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COMPREHENSIVE CARDIAC REHABILITATION PROGRAMME IMPROVES QUALITY OF LIFE AND EXERCISE TOLERANCE IN LOW RISK CARDIAC PATIENTS.

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ABSTRACT

Objective: To assess the effect of an outpatient comprehensive cardiac rehabilitation (CCR) programme on cardiac risk factors and quality of life among low risk cardiac patients. **Method:** Retrospective review of 240 low risk cardiac patients who were enrolled into an eight-weeks CCR programme (Phase II), followed by an 18-months CCR maintenance programme (Phase III) in Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital from 2011 to 2015. Short Form 36 (SF36), exercise test time (ETT), resting systolic and diastolic blood pressure (SBP, DBP), resting heart rate, fasting blood sugar, cholesterol profile (total cholesterol, HDL, LDL, triglyceride), weight, waist circumference (WC) and smoking status were recorded at baseline Phase II enrolment (P1), at the end of Phase II (P2) and Phase III (P3). **Results:** of the 240 patients enrolled, only 182 patients (75.8% retention rate) completed at least 60% attendance of CCR Phase II programme and entered into CCR Phase III maintenance programme. At the end of Phase III, only 122 patients had complete dataset for analysis. There were statistically significant differences in SF36 scores (71.9±18.4 to 77.3±17.0; p=0.001) and ETT (8.4±2.7 to 9.8±2.9; all P<0.001), Fasting blood sugar (p=0.029), total cholesterol (p=0.001), HDL (p=0.001), LDL (p=0.007), trygliceride (p=0.034) and waist circumference (p=0.026) between all time points (P1-P2-P3). However, these differences on post hoc analysis were attributed to outcome measure improvements which were only seen after completion of Phase II (P2) and were maintained only in SF36 scores and ETT with significant improvement in HDL levels after Phase III (P3) of the CCR programme. **Conclusion:** This is the first cardiac rehabilitation efficacy evaluation in Brunei Darussalam. Our study showed that an eight-weeks Phase II CCR programme can significantly improved quality of life measures, exercise test time, biochemical parameters and waist circumference in low risk cardiac patients with sustained improvements in the quality of life measures and exercise tolerance when combine with a 18 months Phase III maintenance programmes. Further implementation of a short supervised period of Phase II in between Phase III may help improve compliance and maintain outcomes.

Key words: Cardiac risk factors, Cardiac rehabilitation, Quality of Life, Percutaneous coronary intervention, myocardial revascularisation.

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Keywords: Cardiac risk factors, Cardiac rehabilitation, Quality of Life, Percutaneous coronary intervention, myocardial revascularisation.

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INTRODUCTION

Globally, cardiovascular disease (CVD) is the leading cause of Years of Life Lost (YLL) due to premature mortality.¹ In most countries,

the national health expenditures for CVD are the highest, varying between 8-22% of the country's GDP.² Effective primary, secondary and tertiary prevention strategies, including cardiac rehabilitation (CR), are paramount to control CVD.³⁻⁵ Many studies have demonstrated improvement and effectiveness of outpatient CR programme (Phase II) in managing cardiac risk factors.^{6,7} Comprehensive Cardiac Rehabilitation (CCR) programme, which includes an additional educational components besides the usual supervised exercise components can reduce cardiac mortality by 26-36% and total mortality by 13-26%.⁸ Long-term comprehensive cardiac care that incorporates close follow-up (Phase III) is likely to be more effective and improve survival.⁹ The Heart Watch's study found that CCR programmes (Phase II) without any Phase III follow-up would most likely allow patients to fall back to their previously undesired lifestyle.¹⁰ Hence Phase III CCR programmes help patients monitor and maintain healthy lifestyles, which help sustain the benefits gained from Phase II.¹¹

CVD is the second leading cause of death in Brunei Darussalam, accounting for 12.5-15.5% of total deaths.¹² In Brunei, only 3 phases CCR programmes were used. Phase 1 is when patients were seen in Coronary Care Unit. Phase 2 is where patients come to CCR programme as outpatient (8 weeks, twice a week programme) and Phase 3 is where patients stay in the community. An Australian model CCR programme was first established in Raja Isteri Pengiran Anak Saleha (RIPAS) hospital in 2004, to prevent cardiac patients from a second cardiac event.¹³ The CCR programme at RIPAS Hospital consisted of 3 phases, with Phase I CR initiated while patients are still in coronary care unit (CCU) recovering from their recent heart attack. Once discharged, patients with recent MI are referred to Outpatient rehabilitation unit to continue their CR in Phase II CR programmes for a total of 8 weeks. On comple-

tion of CR programme (Phase II), patients are entered into an 18 months Phase III CCR programme where they are continue with self directed CR in the community and maintains a long-term heart health on their own.

There has been no evaluation study on the impact of such CCR programme for cardiac patients in Brunei Darussalam. This study was carried out as part of our Departmental audit on our CCR programme to evaluate its effectiveness in terms of improvement in cardiac risk factors, quality of life and sustainability of benefits among cardiac patients after completing 8 weeks of Phase II supervised CCR programme and 18 months of Phase III self-monitored CCR programme respectively in RIPAS Hospital.

METHOD

Participants

Records from patients who have undergone Phase II CCR programme and 18 months Phase III CCR maintenance programme from 2011 to 2015 were retrospectively reviewed. During the study period, patients were referred from hospitals and clinics (government and private) to the CCR programme. Prior to entry into the programme, all patients were screened by cardiologists for enrolment eligibility into the Phase II. Inclusion criteria included any of the following: 1) uncomplicated myocardial infarction managed with medications only; 2) history of coronary arteries revascularisation, either percutaneous transluminal coronary angioplasty (PTCA) or heart surgery; 3) computed tomography angiogram showing minor coronary artery diseases but with symptoms; 4) ejection fraction of >50%; 5) valve surgery and 6) controlled atrial fibrillation, blood pressure, diabetic mellitus and renal impairment. Exclusion criteria were: 1) ejection fraction <50%; 2) PTCA stent/s deployed <one month previously; 3) surgery <six months previously; 4) joint problems in the lower limbs and 5) uncontrolled hyperten-

sion.

At Programme Entry

Data were prospectively collected by the CR nurses since 2004 for patients recruited to the CCR programme and records kept in the rehabilitation unit. A total of 240 patients have registered and undergone CCR programmes at RIPAS Hospital during the study period from 2011-2015. These 240 records were retrospectively retrieved and reviewed. The recruitment process into the CCR programme and its pathways and assessments are shown in Figure 1. In short, a maximum of 10 patients were recruited per rehabilitation group. Recruitment stop once 10 patients consented to attend. On average 6-7 patients per group attended the programme out of the 10 patients recruited. Patients were recruited from all three district hospitals including RIPAS Hospital, primary health clinics, and from Gleneagles Jerudong Park Medical Centre for patients post cardiac procedures. All patients were required to undergo a stress test (Bruce Protocol) to assess fitness prior to starting the CCR programme. Patients certified fit by cardiologists were enrolled into Phase II. Phase II consisted of 16 sessions over eight weeks. Each session was made up of one-hour supervised exercise and one-hour cardiac related education. After initial interview, blood tests were taken after one to two weeks and patients were enrolled into the programme within two to three months. All blood specimens were analysed at the laboratory in the RIPAS hospital. The Short Form 36 (SF36) Health Survey was used to assess patients' quality of life.¹⁴

CCR Programme Intervention
Eight Weeks Phase II Supervised Group Exercise Session

Patient was assigned to an exercise station after completing the baseline assessment. During the one-hour supervised training, they rotate through 10 pre-arranged exercise stations providing resistance and cardio workout.

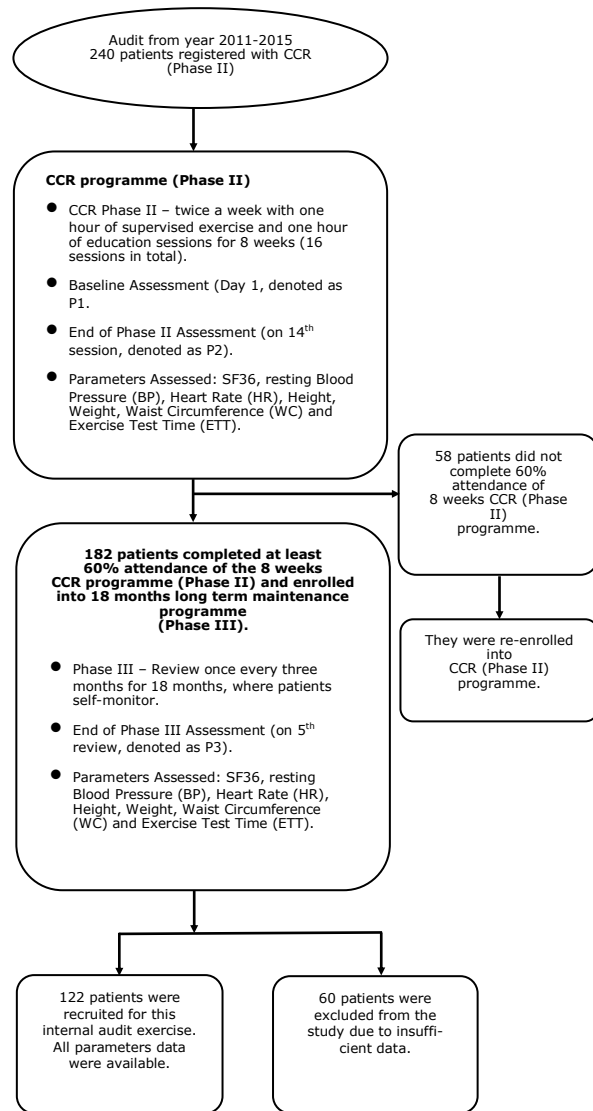


Figure 1: Flow Chart showing recruitment process and CCR programmes pathways and assessments.

Each session starts with 15 minutes of warm-up, followed by 30 minutes circuit training with 3 minutes on each exercise station, and finally 15 minutes of cooling down.

The supervised exercise session started with light intensity exercise to achieve 60% target HR and matched it with the original Borg Rating of Perceive Exertion (RPE) Scale.¹⁶ The exercise intensity gradually increased over 8 weeks period, as tolerated by patients up to RPE 15 or patients' heart rate reached maximum of 85% target HR. Each exercise session was followed by an hour of education session. This study adopted a com-

prehensive approach, which included exercise and education sessions that will empower patients to take more health conscious actions and help prevent future heart attack.^{8,17}

Eight Weeks Phase II Group Education Session

Patients' families were encouraged to attend the education sessions. These sessions covered information on secondary prevention of CVD, healthy lifestyle and diet, physical activity, smoking cessation, risk factor profile, treatment procedures, importance of medication, coping with depression, relaxation technique, spiritual support and cardiopulmonary resuscitation. A multidisciplinary team consisting of clinical psychologist, cardiac rehabilitation coordinator, dietitian, diabetes nurse educator, national resuscitation nurse, occupational therapist, pharmacist, physiotherapist, religious teacher, cardiologist and general practitioner from smoking cessation clinic, delivered these sessions.

Phase III Maintenance Programme

Patients with at least 60% attendance in Phase II proceeded to Phase III maintenance programme, lasting 18 months (Figure 1). Patients who failed to attend 60% of Phase II were re-enrolled for the next Phase II programme. In Phase III, patients performed self-exercise and were encouraged to achieve at least 150 minutes of exercise time per week as recommended by the American College of Sports Medicine.¹⁵ There were six review sessions at three monthly intervals. Results were revealed to patients in the sixth review session before discharge.

CCR Programme Outcome Assessment

Baseline assessment

On day one of entering Phase II CR programme, resting baseline (denoted as P1) measurements such as SF36, resting Blood Pressure (BP), Heart Rate (HR), Height, Weight, Waist Circumference (WC) and Exercise Test Time (ETT) were collected. BP was

measured after at least 15 minutes of rest. In patients with diabetes mellitus, a sugar reading of above 16.7 mmol/l (using Abbott Optium Xceed dipstix blood glucose meter) would lead to urine ketone test using UroColor™¹⁰. If no ketone was found, patients would proceed with exercise test. Otherwise, they were referred to diabetic clinic for management.

Patients were randomly assigned to a treadmill (GE Marquette Series 2000 Treadmill) or a Bicycle Ergometer (Lode Carival 400 Exercise Bike) test. The exercise tests ended when the patient signaled to stop, patient displayed symptoms listed as contraindication by the American College of Sport Medicine or upon reaching 85% of target HR.¹⁵ HR and oxygen saturation level were measured at two minutes thirty seconds (steady stage) after each level of exercise tests, to ensure that the target HR did not exceed 85% and oxygen saturation level is not below 90%.

Assessment at the end of Phase II and Phase III

The same baseline parameters were measured again during the 14th session of Phase II CCR programme (denoted as P2) and the 5th review session (denoted as P3) of Phase III. The exercise tests performed at these times would be the same assigned during commencement of Phase II. Test results were revealed to patients at the end of the Phase II and Phase III follow-up.

Data Analysis

All analyses were conducted using the R Statistical Platform.¹⁸ Continuous data were presented as mean \pm standard deviation. Nominal data were presented as percentage. Repeated ANOVA using the *avov* R function is performed on each parameter where patient records are complete across the three phases. This was followed by post hoc test Tukey Honest Significant Differences (Tukey HSD) using

the *TukeyHSD* R function to determine significance of improvement between phases. Any statistical significance improvements in SF36 score will be analysed further by performing Boxplots on all 8 subscales (a: physical function; b: physical role; c: Body pain; d: General health; e: Vitality; f: Social functioning; g: Emotional role; h: Mental health) to assess which subscale showed significant improvement. For each subscale, only complete patient records across the three phases were considered.

RESULTS

At the period 2011-2015, a total of 240 patients were registered with CCR programme. Only 182 patients completed at least 60% attendance of the 8 weeks CCR programme and were enrolled into Phase III maintenance CCR Programme. There was 75.8% retention rate from registration to completing CCR programme (both Phase II and III). Reasons for non-attendance were a lack of transport, inability to get off work, forgetting appointment and lack of a reminder system for patients of their appointment. Of these, only 122 patients with complete dataset were analysed. Sixty patients had records with missing data and were excluded from the analysis. Table 1 represents the baseline characteristics of the 122 patients. The mean age of these 122 patients were 57.1 ± 9 years and majority 83% were male. Cardiovascular risk factors such as hypertension (77.1%), diabetes (34.4%) and hyperlipidemia (91.8%) were higher than general population. Indications for entry into CCR programme were post-interventional rehabilitation in 91.0% of patients (Table 1).

Outcomes

On completion of the CCR programme (both Phase II and Phase III maintenance, (P1-P2-P3), statistically significant differences were seen in SF36 ($p=0.001$), ETT ($p<0.001$), FBS ($p=0.029$), blood lipids levels (TC ($p=0.001$), LDL ($p=0.007$), HDL ($p=0.001$), TG

($p=0.034$)) and WC ($p=0.026$) (Table 2). On post hoc analysis, these differences were mainly attributed as significant improvements in the outcome measures mentioned above at the end of Phase II CCR programme (P1-P2 assessments: Table 2, except HDL). Improvements from baseline P1 seen in SF36 and ETT at the end of CCR Phase II programme were maintained during the CCR Phase III maintenance programme. However, these improvements were not maintained for biochemical parameters (FBS, TC, LDL and TG) and WC, which showed a worsening from baseline P1 readings although they were not statistically significant (Table 2). HDL however at end of CCR Phase III maintenance programme showed significant improvements (P1-P3: $p=0.008$; P2-P3: $p=0.001$).

Quality of Life (QOL) Boxplots

SF36 showed a significant improvement average score of 5.4 in QOL on completion of CCR Phase II programme (Table 2). There was no further improvement in SF36 scores with Phase III CCR programme but the improvements achieved in Phase II were maintained. SF36 subscales Boxplots analysis showed, improvement at Phase II with maintenance in Phase III were seen in Physical Function, General Health and Mental Health (Figure 2: a, d and h respectively), with increased median scores. While there was improvement in Vitality (Figure 2: e) at P2, the score deteriorated at P3. For subscales, Role (Figure 2: b - Physical and Emotional) and Body Pain (Figure 2: c), the scores were maintained across the three phases. For Social Functioning (Figure 2: f), the boxplots did not showed any improvements from baseline at the end of CCR Phase II programme but did showed a decline in CCR Phase III maintenance programme.

Cardiac Parameters

The physical fitness level (ETT) significantly increased by average of 1.4 minutes from P1 to P2. At P2 to P3, ETT decreased significantly (P2-P3: $p<0.001$). Despite this, there was

Table 1: Baseline characteristics of participants.

| Variables | | Subjects (n = 122) |
|------------------------------|---|-----------------------|
| Age (Mean ± SD years) | | 57.1±9 |
| Gender | Male | 101 (83%) |
| | Female | 21 (17%) |
| Race | Malay | 107 (88%) |
| | Chinese | 9 (7%) |
| | Others | 6 (5%) |
| Nationality | Bruneian | 116 (95.1%) |
| | Foreigner | 6 (4.9%) |
| Clinical Risk factors | Family history of coronary artery disease | 28 (23%) |
| | Weight (kg) | 73.2 ± 11.6 |
| | BMI (kg/m ²) | 28.7 ± 3.9 |
| | WC (inches) | 37.2 ± 3.6 |
| | Hypertension | 94 (77.1%) |
| | Diabetes | 42 (34.4%) |
| | Hyperlipidemia | 112 (91.8%) |
| | Smoking | 7 (5.7%) |
| | Social alcohol use | 4 (3.3%) |
| | No risk factors | 4 (3.3%) |
| Medications | Statin | 118 (96.7%) |
| | Antiplatelets | 106 (86.9%) |
| | Histamine-2 Blockers | 53 (43.4%) |
| | Beta-blockers | 50 (41%) |
| | ①ACE-inhibitors | 28 (23%) |
| | ②ARB | 39 (32%) |
| | Calcium Channel Blockers | 41 (33.6%) |
| | Diabetic medications | 38 (31.1%) |
| | Anti-ischemic metabolic agent | 9 (7.4%) |
| | Nitrates | 5 (4.1%) |
| Diuretics | 9 (7.4%) | |
| CCR indication | Minor CAD | 11 (9.0%) |
| | PCI | 63 (51.6%) |
| | CABG/+Pacemaker | 31 (25.4%) |
| | PCI and CABG | 6 (4.9%) |
| | PCI and VR | 1 (0.8%) |
| VR | 10 (8.2%) | |

Abbreviation: BMI, Body Mass Index; WC, Waist Circumference; CAD, Coronary Artery Disease; PCI, Percutaneous Coronary Intervention; CABG, Coronary Artery Bypass Grafts; VR, Valve Repair, ①(ACE) inhibitors, Angiotensin Converting Enzyme inhibitors; ②ARB, Angiotensin II Receptor Blocker.

significant overall improvement from baseline (P1-P3: p<0.004) to completion of CCR Phase III Maintenance programme. For SBP and DBP, small non-statistically significant im-

provement of 2.5 and 0.3 mmHg respectively were observed between P1 and P2, its level increase between P2 and P3 but no statistically significant overall improvement between P1 and P3. There was no significant improvements seen in HR.

Most smokers had stopped smoking after experiencing MI, PCI or CABG. Seven smokers continued to smoke at baseline P1 of CCR Phase II programme. Two patients stopped smoking after Phase II and remain smoke free until end of Phase III. In total, two (29%) had abstained from smoking completely between P1 to P3.

DISCUSSION

This is the first evaluation study carried out in Brunei Darussalam on CCR programme comprising of two months of Phase II followed by 18 months of Phase III maintenance programmes. This study demonstrated positive effect on our patients in several measured parameters such as improvements in QOL SP36, ETT, biochemical markers (FBS, TC, HDL, LDL, TG) and WC especially during Phase II when subjects were under close supervision. Again our findings are similar to other studies, which showed improvement in SF36 score and ETT.¹⁹⁻²²

It can be seen from the baseline characteristics of the patients, the prevalence of cardiac risk factors (hypertension 77%, diabetes 34% and hyperlipidemia 92%) among our patients are much higher than the prevalence in the general population (hypertension 28%, diabetes 10% and hypercholesterolemia at 51%).²³ The CCR Phase II programme resulted in significant improvement in term of controlling fasting blood sugar (diabetes), blood lipids (hyperlipidemia) and WC (obesity), but these improvement were not maintained during the 18 months CCR Phase III maintenance period. In fact, some of these parameters became worse than baseline, suggesting the

Table 2: Anthropometric, Metabolic and Exercise Test variables at Baseline (P1), end of Phase II (P2) programme and end of Phase III (P3) with ANOVA and Tukey HSD results.

| Variables | Time points | Mean±SD | F-statistics (df) | p | TukeyHSD | 95% CI | adj p |
|-----------------------|-------------|--------------|-------------------|------------------|----------|-------------|------------------|
| SF36 | P1 | 71.94±18.41 | | | P1-P2 | 1.44 9.27 | 0.004 |
| | P2 | 77.3±17.02 | 6.708 (2) | 0.001 | P2-P3 | -4.09 3.74 | 0.994 |
| | P3 | 77.12±15.81 | | | P1-P3 | 1.26 9.10 | 0.006 |
| ETT (min) | P1 | 8.35±2.72 | | | P1-P2 | 1.12 1.76 | <0.001 |
| | P2 | 9.79±2.85 | 57.38 (2) | <0.001 | P2-P3 | -1.32 -0.67 | <0.001 |
| | P3 | 8.8±2.65 | | | P1-P3 | 0.12 0.77 | 0.004 |
| SBP (mmHg) | P1 | 126.25±12.93 | | | P1-P2 | -5.84 0.92 | 0.201 |
| | P2 | 123.79±11.04 | 1.579 (2) | 0.208 | P2-P3 | -2.71 4.04 | 0.888 |
| | P3 | 124.45±13.87 | | | P1-P3 | -5.17 1.58 | 0.423 |
| DBP (mmHg) | P1 | 78.2±8.92 | | | P1-P2 | -2.74 2.10 | 0.948 |
| | P2 | 77.88±8.99 | 0.74 (2) | 0.478 | P2-P3 | -1.22 3.63 | 0.470 |
| | P3 | 79.08±8.5 | | | P1-P3 | -1.54 3.31 | 0.665 |
| HR (beats/min) | P1 | 71.83±11.23 | | | P1-P2 | -3.86 0.37 | 0.129 |
| | P2 | 70.08±10.77 | 2.296 (2) | 0.103 | P2-P3 | -0.54 3.69 | 0.188 |
| | P3 | 71.66±10.51 | | | P1-P3 | -2.29 1.95 | 0.980 |
| FBS (mmol/L) | P1 | 5.98±2.08 | | | P1-P2 | -0.59 0.13 | 0.300 |
| | P2 | 5.75±1.58 | 3.587 (2) | 0.029 | P2-P3 | 0.05 0.78 | 0.022 |
| | P3 | 6.16±2 | | | P1-P3 | -0.18 0.55 | 0.462 |
| TC (mmol/L) | P1 | 4.14±0.95 | | | P1-P2 | -0.37 0.01 | 0.060 |
| | P2 | 3.96±0.93 | 7.043 (2) | 0.001 | P2-P3 | 0.11 0.48 | 0.001 |
| | P3 | 4.25±1.08 | | | P1-P3 | -0.07 0.30 | 0.324 |
| HDL (mmol/ L) | P1 | 1.09±0.22 | | | P1-P2 | -0.04 0.02 | 0.865 |
| | P2 | 1.08±0.21 | 7.288 (2) | 0.001 | P2-P3 | 0.02 0.08 | 0.001 |
| | P3 | 1.13±0.24 | | | P1-P3 | 0.01 0.07 | 0.008 |
| LDL (mmol/ L) | P1 | 2.34±0.8 | | | P1-P2 | -0.29 0.02 | 0.117 |
| | P2 | 2.2±0.76 | 5.108 (2) | 0.007 | P2-P3 | 0.05 0.37 | 0.005 |
| | P3 | 2.42±0.92 | | | P1-P3 | -0.08 0.24 | 0.472 |
| TG (mmol/ L) | P1 | 1.6±0.71 | | | P1-P2 | -0.24 0.00 | 0.053 |
| | P2 | 1.48±0.66 | 3.422 (2) | 0.034 | P2-P3 | -0.13 0.11 | 0.990 |
| | P3 | 1.59±0.72 | | | P1-P3 | -0.01 0.23 | 0.074 |
| Weight (kg) | P1 | 73.16±11.61 | | | P1-P2 | -0.44 0.51 | 0.984 |
| | P2 | 73.19±11.36 | 0.294 (2) | 0.746 | P2-P3 | -0.36 0.59 | 0.840 |
| | P3 | 73.3±11.75 | | | P1-P3 | -0.33 0.63 | 0.745 |
| WC (inches) | P1 | 37.17±3.65 | | | P1-P2 | -1.10 0.36 | 0.465 |
| | P2 | 36.81±3.48 | 3.718 (2) | 0.026 | P2-P3 | 0.11 1.57 | 0.019 |
| | P3 | 37.65±5.52 | | | P1-P3 | -0.25 1.21 | 0.276 |

Footnote: P1: Baseline; P2: 8 weeks; P3: 18 months.
 Abbreviation: SF36, Short Form 36 Quality of Life Questionnaire; ETT, Exercise Testing Time; SBP, Systolic Blood pressure; DBP, Diastolic Blood Pressure; HR, Heart Rate; FBS, Fasting Blood Sugar; TC, Total Cholesterol; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein; TG, Triglyceride; WC, Waist Circumference.

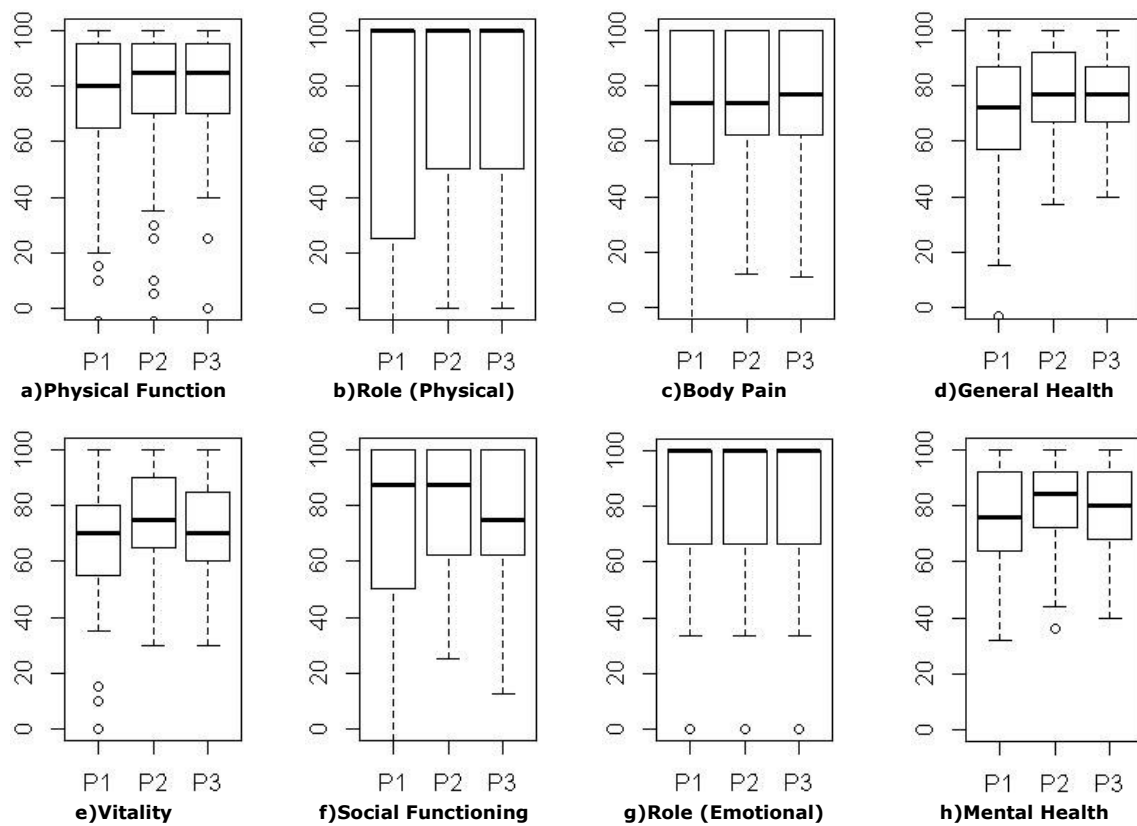


Figure 2: SF36 subscales boxplots of the 8 variables: a)Physical Functioning, b)Role (Physical), c)Body Pain, d)General Health, e)Vitality, f)Social Functioning, g)Role (Emotional), h)Mental Health.

lack of compliance with programme exercises and diet among our participants due to a lack of supervision. Short term supervised CR programme studies have shown significant improvement in exercise capacity after three months but was not sustained at 12 months follow up.²⁴ Our study too have shown even with longer follow up of 18 months, a large part of the improvements achieved during the Phase II CCR programme are not maintained. Perhaps adding a component of intermittent close supervision of exercises and diet during the 18 months Phase III may improve compliance with the programme. Despite a less than satisfactory outcome achieved with Phase III of our CCR programme, some of our patients did improved their exercise capacity even after 18 months followed up but this in a minority group who may be more committed to improving their lifestyle. This study confirmed that patients require reassurance and encouragement throughout their cardiac care to en-

courage behaviour change.²⁵ Phase III can provide such support and help these cardiac patients live an active life in the community, leading to reduction in mortality but suggest a period of close supervision with their exercise designed and implemented somehow in the middle of the 18 months period may help to improve compliance.^{26,27}

Analysis of the SF36 QOL questionnaire subscales (Figure 2) showed improvement in physical function, general health and mental health at the end of 8 weeks and maintained by the end of 18 months followed up, although there were no further improvements. This is consistent with existing studies that strengthening physical fitness in Phase II can directly influence mental health until 18 months later.^{28,29} It is of interest to note that the only subscale parameter of SF36 QOL which showed worsening outcome after 18 months of CCR Phase III follow up was social

functioning. This could possibly be explained by the lack of social interaction which the participants were getting while they were undergoing intensive supervised CCR Phase II programme and interacting with other participants of similar condition. This again suggest that in designing future CCR Phase III maintenance programme, a short period (4-8 weeks) of Phase II close supervision injected in between the 18 months of the programme, may help to improve social functioning as well as compliance with programme self exercises and diet. However, this may need to be tested to confirm whether our assumptions are correct.

Limitations

This study has several limitations. First, as with all retrospective study, missing dataset creates a significant problem and as a result almost half of the initial group of 240 patients have to be excluded from the analysis. Thus the small sample size would have affected the statistical power of the analysis. Factors that contributed to poor turnout rates were identified and these include lack of transport, inability to get off work, forgetting appointment and lack of reminder system for patients. Attempts were made by the CR coordinator to provide assistance to patients where possible to improve the turnout.

CONCLUSION

This study demonstrated significant improvement in patient's cardiac risk factors profile following the two-month closed group CCR programme (Phase II) in Brunei Darussalam. However, not all improvements were maintained during phase III of the CCR maintenance programme except SF36 and ETT. The lack of supervision during the CCR Phase III maintenance programme may have resulted in non-compliance with programme self exercises and diet, thus contributed to the worsening outcome in some of the biochemical parameters.

Recommendation to improve future CCR services

The suggestions to improve compliance and reduce dropout rate are: 1) Strengthen appointment systems with flexible schedules and reminder system; 2) Strengthen communication with the aid of social media to maintain a CCR social network group and organizing social events for patients and their families³⁰; 3) Improve the systematic approach to data collection with set protocols to measure the effectiveness of the programme; 4) Strengthen awareness of CCR programme among relevant stakeholders including referring physicians by providing continuous education programme about the CCR programme, 5) Develop Phase III CCR service in designated health clinics and community centers with a 4 weeks close supervision component for better compliance and accessibility by the patients.

Declaration of Conflicting Interests

The Authors declares that there is no conflict of interest.

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Ethics

This study was conducted in accordance with the standards set in the Declaration of Helsinki.

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