are free to withdraw your consent or discontinue participation at any time, for any reason.

If you decide you would like to participate, you will be asked to sign a consent form prior to the assessment.

Please do not hesitate to contact Lyra Butler (4221 6757) should you have any doubts or questions regarding the assessment procedures.

Appendix 4:
Follow-up letter and consent form

Date

Dear _____,

Thank you for deciding to participate in the Illawarra and Shoalhaven Healthy Heart Project. Please find enclosed two copies of the consent form for you to sign. Please bring these forms with you to your first meeting. I will sign both forms and you will be given one copy to keep.

Please read the following additional information before signing the consent form.

[As part of this project you will be given a pedometer and asked to wear it from when you get up in the morning until you go to bed at night for a period of six weeks. You will also be required to record your daily steps on a calendar that will be provided. You will be taught how to use your pedometer and step calendar during our first meeting.

As part of the project I would like to call you approximately every fortnight in the first six weeks to see how you are going. I will then call you every two months after this until the end of the project at six months. The purpose of this regular telephone contact is to provide you with feedback and advice on your progress throughout the project] *omit for control group participants.*

Once again, please do not hesitate to contact me on 4221 6757 should you require further information.

I look forward to meeting with you soon.

Lyra Butler
Project Officer
South Eastern Sydney and Illawarra Area Health Service

Your first appointment:

Date and time: _____

Please call Lyra on 4221 XXXX if you are not able to attend this appointment.

Place: _____

Please read the Cardiorespiratory Fitness Assessment Sheet (given to you in the cardiac rehab class) and remember to bring the following items with you to your appointment:

- Consent forms
- Current medication list

The Illawarra and Shoalhaven Healthy Heart Project is a partnership with NSW Health, South East Sydney Illawarra Area Health Service, NSW Centre for Physical Activity and Health and the National Heart Foundation.



CONSENT FORM
The Illawarra and Shoalhaven Healthy Heart Project

Please read and sign the following statements:

1. I agree to participate in *The Illawarra and Shoalhaven Healthy Heart Project* and understand the requirements of the project as stated in the Participant Information Sheet and the Cardiorespiratory Fitness Assessment Information Sheet.
2. I understand that the project involves the following procedures:
 - Travelling to Port Kembla Hospital or Shoalhaven Memorial Hospital to meet with the researchers three times over six months.
 - Answering a questionnaire at the beginning of the project, at six weeks and again at six months.
 - Having my cardiorespiratory fitness measured using gas analysis system at the beginning of the project, at six weeks and six months.
 - [Wearing a pedometer and recording my step count each day for a period of six weeks] *omit for control group participants.*
 - [Participating in a series of brief telephone interviews with the researcher] *omit for control group participants.*
3. I have not been advised by any doctors to avoid physical activity as it could be harmful to my health.
4. I understand that I am to cease participation in the project immediately and contact the researcher should any serious symptoms arise that are made worse by physical activity.
5. I understand that I am to see my doctor if I experience any symptoms or problems that could affect my safety or comfort when participating in physical activities.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered for the project may be published provided that I cannot be identified as a participant.
8. I agree to participate in this project and understand that I may withdraw at any time without penalty or loss of benefits to which I am otherwise entitled.

Please sign here Name of participant

—————▶ Signature Date

9. I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of researcher

Signature of researcher Date

*Please sign the consent form and bring to our first meeting
You will be given a signed copy of the form for you to keep.*

Appendix 5: Cardiac Rehabilitation Trial questionnaire

Participant ID: _____ Today's Date: _____ Group Code: _____

Good Morning/Afternoon _____, its Lyra from SESIAHS. We have received your consent form back for the Healthy Heart Project. I am calling to make a time with you to answer the first questionnaire. This will take about 30 minutes, is now a good time for you to do this? (if not, make another appointment).

Note: Fill out **Telephone Call Record** for each phone call made to participant.

Your participation in this questionnaire is entirely voluntary. You don't have to answer a question if you don't want to. All data is confidential, and your name will be changed to a code to protect your privacy.

SECTION A ~ PHYSICAL ACTIVITY

The first questions I am going to ask you are about any physical activities, (e.g. sport, recreation or leisure time physical activities) that you have participated in over the last month.

1. Could you tell me the physical activities (sports or forms of recreation) that you have actively participated in during the past month? [Fill in the following table]

[Write down sport, recreation, or other physical activity] <i>Ask about gardening and lawn mowing</i>	Approximately how many Times in the past month did you [name the activity]?	Approximately how much time did you spent each time doing this activity? [average time per episode]
1	<i>times/ month</i>	<i>hrs min</i>
2	<i>times/ month</i>	<i>hrs min</i>
3	<i>times/ month</i>	<i>hrs min</i>
4	<i>times/ month</i>	<i>hrs min</i>
5	<i>times/ month</i>	<i>hrs min</i>

The next questions I am going to ask you are about any physical activities you may have done in the past week.

2. In the past week, how many times have you walked continuously, for at least 10 minutes, for recreation, exercise or to get to or from places?
_____ **Times** → if 0, go to Q4
3. What do you estimate was the total time that you spent walking in this way in the past week?
_____ **Hours and/or minutes**
4. In the past week, how many times did you do any vigorous gardening or heavy work around the yard, which made you breathe harder or puff and pant?
_____ **Times** → if 0, go to Q6
5. What do you estimate was the total time that you spent doing vigorous gardening or heavy work around the yard in the past week?
_____ **Hours and/or minutes**

The next questions exclude household chores, gardening or yard work:

6. In the past week, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis)
_____ **Times** → if 0, go to Q8
7. What do you estimate was the total time that you spent doing this vigorous physical activity in the past week?
_____ **Hours and/or minutes**
8. In the past week, how many times did you do any other more moderate physical activities that you have not already mentioned? (e.g. gentle swimming, social tennis, golf)
_____ **Times** → if 0, go to Q10
9. What do you estimate was the total time that you spent doing these activities in the past week?
_____ **Hours and/or minutes**

The next questions are about your general physical activity level.

10. Think back to the month prior to your heart surgery or hospital stay. Compared to that month, are you now....?

- 1 much more active
- 2 more active
- 3 about the same
- 4 less active
- 5 much less active

11. How would you rate your own level of physical activity **now**?

- 1 very active now
- 2 somewhat active now
- 3 somewhat inactive now
- 4 very inactive now

12. **Dog ownership**

a. Do you have a dog?

- 1 Yes
- 2 No → Go to Q13

b. Do you personally walk your dog?

- 1 Yes
- 2 No → Go to Q13

c. How many times, if any, in the past week did you take your dog for a walk?

_____ Times

d. Please estimate the total time you spent walking your dog in the past week.

_____ Total time (hrs/mins)

13. **Carer status**

a. During the past week, how often did you care for another person, such as children, a dependant spouse, or another adult?

- 1 Never → Go to Q14
- 2 Seldom (1–2 days)
- 3 Sometimes (3–4 days)
- 4 Often (5–7 days)

b. On average, how many hours per day did you spend caring for another person?

- 1 less than 1hr
- 2 ≥1 but less than 2 hrs
- 3 2 - 4 hrs
- 4 More than 4 hrs

SECTION B ~ PSYCHOSOCIAL FACTORS

Self-efficacy

The next section asks how confident you are about doing regular physical activity in different circumstances.

14. On a scale of 1–7, how confident are you that you can do regular, moderate physical activity (such as walking, swimming or cycling) on most days of the week?

Not at all confident 1 2 3 4 5 6 7 Totally confident

15. On a scale of 1–7, how confident are you right now that you could do regular moderate physical activity such as walking for 30 mins on most days of the week

	Not at all confident				Totally confident		
	1	2	3	4	5	6	7
a. If the weather was bothering you	1	2	3	4	5	6	7
b. If you were bored by the program or activity	1	2	3	4	5	6	7
c. If you had to exercise alone	1	2	3	4	5	6	7
d. If you did not enjoy it	1	2	3	4	5	6	7
e. If you were too busy with other activities	1	2	3	4	5	6	7
f. If you felt tired	1	2	3	4	5	6	7
g. If you felt stressed	1	2	3	4	5	6	7
h. If you felt depressed	1	2	3	4	5	6	7

The next questions ask specifically about walking.

Self-regulation efficacy

16. How confident are you that you can schedule time for walking sessions for most days of the week during the next 6 weeks? (e.g. organising chores and responsibilities around your walking times)

Not at all confident 1 2 3 4 5 6 7 Totally confident

Walking self-efficacy

17. How confident are you that you can walk at a moderate pace continuously for at least.....?

	Not at all confident confident				Totally		
	1	2	3	4	5	6	7
a. 10 minutes	1	2	3	4	5	6	7
b. 20 minute	1	2	3	4	5	6	7
c. 30 minutes	1	2	3	4	5	6	7

Self-management strategies

18. There are a variety of things people do to stay physically active. For each of the following statements please consider how often — whether never, rarely, sometimes, often or very often — do you do the following? If you find these questions are not applicable to you, please indicate NA.

[NB: replace 'walking' with 'physical activity' if the respondent regularly does activities other than walking]

	N	R	S	O	VO
a. You do things to make walking more enjoyable	1	2	3	4	5
b. You think about the benefits you will get from walking	1	2	3	4	5
c. You try to think about the benefits of walking and less about the hassles of walking	1	2	3	4	5
d. You say positive things to yourself about walking	1	2	3	4	5
e. When you get off track with your walking plans, you tell yourself you can start again and get right back on track	1	2	3	4	5
f. You try different kinds of physical activity so that you have more options to choose from	1	2	3	4	5
g. You set goals to walk	1	2	3	4	5
h. You make back-up plans to be sure you get your walks	1	2	3	4	5

Outcome expectancies

19. The next questions ask about a number of outcomes that could occur if you walked regularly.

Please tell me how much you agree or disagree with the following statements — whether you strongly agree, agree, are neutral, disagree or strongly disagree.

[NB: replace 'walking' with 'do physical activity' if the respondent regularly does activities other than walking]

If you walk (or do physical activity) regularly....	SD	D	N	A	SA
a. Your heart condition will improve	1	2	3	4	5
b. You'll feel more confident about delaying or preventing long term heart complications	1	2	3	4	5
c. Your symptoms will get worse	5	4	3	2	1
d. You will worry less about having further heart problems	1	2	3	4	5
e. Your family and friends will worry less about you having further heart problems	1	2	3	4	5
f. You will experience more symptoms from your heart condition	5	4	3	2	1
g. You will feel more in control of your health	1	2	3	4	5
h. You will feel more tired	5	4	3	2	1

Social support

20. The next questions ask about the support that you have to be physically active.

In the past three months, how often – whether often, sometimes, rarely or never — did your family or friends

	Never	Rarely	Sometimes	Often
a. Do physical activity with you	1	2	3	4
b. Give you encouragement to stay physically active	1	2	3	4
c. Make it difficult for you to do physical activity	4	3	2	1
d. Give you helpful reminders to do physical activity	1	2	3	4

21. Intention to exercise

a. Have you been getting regular physical activity over the past six months? (30 mins at a moderate intensity on at least 5 days per week).

- 1 Yes → go to Qc and Qd
- 2 No → go to Qb, Qc, then Qd

b. On a scale of 1–7, how *likely* are you to *start* regular physical activity *in the next six weeks*?

Not at all likely 1 2 3 4 5 6 7 Very likely

c. On a scale of 1–7, how *likely* are you to be getting regular physical activity *in the next six weeks*?

Not at all likely 1 2 3 4 5 6 7 Very likely

d. On a scale of 1–7, how *likely* are you to be getting regular physical activity *in the next six months*?

Not at all likely 1 2 3 4 5 6 7 Very likely

SECTION C ~ CARDIAC REHAB

[baseline only] 22. Attendance at cardiac rehabilitation

You have attended an OCR program recently, can you tell me the main reasons why you chose to attend this program? _____

[baseline only] 23. Did you have a companion who attended the first class with you?

- 1 Yes
- 2 No

22. In the past four weeks have you attended...?

- 1 A cardiac rehab program
- 2 A home visit with cardiac rehabilitation staff
- 3 A community-based physical activity class eg Heart Moves
- 4 A gym-based physical activity class eg. CR based ex at PKH, Movement Medicine
- 5 A walking group eg. Just Walk It
- 6 Other _____
- 7 No, I did not attend another class

SECTION D ~ GENERAL HEALTH AND WELLBEING

23. Overall, how would you rate your health during the past four weeks?

- 1 Excellent
- 2 Very good
- 3 Good
- 4 Fair
- 5 Poor
- 6 Very poor

[six week and six month only] Document any major setbacks or rehospitalisation:

24. Have you recently received any advice on physical activity?

- 1 Yes → How/where did you receive this advice? _____
- 2 No
- 3 Don't know [don't read]

The next questions ask about living with your heart condition

25. Brief illness perception questionnaire

On a scale of 1 to 7.....

a. How much does your heart condition affect your life?

No affect at all 1 2 3 4 5 6 7 Severely affects my life

b. How long do you think your heart condition will be present?

A very short time 1 2 3 4 5 6 7 Forever

c. How much control do you feel you have over your heart condition?

Absolutely no control 1 2 3 4 5 6 7 Extreme amount of control

d. How much do you experience symptoms from your heart condition?

No symptoms at all 1 2 3 4 5 6 7 Many severe symptoms

e. How concerned are you about your heart condition?

Not at all concerned 1 2 3 4 5 6 7 Extremely concerned

f. How well do you feel you understand your heart condition?

Don't understand at all 1 2 3 4 5 6 7 Understand very clearly

g. How much does your heart condition affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)

Not at all affected emotionally 1 2 3 4 5 6 7 Extremely affected emotionally

[baseline only] h. Please list in rank-order the three most important factors that you believe caused your heart condition. The most important causes for me:

- 1. _____
- 2. _____
- 3. _____

Wellbeing

26. The following questions are about how you may have been feeling at times in the last 4 weeks. When I read each statement can you please tell me how often you felt this way? For instance, very often, often, sometimes, rarely or never.

In the last 4 weeks....	VO	O	S	R	N
a. About how often did you feel so sad that nothing could cheer you up?	1	2	3	4	5
b. About how often did you feel nervous?	1	2	3	4	5
c. About how often did you feel restless or fidgety?	1	2	3	4	5
d. About how often did you feel hopeless?	1	2	3	4	5
e. About how often did you feel that everything was an effort? eg How often did you feel everything was hard and difficult to do?	1	2	3	4	5
f. About how often did you feel worthless?	1	2	3	4	5

27. Which of the following best describes your smoking status?

- 1 I smoke daily
- 2 I smoke occasionally
- 3 I don't smoke now, but I used to → When did you quit? _____
- 4 I've tried it a few times but never smoked regularly
- 5 I've never smoked

28. Are you currently following any dietary guidelines to help with your heart condition? (eg watching cholesterol or saturated fat intake)

- 1 Yes
- 2 No

29. If you are 65 years of age or older, have you had a fall that required medical treatment for injuries in the last 12 months?

If no, tick box 1, If yes, ask how many times have you had a fall?

- 1 I have not had a fall
- 2 Once
- 3 Twice
- 4 Three times or more

[six week and six month only] 31. Could I have your weight please?

a. Weight: _____kg OR _____ stone, lbs

[baseline and six month only] 30. The next questions are about your local area. When I refer to places that are local or within walking distance I mean within a 10–15 minute walk from your home. To what extent do you agree or disagree with the following statements? (e.g. Strongly agree, agree, disagree, strongly disagree)

	SD	D	A	SA
a. There are many shops or other places to buy things you need within easy walking distance of your home	1	2	3	4
b. It is easy to walk to a public transport stop (bus, train) from your home	1	2	3	4
c. The streets in your local area have many dead end streets	4	3	2	1
d. There are footpaths on most of the streets in your local area	1	2	3	4
e. There is a park or nature reserve in your local area that is easily accessible	1	2	3	4
f. The streets in your local area are hilly, making it difficult to walk in	4	3	2	1
g. There is lots of greenery around your local area (trees, bushes, household garden)	1	2	3	4
h. There are many interesting things to look at while walking in your local area	1	2	3	4
i. Your local area has several free or low cost recreational facilities, such as parks, walking trails, bike paths, playgrounds and recreation centres	1	2	3	4
j. You live on or near a main road or busy highway	4	3	2	1
k. There is so much traffic along most nearby streets that it makes it difficult or unpleasant to walk in your local area	4	3	2	1
l. Streets in your local area are well lit at night	1	2	3	4

[six month only] 31. Have you moved house in the last six months? If so, could I have your new address?

_____ Postcode: _____

[baseline only] SECTION E ~ DEMOGRAPHIC INFORMATION

Lastly, I would like to ask you a few questions about yourself. Please remember that all data is confidential. Only anonymous data will be used in the study

31. Date of Birth: ___/___/___ Age: _____

32. Country of Birth

a. Were you born in Australia?

1 Yes → Go to Q33

2 No

b. What country were you born in? _____

c. When did you first arrive in Australia? 19 ___

d. What language do you usually speak at home? (If NOT English) _____

33. Are you male or female? (only ask if not obvious)

1 Male

2 Female

34. Could I have your height and weight please?

a. Weight: _____ kg OR _____ stone, lbs

b. Height: _____ m OR _____ ft _____ in

35. What is your current marital status?

1 Married

2 Living with partner

3 Widowed

4 Separated but not divorced

5 Divorced

6 Never Married

36. What is the highest level of education you have completed?

1 Never attended school

2 Completed some primary school

3 Completed primary school

4 Completed some high school

5 Completed School Certificate/ Intermediate/Year 10/4th Form

6 Completed HSC/Leaving/Year 12/ 6th Form

7 TAFE Certificate or Diploma

8 University, CAE or some other tertiary institute degree or higher

9 Other (*Specify*) _____

37. Occupation

a. Are you.....?

- 1 Currently employed
- 2 On sick leave from paid employment
- 3 A volunteer (3 or more days per week)
- 4 A student
- 5 Retired → **questionnaire complete**
- 6 Unemployed (or disability pension) → **questionnaire complete**

b. What is your [current / usual] occupation/activity? _____

c. How many hours do you normally spend in all jobs/activities each week? Hrs/wk _____

d. How would you describe your workplace activity?

- 1 Physically inactive
- 2 Regular walking in blocks of at least ten minutes
- 3 Moderately active (raised heart rate) for a total of 30 minutes every day
- 4 Vigorously active (breathing hard) for a total of at least 20 minutes on three or more days

[six week and six month only] SECTION F ~ Pedometer Questions

INTERVENTION SIX WEEKS

30. a. Did you find the pedometer useful?

- 1 Yes
- 2 No
- 3 Don't know [don't read]

b. Why? _____

31. Would you recommend a pedometer to a friend or family member?

- 1 Yes
- 2 No
- 3 Don't know [don't read]

32. a. Did you find the step calendar useful?

- 1 Yes
- 2 No
- 3 Don't know [don't read]

b. Why? _____

33. Do you have any other comments about pedometers? _____

INTERVENTION SIX MONTHS

32. In the last two weeks how many days, if any, did you use your pedometer? _____ days (if none, write '0')

33. In the last two weeks how many days, if any, did you record your steps? _____ days (if none, write '0')

34. Do you have any other comments about pedometers? _____

CONTROL SIX MONTHS

32. Have you ever used a pedometer? *(For participants who do not know, a pedometer is a small electronic device worn on the waist that counts your steps).*

- 1 Yes
- 2 No → (go to question 37)
- 3 Don't know [don't read] → (go to question 37)

33. Have you used a pedometer at all in the last 5 months?

- 1 Yes
- 2 No → (go to question 37)
- 3 Don't know [don't read] → (go to question 37)

34. In the **last two weeks** how many days, if any, did you use a pedometer? _____ days *(if none, write '0')*

35. a. Did you find the pedometer useful?

- 1 Yes
- 2 No
- 3 Don't know [don't read]

b. Why? _____

36. Would you recommend a pedometer to a friend or family member?

- 1 Yes
- 2 No
- 3 Don't know [don't read]

37. Do you have any *(other)* comments about pedometers? *(e.g. If you used a pedometer, did you record steps?)*

Thank you for your time today!

Interviewer: _____

Duration of interview: _____ mins

Notes: _____

Appendix 6: List of Publications and Presentations

A detailed report of this project has been written as a thesis for the degree of Doctor of Philosophy (University of NSW) by Lyra Butler, 2008.

Butler L, Furber S, Phongsavan P, Mark A, Bauman A. Effects of a pedometer based intervention on physical activity levels after cardiac rehabilitation: A randomised controlled trial. *J Cardiopulm Rehabil Prev.* 2009; 29(2):105-114.

This project was presented at the 16th National Conference of the Australian Health Promotion Association. 23–26 April 2006. Butler L et al. *A pedometer based intervention to increase physical activity in people with heart disease.*

