

Safety and feasibility of early-initiated Cardiac Rehabilitation in Stroke Survivors to Improve Survivorship (CRiSSIS).

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Clinical or Research Abstract

Background: People with stroke could benefit from Cardiac rehabilitation (CR), yet they are rarely referred to it. The aim of CRiSSIS was to test the safety and feasibility of early-initiated, stroke-adapted CR.

Methods: People with ischaemic stroke admitted to a large metropolitan hospital were screened for eligibility and invited to participate in stroke-adapted CR, consisting of cardiorespiratory fitness training 3-days/week during inpatient rehabilitation, and 2-days/week cardiorespiratory fitness training and health education for 6-weeks during outpatient rehabilitation. Primary outcomes were safety (study-related adverse events) and feasibility (recruitment rate, retention and adherence).

Results: Between April 2018 - November 2019, 167 people with stroke were screened, 119 (71%) were eligible, with 73 (61%; n=37 females, mean age 77.4±9.7 years; time post-stroke 16±9 days) consenting to participate. There were no study-related adverse events. Ten participants ceased the study due to: lack of time (n=1), transferred off-ward (n=3) or declined to continue (n=6). 23 (32%) participants completed both inpatient and outpatient training. Reasons for not participating

in the outpatient program included participants feeling overwhelmed (n=5), needing further medical treatment (n=2), lack of transport (n=1), uncontactable (n=1) and no reason given (n=12). During inpatient training, 57% and 55% of participants achieved the minimum recommended training intensity and duration respectively.

Conclusions: Cardiac rehabilitation appears safe and feasible for people with stroke. High attendance and retention rates were observed during inpatient rehabilitation, but not all people with stroke want, or can access, centre-based outpatient training. A more accessible model of stroke-adapted CR may increase uptake.

Improving women's cardiac rehabilitation attendance: a women-only yoga program

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Background. Despite its demonstrated benefits, cardiac rehabilitation (CR) attendance is suboptimal, with women less likely than men to attend or complete. Given this CR crisis for women, alternatives need to be investigated. The aim of this study was to develop a women-only yoga-based CR program and investigate uptake, completion and acceptability.

Method. A yoga program, developed by an accredited yoga instructor, was offered as an alternative to the standard exercise program for women eligible to attend CR at a tertiary hospital in Melbourne. Participating women attended the usual mixed-sex one-hour education component of CR, followed by a one-hour yoga session, over a seven week period. Attendance and completion rates for the women-only yoga program, offered over six months in 2019, were compared to the standard CR program offered in 2018. Women completed pre- and post-program questionnaires and participated in focus group discussions.

Results. From a total of 35 eligible women, 22 (63%) attended the *Women's CR program* over six months, and 21 (95%) completed it. While improved uptake was not demonstrated, completion was significantly higher than in 2018 (56%). Ratings of program acceptability were consistently positive. Key themes included: suitability of yoga for CR, benefits of a women-only group, safety and

comfort, confidence in the body, and importance of referral.

Conclusions. This pilot study has demonstrated that the completion of CR by female patients can be improved by offering a women-only yoga CR alternative. Future studies could use these findings to support further development of women-only and yoga-based CR.

Engaging in physical activity after a transient ischemic attack or non-disabling stroke is "Business as usual": A grounded theory study.

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Background: Physical activity is an important component of secondary stroke risk reduction following a transient ischemic attack (TIA) or non-disabling stroke. Clinical guidelines recommend the accumulation of at least 150 minutes of physical activity at moderate-to-vigorous intensity per week. This study investigated attitudes and engagement in physical activity following a TIA or non-disabling stroke.

Methods: Telephone-based semi-structured interviews were completed with people who had experienced a TIA or non-disabling stroke. In-depth questioning centred on beliefs, physical activity practises, and factors influencing participation. Data were analysed using ground theory methods.

Results: Analysis of interviews with 33 participants (mean age 65.5 years [SD 9.8], 52% male) revealed the core concept, 'Business as usual'. Post-stroke event physical activity habituation was dependent upon the participant identifying as an 'exerciser' or 'non-exerciser'. Participants' spoke of an "information void" indicating they did not receive new or useful information to suggest the need to "do anything different". Only a small proportion of participants reported they had increased their level of exercise behaviour. Factors influencing engagement in physical activity were: challenges preventing engagement (e.g. pain), support (e.g. structured interventions), strategies (e.g. exercise

adaptation), and information (e.g. pertinent, relevant and applicable).

Conclusions/Implications: These results suggest that information about engagement in recommended levels of physical activity requires tailoring to the needs of people that have had a TIA or non-disabling stroke. This in combination with guidance on how to navigate factors preventing engagement might influence the low level of physical activity prevalent in this population.

Cumulative impact of multiple risk factors on prevalence of anxiety and depression during early and late convalescence following a cardiac event

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Background: Comorbid anxiety with depression following a cardiac event predicts poorer outcomes than either disorder occurring alone, with a higher rate of treatment resistance. It is therefore important to identify these patients early in order to initiate preventive measures. In this study, we report on the prevalence of anxiety, depression, and comorbid anxiety and depression, during the first 12 months after an acute cardiac event, and the baseline patient characteristics predictive of these conditions.

Methods: We recruited a sample of 911 patients with acute coronary syndrome (ACS) or undergoing coronary artery bypass graft surgery (CABGS). Patients completed the Hospital Anxiety and Depression Scale (HADS) near the time of their event, and again at early (2–4 months post-event) and late (6–12 months post-event) convalescence. Prevalence rates for anxiety, depression, and comorbid anxiety and depression were determined for each timepoint. Binary logistic regression analyses were used to identify baseline patient characteristics associated with increased anxiety and depression risk over 12 months. In

the multivariate analysis, we utilised decision-tree analysis to determine clinically relevant predictors of anxiety or depression at early and late convalescence.

Results: Factors consistently associated with increased anxiety and depression risk were history of depression, financial strain, poor self-rated health, low socioeconomic status, younger age, and smoking. Obesity, diabetes, living alone or being unpartnered, were identified as important albeit less significant risk factors. **Implications:** By identifying patients early, during hospitalisation or at discharge, those at risk can be supported, potentially mitigating or even preventing future mental health problems.

High intensity interval training in cardiac rehabilitation: long-term adherence and effect on cardiorespiratory fitness

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Background: High intensity interval training (HIIT) is a potent stimulus for improving cardiorespiratory fitness (VO_{2peak}), however the long-term effect of HIIT in cardiac rehabilitation (CR) is unclear. This study compared 12-months of HIIT with usual care moderate intensity continuous training (MICT) on VO_{2peak} and exercise adherence during and following hospital-based CR.

Methods: Participants with coronary artery disease attending a 4-week CR program (n=93) were randomised to: 1) 4x4min HIIT at a rating of perceived exertion (RPE) 15-17/20 or 2) 40-min MICT at an RPE 11-13/20. Patients were asked to complete 3 sessions/week (two supervised, one home-based) for 4-weeks, and 3 home-based sessions/week thereafter for 48-weeks. Maximal cardiopulmonary exercise testing measured VO_{2peak} at baseline, 4-weeks, and 12-months. Exercise adherence to sessions and intensity was measured from questionnaires and self-report exercise logs. Data are mean change \pm SD.

Results: After 4-weeks, HIIT doubled improvement in VO_{2peak} [2.9 ± 3.5 ml/kg/min] compared with MICT [1.2 ± 3.1 ml/kg/min] (p=0.017). After 12-months, intention-to-treat analysis showed similar improvement between HIIT (2.9 ± 4.6 ml/kg/min) and MICT [1.8 ± 3.8 ml/kg/min] (p=0.290). However, per-protocol analysis revealed greater improvement in VO_{2peak} with HIIT [5.2 ± 4.5 ml/kg/min] compared with MICT [2.2 ± 3.5 ml/kg/min] (p=0.039). Both groups had high exercise adherence during the supervised

stage (91%) but low adherence at 12-months (HIIT=53% vs MICT=41%; p=0.346).

Conclusion: Compared with usual care CR exercise, HIIT provided greater improvements in VO_{2peak} but only for patients with good adherence over 12-months. Given these findings, HIIT should be recommended in CR as an adjunct or alternative to MICT for appropriate and willing patients.

High-intensity interval training versus moderate intensity continuous training within cardiac rehabilitation: a systematic review and meta-analysis

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Background: Aerobic capacity has been shown to be inversely proportionate to cardiovascular mortality and high-intensity interval training (HIIT) appears to be more effective than moderate-intensity continuous training (MICT) in improving cardiorespiratory fitness. Previously published systematic reviews in cardiovascular disease have neither investigated the effect that the number of weeks of intervention has on cardiorespiratory fitness changes, nor have adverse events been collated.

Objective: We aimed to undertake a systematic review and meta-analysis of randomized controlled trials (RCTs) within the cardiac population that investigated cardiorespiratory fitness changes resulting from HIIT versus MICT and to collate adverse events.

Methods: A critical narrative synthesis and meta-analysis was conducted after systematically searching relevant databases up to July 2017.

Results: Seventeen studies, involving 953 participants (465 for HIIT and 488 for MICT) were included in the analysis. HIIT was significantly superior to MICT in improving cardiorespiratory fitness overall (SMD 0.34 mL/kg/min; 95% confidence interval [CI; 0.2–0.48]; $p < 0.00001$; $I^2 = 28\%$). There were no deaths or cardiac

events requiring hospitalization reported in any study during training. Overall, there were more adverse events reported as a result of the MICT (n=14) intervention than the HIIT intervention (n=9).

Conclusion: HIIT is superior to MICT in improving cardiorespiratory fitness in participants of cardiac rehabilitation (CR). Improvements in cardiorespiratory fitness are significant for CR programs of >6-week duration. Programs of 7–12 weeks' duration resulted in the largest improvements in cardiorespiratory fitness for patients with coronary artery disease. HIIT appears to be as safe as MICT for CR participants.

PRIME-HF: Novel exercise for older patients with heart failure. A pilot randomised controlled study

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Background: Older adults with HF_{rEF} are underrepresented in clinical trials and it is unclear whether they can tolerate current exercise guidelines. PRIME (Peripheral Remodelling through Intermittent Muscular Exercise) offers advantages to older adults however, it is yet to be tested in clinical populations. This study tested the hypothesis that a) older patients with HF_{rEF} can tolerate aerobic and resistance training (COMBO) and b) 4-weeks of PRIME prior to 4-weeks of COMBO will improve VO_{2peak} , VO_2 at Anaerobic Threshold (AT), and Muscle Voluntary Contraction (MVC) to a greater extent than 8-weeks of COMBO.

Methods: Nineteen adults (72.8±8.4years) with HF_{rEF} were randomised to 4-weeks of PRIME or COMBO. All participants subsequently completed 4-weeks of COMBO. Sessions were twice-weekly (60 minutes). PRIME is a low-mass, high-repetition regime (40%1RM, 8 strength exercises, 5-minutes each). COMBO involved aerobic (40-60% VO_{2peak} , up to 20 minutes) plus resistance training (50-70%1RM, 8 exercises, 2 sets of 10). Outcomes were measured at baseline and 8-weeks.

Results: PRIME significantly increased VO_{2peak} after 8-weeks (2.4 ml.kg⁻¹.min⁻¹, $p<0.005$) while COMBO showed minimal change, producing a large between-group effect size of 1.0. VO_2 at AT increased in PRIME but not in COMBO, producing

a large between-group effect size of 1.5. MVC increased significantly in both groups, however the change was larger in COMBO (Effect Size 0.6).

Conclusion: COMBO and PRIME improved strength. Only PRIME produced significant improvements to aerobic capacity. Taken together, these findings support the hypothesis that PRIME may have advantages for older patients with HF_{rEF} and could be a possible alternative exercise modality.

Safety and Feasibility of Early Resistance training following Median Sternotomy: The SAFE-ARMS study.

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Background. To determine the safety and feasibility of upper limb resistance training on sternal micromotion and pain, as early as two post-operative weeks following cardiac surgeries via a median sternotomy.

Methods. Using the resistance training cohort of the SEcReT pilot RCT, 16 patients who underwent cardiac surgery via a median sternotomy. The upper limb exercises performed were seated row, bicep curl, triceps dip, lateral raise, shoulder pulldown and shoulder press, commencing at a base resistance of 20lbs. Sternal micromotion was assessed using ultrasound at the mid- and lower- sternum at 2-, 8- and 14- weeks post-operatively. Pain was assessed using a visual analogue scale.

Results. Two patients withdrew from the study prior to the 8-week assessment and a further two were not assessed at 14-post-operative weeks due to assessor unavailability. The highest median micromotion was observed during the bicep curl (median= 1.5mm; IQR= 1.9mm) in the lateral direction and the shoulder pulldown (median= 0.5mm; IQR= 1.1mm) in the anterior-posterior direction. Furthermore, no increase in pain from rest was reported by any patient at any time point, during the six upper limb exercises. Inter-rater reliability was moderate- good for both lateral micromotion (ICC=0.73; 95% CI=0.58-0.83) and anterior-posterior micromotion (ICC=0.83; 95% CI=0.73-0.89).

Conclusions. Bilateral upper limb resistance training performed on machines that move in one plane does not result in sternal micromotion exceeding 2mm or an increase in pain from rest, at 2-, 8- or 14-weeks following cardiac surgeries performed via a median sternotomy.

Predicting repeat hospital presentations for atrial fibrillation: the REVIEW AF study

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Background: Hospitalisations are the main driver of health care resource utilisation in atrial fibrillation (AF). The aim of this study was to characterise predictors of repeat emergency department (ED) presentations and hospital admissions in a cohort of individuals with AF.

Methods: Individuals presenting to the ED of three major tertiary centres in South Australia from March 2013 to February 2014 with a primary diagnosis of AF, were screened by electronic health record. Clinical, socio-demographic and other variables, including the presence of advice to manage future AF episodes, were collected to identify predictors of repeat AF related ED presentations and hospitalisations.

Results: The cohort comprised of 437 individuals who presented to hospital with AF as a principal diagnosis. Mean age was 69±15 years and 49.9% were male. Individuals were followed for a mean of 3.7±0.4 years. There were 2304 repeat unplanned presentations over follow up. Following the index presentation, 16.7% of the cohort experienced at least one AF related hospital admission annually. Multivariate analysis did not identify any demographic or clinical factors predictive of re-presentation to hospital. Non-standardised advice to manage future AF episodes was associated with a significant increase in the risk of repeat ED presentations (Odds Ratio [OR] 6.7, 95% CI 2.4-18.3;

p<0.0001), and hospital admissions for AF (OR 2.8, 95% CI 1.00-7.63; p=0.05).

Conclusions: A hospital presentation with a primary diagnosis of AF identifies individuals who pose significant ongoing health care burden. These data highlight the need for standardised management to reduce health care burden.

Gamified mobile applications for lifestyle risk factors in the high risk for cardiovascular disease events populaton: A systematic review

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Background: Cardiovascular disease (CVD) is a leading cause of mortality and morbidity, but risk for events can be reduced by lifestyle behaviour change. Conventional cardiac rehabilitation and diabetes education programs effectively reduce risk but have limited participation. A potential solution to improve access and engagement includes mobile applications (apps) that include game strategies. However, there is a lack of synthesised information on effectiveness and acceptability.

Purpose: To determine the effectiveness and acceptability of gamified mobile applications for reducing risk factors in the high-risk for CVD events population.

Methods: A systematic review of electronic databases (Medline, Embase, and SCOPUS) for studies including CVD or Type 2 diabetes mellitus (T2DM) samples, evaluating a mobile app with at least two defined game strategies. Meta-analyses was not possible so results were narratively appraised and synthesised.

Results: Seven studies including 657 patients diagnosed with a CVD/T2DM were included and were generally low in methodological quality. Gamified mobile apps resulted in significant improvements in mean HbA1C of 10.6%, mean step count of 1633 steps, heart failure knowledge by 8%, and physical activity motivation of 8.8%. Game strategies identified as effective and acceptable were comparing progress and social connectivity.

Conclusion/findings: Gamified mobile apps show promise for improving risk factors in patients at

high risk for CVD events. Poor quality methods limit further conclusions. Game strategies of comparing progress and social connectivity have strong potential and should be tested in randomised controlled trials.

Physical activity and incident arrhythmia in 402 406 individuals from the UK biobank

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Introduction: Whilst physical activity benefits overall cardiovascular health, the impact on risk of arrhythmia development has not been well characterised.

Methods: A total of 402 406 individuals aged 40-69 years from the UK biobank cohort were included in this study. Self-reported physical activity was assessed as metabolic-equivalent (MET) minutes per week. Detailed physical assessment was undertaken and information concerning medical history collected. Arrhythmia development over follow up was ascertained via hospital admissions and death reports.

Results: After a median follow up of 7 years, a lower risk of atrial fibrillation (AF) and ventricular arrhythmias were observed in physically active individuals. For AF, gender differences were apparent with males demonstrated reduced AF risk from 500 (hazard ratio [HR] 0.95, 95% CI 0.91-1.00) to 1500 MET-minutes per week (HR 0.90, 95% CI 0.82-1.00). Females demonstrated reduced AF risk at all levels of physical activity from 500 MET-minutes per week (HR 0.94, 95% CI 0.88-1.0) to 5000 MET-minutes per week (HR 0.80, 95% CI 0.71-0.91). High levels of vigorous physical activity (5000 MET minutes per week) was associated with a 12% increase in incident AF for males (HR 1.12, 95% CI 1.01-1.25) whilst vigorous activity across all levels was associated with reduced risk of AF in females. Moderate and vigorous activity was associated with a reduced risk of ventricular arrhythmias for males and females. Vigorous physical activity reduced risk of bradyarrhythmia development in females.

Conclusions: Physical activity is associated with a reduction in risk of atrial and ventricular arrhythmia development.

What are the right tools to screen for sleep disorders in cardiac patients?

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Background: Screening for sleep disorders in cardiac rehabilitation settings is currently recommended. However, there is no recommendation about which convenient, effective and inexpensive tools that have high diagnostic accuracy should be used.

Methods: We searched online databases to identify patient reported outcome instruments that have been used in published research studies to assess the likelihood of obstructive sleep apnoea (OSA) in cardiac patients. For studies that provided diagnostic data, this was extracted and verified via an evidence-based diagnostic calculator. Where sufficient number of studies were available, meta-analysis was conducted in order to obtain pooled estimates of specificity, sensitivity and diagnostic odds. We also identified and qualitatively evaluated instruments that have been used to identify other sleep disorders in cardiac patients.

Results: A total of 20 instruments were identified that have been used in research studies involving cardiac patients (13 for detecting likelihood of OSA, 2 for assessment of daytime sleepiness, 2 for sleep quality, 1 for insomnia and 2 for detecting multiple sleep conditions). A meta-analysis of 13 studies that assessed diagnostic accuracy of OSA, showed acceptable sensitivity for two instruments: Berlin Questionnaire, Sens = 0.70 (95% CI 0.63-0.75) & Stop-BANG, Sens = 0.98 (95% CI 0.88-0.99) but poor specificity at standard cut-off criteria.

Conclusion: There are promising practical tools available to correctly identify patients with OSA and other sleep disorders in cardiac rehabilitation settings, but standard cut-off criteria may need to be raised in order to improve specificity and correctly identify patients without OSA.

Seeing is believing: the use of wearable cameras to enhance self-management of heart failure is feasible and acceptable.

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Introduction: For people with heart failure (HF), self-management is critical for disease management.

We aimed to test the feasibility and utility of wearable cameras for identifying self-management practices and to determine if these images can be used to enhance self-management in people with HF.

Methods: Participants wore a small wearable camera for one month during waking hours; still images were taken every 30 seconds. We investigated automated image analysis to determine the potential of identifying four categories of activities. Participants also completed a semi-structured questionnaire about acceptability and feasibility.

Results: 30 participants (mean age 73.6 years, 60% male) with HF NYHA Class II-III were recruited. A total of 629,603 images were available for analysis. Higher order analyses were conducted to determine precision of identifying correct images for the pre-defined self-management categories. Precision of identifying correct images was highest in dietary intake (average 49%, range 13-94%) followed by meal preparation (average 40%, range 1-99%), physical activity (average 31%, range 0-95%) and medication management (average 6%, range 6-22%). Manual review of images revealed significant sedentary time, typically paired with screen time. Participants agreed the camera was easy to use, felt comfortable wearing the camera

(93%) and thought this technique will help people with HF in the future (93%).

Conclusions: Images from wearable cameras provided rich contextual data to better understand the lived experiences of people with HF and was acceptable to participants. Data collected can be used as an adjunct to self-report and may also prove useful for nurses to provide tailored education for self-management.

Unmet self-management needs among Chinese immigrants with heart disease in Australia

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Background: Effective heart disease self-management leads to better symptom control and health-rated outcomes. However, self-management needs are poorly understood in Chinese immigrants in Australia, one of the fastest growing immigrant groups in Australia and has multiple health disadvantages. This study aimed to explore heart disease self-management needs of Chinese immigrants in Australia.

Methods: Chinese immigrants with heart disease (n=20) were recruited from a study of health literacy in Chinese communities in NSW. Data were collected on participants' socio-demographic characteristics and self-management needs using semi-structured face-to-face interviews (ten individual interviews and two focus groups) and were analysed using content analysis.

Results: Participants were aged mean 75±7 years and had lived in Australia for mean 16± 8 years; 95% had poor English language proficiency and 90% reported poor health status.

Themes emerged that related to self-management centring on cultural beliefs and language barriers; imbalance of care expectations between healthcare providers and patients; proactive approaches; poor health literacy; and availability of social support. Cultural beliefs and language barriers had a strong impact on this group's communication with health care providers, their self-management strategies and help-seeking behaviour.

Conclusion: Chinese immigrants with heart conditions have many self-management needs which are currently not met by the healthcare providers. The findings imply that there is a need for healthcare providers' active engagement in promoting better self-management. Culturally and linguistic appropriate health information and support services may facilitate good doctor-patient interaction and appropriate use of healthcare services.

PACE – an innovative partnership approach to cardiopulmonary rehabilitation in the Alpine Shire, Victoria.

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In Alpine Shire, rates of heart attack, heart failure, ACS, hypertension and avoidable deaths from IHD are significantly elevated and COPD is one of the top three causes of hospitalisation. No public cardiopulmonary rehabilitation existed prior to 2018 in the shire – nearest programs could be 100+km away. Murray PHN released a funding opportunity for improving chronic disease management. Alpine Health brought together three PRIVATE providers to jointly develop a submission to create new flexible services based at Bright, Mount Beauty and Myrtleford.

PACE is offered one day per week at each location with Nurse Coordinator (public sector) providing care coordination and expert nursing skills. A private sector exercise professional in each location provides skilled exercise prescription and supervision. PACE is delivered in community settings (not hospital based) which created some challenges in terms of emergency policies and procedures, equipment and staff skills. PACE has received over 300 referrals in two years with 59% cardiac diagnoses, 22% pulmonary diagnoses, and 19% with both. Key client outcomes include:

- 4.78 point mean improvement in AQoL quality of life score
- 35.49m mean improvement in 6MWT
- Poorer entry AQoL score mean for pulmonary clients (82.18 vs 68.29) but greater mean improvement (5.00 vs 3.29)

- Greater improvement in 6MWT for cardiac clients (39.63m vs 17.85m).

In smaller rural areas it is feasible to establish a robust public private partnership which combines cardiac and pulmonary rehabilitation and achieves positive outcomes for participants. More work is required to address areas where outcomes are equivocal including BMI and dyspnoea.