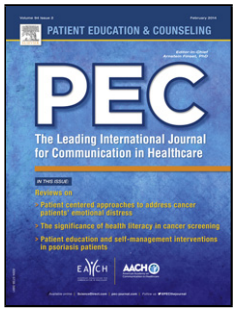

Title: Patient Preferences for the Delivery of Cardiac Rehabilitation

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Title: Patient Preferences for the Delivery of Cardiac Rehabilitation

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Highlights

- Flexible delivery of CR programs has the potential to improve uptake and attendance
- Many but not all patients prefer a centre-based program compared to a home-based program for their CR
- Some patients preferred a CR program delivered out of working hours rather than within working hours
- Most patients have a preference for a CR program which starts within two weeks of discharge
- Patients disliked the proposal of receiving education and information via a smart phone App

Abstract

Objective: To elicit patients' preferences for cardiac rehabilitation(CR).

Methods: A Discrete Choice Experiment was used to quantify patients' preferences for the delivery of CR. This survey-based method elicited the relative importance of different characteristics of a program.

Results: 200 in-patients eligible to attend CR completed the survey. Over half of the patients strongly preferred a centre-based compared to a home-based program. Many but not all preferred a program starting within two rather than six weeks of discharge and exercise delivered in a group rather than individual setting, with exercise via the internet using telehealth strongly disliked. Some respondents preferred lifestyle information delivered one-to-one by a health professional, and there was an overall preference against delivery by smart

phone Apps. Some preferred a program out of rather than within working hours and a shorter program (four weeks compared to eight weeks).

Conclusions: This study provides further insight into patient preferences for a CR program. Although the strongest preferences were for centre-based programs with healthcare professionals facilitating exercise classes and one-on-one education, it is important to offer flexible delivery as one approach will not suit everyone.

Practice Implications: There is the potential to improve CR programs by focusing on patient preferences.

Keywords: cardiac rehabilitation, patient preferences, discrete choice experiment

1. Introduction

Cardiovascular disease (CVD) is the leading cause of death globally [1] and in Australia [2] . In 2015, CVD accounted for 45,392 or 29% of all deaths in Australia [3] . A high proportion of CVD events occur in people already diagnosed with Coronary Heart Disease (CHD) with one in four people having a repeat event [4]. These repeat events have a high risk of death, 21% for women and 14% for men [5] . In Australia the cost of repeat Acute Coronary Syndrome (ACS) events exceeded $8 billion in 2010 with predictions that the number of hospitalisations due to repeat events is likely to increase by more than 30% by 2020 [5] . Many repeat events are avoidable through secondary prevention. However patients diagnosed with CVD are still not achieving the lifestyle and risk factor goals recommended by clinical practice guidelines following discharge after an acute cardiovascular event [6]. There is strong evidence that Cardiac Rehabilitation (CR) programs reduce the risk of future cardiovascular events [6] with a Class 1 recommendation from the American Heart Association, American College of Cardiology and the European Society of Cardiology [7]. Current guidelines promote CR programs that are evidenced-based, with exercise, education and psychosocial interventions incorporating individual goals and strategies that underpin secondary prevention [8, 9].

Participation in CR programs after a cardiac event decreases hospital admissions, improves quality of life, morbidity and mortality [7, 10, 11]. Despite these proven benefits, CR programs are underutilised [8], with low participation rates internationally and in Australia [12, 13], with minimal improvement over the last decade [14]. Our own research has reported only 30% of patients discharged following an acute myocardial infarction commenced a CR program within 10 weeks of discharge [15]. Additionally patients with the highest risk for recurrent events are least likely to participate in any CR program [16] and evidence to

support interventions that improve uptake and adherence is weak [11]. Barriers relating to the availability of programs, referrals, attendance, and completion have been widely researched and are multifactorial [8]. Traditional CR programs have been delivered as centre-based programs in hospitals and community centres. Participants attend regular sessions of supervised group-based exercise and education. The literature reports heterogeneity in the composition of these programs, most commonly delivered over 4 to 12 weeks[7]. In an effort to address the barriers contributing to poor uptake and improve program participation, there is increasing interest in alternative CR program models [17] . These models may include structured education and exercise interventions based at the individual's home [18], telephone interventions. tele-health programs and telephone or web-based Apps.

Understanding patient perspectives, preferences and choices for the delivery of programs are crucial factors to be considered to optimise CR uptake. Program participation, as well as persistence and adherence to recommendations are likely to be significantly increased when patients are provided with their preferred choice of program delivery [19]. There is a clear need to investigate patients' preferences for CR to inform the development of applicable CR interventions. The aim of this study was to elicit CVD patients' preferences for the delivery of CR in order to identify their preferred characteristics for a centre- based or home-based CR intervention program.

2. Methods

A Discrete Choice Experiment (DCE) was employed to elicit patients' preferences for the delivery of CR in order to identify the relative importance of different characteristics of a CR program. The DCE is a survey-based method used to quantify preferences and trade-offs for the delivery of health care service and interventions, and has the potential to estimate the uptake of a program in a population [20].

2.1 Development of the DCE Instrument

A DCE survey instrument was developed in which participants were asked to make eight hypothetical choices between different CR programs. Each program was described according to five attributes or characteristics of the program including the time to commencement, duration of the program, and the mode for delivery of exercise and lifestyle information in the program. The attributes were developed by reviewing the literature regarding CR program components. Additionally these components were reconciled with the current options available to patients being referred to CR programs within the study setting. The CR programs within the study setting are centre-based, offer attendance for 4 to 8 weeks, commence after 6 weeks with mixed gender exercise and education groups. The attributes developed for the DCE are summarised in **Table 1**.

A full factorial design would result in 128 possible program profiles (2^3 x 4^2). Since this is excessive to administer within a survey, profiles were paired using a main effects fractional factorial design in NGENE software based on the principle of D_z-efficiency [21, 22]. Each pair gave participants a choice between two programs (described generically as program A or program B) with a third option of opting out by selecting "I would not attend either program" (see example in Figure 1). The design consisted of 24 different choice tasks which were divided into three survey versions, each containing 8 choice tasks.

In addition to the choice tasks, participants were asked questions related to their (i) sociodemographic characteristics; (ii) direct preference for attending a centre-based program at a hospital or community setting or a program completed in their own home and their strength of preferences for that choice on a 1-10 scale (where 1 represents no real preference and 10 indicates they strongly prefer this setting); (iii) willingness to pay for: travel and parking to attend a centre-based sessions, and home-based sessions; and (iv) influencing

factors in the participation of a CR program. Visual aids and cards containing the choice sets were available to support survey administration. The DCE instrument was pilot tested in the first 10 of 200 participants recruited for the study.

2.2 Study Setting and Population

Ethical approval was obtained from Metro South Health (MSH) HREC. Participants were enrolled from a tertiary hospital in Brisbane, Australia, between April 2016 and July 2017. Informed consent was obtained from all participants. All patients in this study were offered standard care at the bedside by a specialist cardiac nurse with one to one consultation, education, and referral to a cardiac rehabilitation program of the patient's choice. Prior to consent it was clearly articulated to each participant that the options in the survey were hypothetical. A research nurse administered the survey at a separate time prior to discharge to 200 patients who met the following criteria:-

Inclusion criteria:

- ≥18 years old
- diagnosed with an ST Elevation Myocardial Infarction (STEMI) or Non ST Elevation Myocardial Infarction (NSTEMI) or post percutaneous coronary intervention (PCI) or post Cardiac Surgery

Exclusion criteria:

- unable to read English
- cognitive impairment (MMSE≤24)

2.3 Data Analysis

A latent class logit model was employed to analyse the choice data in NLogit software [23]. Latent class models are a form of regression analysis, which explain the extent to which the characteristics used to describe the CR program in the DCE explain the participant's choice between programs. The latent class model was used as it does not assume all participants in the sample to have the same preference for CR program. Rather, it is flexible in allowing there to be different groups or 'classes' of preference within the sample. Thus, the latent class model can identify the existence and characteristics of different preference classes or segments within the sample, enabling a more detailed investigation of subgroup preferences. For each preference class, the analysis provides "preference weights" representing the relative importance of improvements in different service characteristics, from the perspective of patients. This in turn can be used to indicate patient driven priorities for service implementation.

For the model, the choice of program (A, B or opt-out) was specified as the dependent variable and the levels of the program attributes were used to explain choice. A constant was specified to be associated with the option of taking up a program (alternatives A or B). Participant sociodemographic characteristics and comorbidities were specified as covariates alongside the constant, to control for the likelihood of people taking a program up, independent of the attribute levels. Models were estimated with all attribute levels and covariates effects-coded [24]. The optimal number of classes was determined in an iterative procedure, by making comparisons of models with different numbers of classes, on the basis of the Akaike Information Criterion AIC. A p-value <0.05 was considered to be statistically significant.

3. Results

Sample Characteristics

The DCE survey was completed by 200 participants. The sample was reasonably balanced in terms of age, education, employment and income (**Table 2**). There was a higher proportion of males (78.5%), married participants (76%), those who lived with friends/family (89%), those who had a diagnosis of PCI (68.5%) and participants who had not previously attended CR (89%) than their counterparts.

Uptake and preferred characteristics of a CR program

A total of 1600 choice observations were included in the latent class model (8 choices from each of 200 respondents). Respondents chose to take up a CR program for the majority of the choices (982/1600 = 61.4%). Most respondents (*n*=157, 78.5%) chose the opt-out option "I would not attend either program" at least once (**Figure 2**). However, only 4 (2%) participants opted out of all eight choice tasks (that is, they never selected a CR program).

The preferred choice model was a latent class model with five different preference classes (Table 3 Supplementary material and **Table 4**). The likelihood of a respondent belonging to each preference class was 28.4%, 13.2%, 18.4%, 13.5% and 26.4% for classes 1 to 5 respectively. All characteristics of a CR program impacted for the choice between different CR programs, but their impact differed across classes.

The largest Class, representing the preference of 28.4% of respondents, was Latent Class 1. Respondents in Class 1 preferred a program to start within two weeks of hospital discharge ($p<0.05$), and strongly preferred a single or mixed gender exercise group over exercising using written instructions, but strongly disliked exercising in a group over the internet using telehealth. They strongly preferred lifestyle information provided one-on-one by a health professional rather than in a group setting, and strongly disliked information via a smart phone App. Program length and time did not affect their choice of program.

Latent Class 5 had a similar size to Class 1, representing the preference of 26.4% of respondents. However, unlike Class 1, choice of program was only affected by the program time. Respondents in Class 5 preferred a program delivered out of rather than within working hours. The other program characteristics did not affect their choice of program.

The third largest class, Latent Class 3, represented the preference of 18.4% of respondents. Respondents in Class 3 strongly preferred a shorter program length (four instead of eight weeks) and exercising alone using written or internet information rather than exercising in a group (face-to-face or via telehealth). The other program characteristics did not affect their choice of program.

Latent Classes 2 and 4 had similar size, each representing the preferences of about half as many as the larger Class 1. However, the classes were not small, representing the preferences of 13.2% and 13.5% respondents respectively. Respondents in Class 2 indicated similar preferences to those in Class 1. However, their distinguishing feature was a strong preference for the program to start six weeks after hospital discharge (whereas, Class 1 preferred two weeks after discharge). Respondents in Class 4 indicated similar preferences to those in Class 1. However, they strongly preferred lifestyle information provided by a health professional in a group setting, rather than having a strong preference for information to be provided one-on-one (as was seen in Class 1). However, similar to Class 1, they strongly disliked information via a smart phone App.

The sociodemographic parameters in the model specify whether the probability of uptake of a CR program within that class is associated with the characteristics of the respondents (Table

3 Supplementary material and Table 4). Respondents with preferences belonging to Class 1 were more likely to take up a CR program if they lived alone rather than with friends/family, had a lower rather than higher income, or had undergone PCI or medical treatment rather than surgical treatment ($p<0.05$). Those in Class 3 were more likely to take up a CR program if they had a trade/certificate than a university degree, and less likely to if they left school before Year 12. They were also more likely to take up a CR program if they lived with friends/family than if they lived alone. Respondents with preferences belonging to Class 4 were more likely to take up a CR program if they were older (>60 years), had a trade/certificate, or had a lower rather than higher income. Those in Class 5 were more likely to take up a CR program if they lived with friends/family or had received PCI rather than medical treatment. There were no sociodemographic associations observed to be associated with uptake of a program in Class 2. Gender, marital status, employment status and previous CR were not significant in predicting uptake of a CR program for any Class.

Preferred CR program setting

More than half of the respondents (57.3%) stated a preference for a centre-based rather than home-based program, with a mean strength of preference rated at 7.5 (median 8) out of 10. When individuals who stated they would prefer a centre-based based program were asked "why", reasons pertaining to convenience, motivation, lack of technology at home, social situation and instant access to health professionals were cited. Fewer respondents (42.7%) stated they would prefer a home-based program, citing convenience, independence, work commitments, issues with travel, flexibility and a dislike of social groupings. However, those preferring a home-based program indicated a similar strength of preference to those preferring centre-based. A binary logistic regression model found no sociodemographic variables responsible for the variation in the outcome measure of preferences for either a

centre-based or home based program; with the exception of those with a diagnosis of surgical treatment. Participants in this category were significantly (p=0.018) more likely to choose a centre-based program compared to those who had undergone percutaneous coronary intervention (PCI).

Willingness To Pay for a CR program

Just over half the sample were willing to pay (WTP) at least AU$10 to travel and park (51.3%) and over three quarters of the sample (79.3%) were willing to pay at least AU$10 in addition to travel costs to attend a centre-based program, per visit (**Table 6 and Figure 3**). This compared to just under half of the sample (48.9%) who were willing to pay at least AU$10 per session to complete their rehabilitation program at home. WTP differed across some subgroups (**Table 6**). A higher proportion of males than females were WTP at least AU$10 for a session in either the centre-based or home-based setting. A higher proportion of those in employment or living with friends/family were WTP at least AU$10 for a session in the centre-based setting than those who were not employed or were living alone. Those with a higher income were more likely to be WTP at least $10 to travel/park than those on a lower income. WTP also differed by diagnosis, with a lower proportion of individuals who had undergone surgical treatment WTP at least $10 for a home session than those who underwent medical treatment or PCI.

4. Discussion and Conclusion

4.1 Discussion

Overall, the findings from this study suggest that over half of patients (57% in our study) strongly preferred a centre-based program. Patients felt that this type of program provided instant access to healthcare professionals, was more convenient and may improve their

motivation. However, it is also important to note that the remaining 43% strongly preferred CR to be delivered in the home setting. For these patients convenience, independence, work commitments, issues with travel, flexibility and a dislike of social groups influenced their decision. Both programs elicited a similar strength of preference from the study participants. These findings support Tang and colleague's study that reported 55% of patients preferred a centre-based exercise program compared to 45% who preferred a home-based setting [25].

Our findings indicated a preference towards information being delivered by health care professionals on a one-to-one basis compared to a group setting and participants strongly disliked the proposal of receiving education and information via a smart phone App. With recent advances in smart phone information and communication technologies, App development is emerging to enhance healthcare delivery. In the field of CR, Apps have been developed and implemented as an innovative strategy to improve CR uptake. While studies have demonstrated similar clinical outcomes using a smart phone App for CR [26] and some interest from patients [27], the effect on uptake needs further investigation. Patient preferences for this type of application remains unclear and acceptance of these technologies will be variable between patients.

Participants in this study mostly indicated that they preferred to exercise in a single or mixed gender group with other patients compared to using written instructions or exercising with a group using telehealth over the internet. A minority of our participants preferred exercising alone using written or internet information; however, exercising in a group using "telehealth" was strongly disliked by the majority of participants overall. There is evidence to suggest that women prefer single sex exercise classes for CR and that mixed classes may be a barrier to

attendance [28]. Additionally, previous research suggests that preferences for CR may be gender-specific, and developing programs which incorporate women-specific subjective views make increase the uptake and participation [29]. However, our findings did not indicate that men and women had different preferences for program uptake. Evidence suggests that CR programs delivered via telehealth do not have inferior outcomes compared to centre-based supervised programs [30], nevertheless patient preferences for these types of programs may need to be considered as this may affect uptake and participation. Our study has reinforced that group participation is generally the preferred mode of participation.

Almost half of the participants indicated a strong preference for commencing a program within two weeks of discharge (preference classes 1 and 3); whilst a minority strongly preferred CR to start 6 weeks after discharge (preference class 2). Timely access to a CR program is an enabling factor for uptake with longer time to commencement associated with poorer outcomes [31]. Delays in commencing CR are associated with less improvement in cardiopulmonary fitness and decreased completion rate [32]. Some patients have clearly indicated a preference for an early start after hospital discharge, however early commencement may not always be feasible due to service demands or clinical condition, and this may contribute to poor uptake.

CR models of delivery are varied although most are delivered as ambulatory outpatient programs beginning soon after discharge and ending within three months [33]. These programs are generally based on supervised group exercise sessions and education although the content and delivery varies considerably [33] . Our study indicated that about one quarter of patients preferred a CR program delivered outside of rather than within working hours, however as these programs are usually run by hospital or community healthcare professionals

most programmes are offered during business hours which may make it difficult for people returning to work to attend regularly. A minority of participants also strongly preferred a shorter program of four weeks compared to an eight week program, with the others not having a strong preference for program length. The delivery of these outpatient programs often depends on availability of specialist CR staff including nurses, physiotherapists and other members of the multidisciplinary team, so length of the program and times of attendance may be inflexible and are often constrained by the ability of the centre-based service to provide the program rather than on patient preferences.

One of the most striking findings of our study was the variation in people's preferences for a CR program. Although our findings indicated where the strongest preferences lie for the majority of patients, we were able to identify five different classes or subgroups of preference within our sample. This suggests that to optimise program uptake and adherence, it is important to tailor the delivery of CR programs wherever possible to suit individual patient preferences. However, while laudable, achieving this may not always be pragmatic or possible when CR is delivered from public or insurance funding. Overall, the findings of the survey indicated a preference towards information being delivered by health professionals on a one-on-one basis as well as a program which supports exercising with groups of people. This is not surprising as over half of participants stated a preference for a centre-based program. The large proportion of participants (78.5%) who opted-out of one or more of the eight questions indicated that respondents will not always take up a CR program. Therefore, the characteristics of delivery are important in affecting demand and likely compliance to a recommended CR program. This has implications for health as the high cost of repeat events in people diagnosed with CVD is a burden for the healthcare economy as well as for patients and their families. An increase in the uptake of CR will decrease inpatient costs, other

healthcare costs, informal care costs and reduce premature mortality[34] . This research has focused on patient preferences for the delivery of a CR program which can inform the structure and delivery of programs aimed at increasing CR uptake.

There are limitations associated with our study as this was a single site study from a tertiary centre in Australia which may decrease the generalisability of our findings to other countries.

Future research could explore patients' preferences using the DCE approach in other settings and correlate this with actual uptake of CR programs to establish the influence of patient preferences on uptake.

4.2 Conclusion

In this study patients have had the opportunity to voice their preferences for the delivery of a CR program. However it is important to remember that even though the strongest preferences were for centre-based programs with healthcare professional education and exercise classes, we need to have flexible delivery as one approach will not suit everyone. As service providers we need to balance the needs of the patients within the service model of the organisation.

Practice Implications

It is important to give special attention to the preferences of patients for the delivery of CR programs. Developing and implementing flexible programs based on identified preferences has the potential to improve uptake of CR.

Conflicts of Interest: nil

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Ethics Approval: This study was approved by the Metro South Health Service Human Research Ethics Committee, Brisbane, Queensland. HRC Ref: HREC/15/QPAH/679.

References

[1] American Heart Association Statistics Committee and Stroke Statistics Subcommittee Writing Group, E.J. Benjamin, M.J. Blaha, S.E. Chiuve, M. Cushman, S.R. Das, R. Deo, S.D. de Ferranti, J. Floyd, M. Fornage, C. Gillespie, C.R. Isasi, M.C. Jiménez, L.C. Jordan, S.E. Judd, D. Lackland, J.H. Lichtman, L. Lisabeth, S. Liu, C.T. Longenecker, R.H. Mackey, K. Matsushita, D. Mozaffarian, M.E. Mussolino, K. Nasir, R.W. Neumar, L. Palaniappan, D.K. Pandey, R.R. Thiagarajan, M.J. Reeves, M. Ritchey, C.J. Rodriguez, G.A. Roth, W.D. Rosamond, C. Sasson, A. Towfighi, C.W. Tsao, M.B. Turner, S.S. Virani, J.H. Voeks, J.Z. Willey, J.T. Wilkins, J.H.Y. Wu, H.M. Alger, S.S. Wong, P. Muntner, Heart Disease and Stroke Statistics—2017 Update: A Report From the American Heart Association, Circulation 135 (2017) e146-e603.

[2] Australian Institute of Health and Welfare., Trends in cardiovascular deaths. Bulletin no. 141., Canberra, 2017.

[3] Australian Bureau of Statistics., 3303.0 - Causes of Death, Australia, 2015, Canberra, 2017.

[4] D.P. Chew, J.V. Amerena, S.G. Coverdale, J.M. Rankin, C.M. Astley, A. Soman, D.B. Brieger, Invasive management and late clinical outcomes in contemporary Australian management of acute coronary syndromes: observations from the ACACIA registry, Med. J. Aust. 188 (2008) 691-697.

[5] Deloitte Access Economics, Access ACS in Perspective: The importance of secondary prevention Sydney, Australia, 2011.

[6] K. Kotseva, C. Jennings, E. Turne, A. Mead, S. Connolly, J. Jones, T. Bowker, D. Wood, ASPIRE-2-PREVENT: a survey of lifestyle, risk factor management and cardioprotective medication in patients with coronary heart disease and people at high risk of developing cardiovascular disease in the UK, Heart 98 (2012) 865-871.

[7] L. Anderson, N. Oldridge, D.R. Thompson, A.-D. Zwisler, K. Rees, N. Martin, R.S. Taylor, Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease, J. Am. Coll. Cardiol. 67 (2016) 1-12.

[8] T. Briffa, L. Kinsman, A. Maiorana, R. Zecchin, J. Redfern, P. Davidson, G. Paull, A. Nagle, A. Denniss, An integrated and coordinated approach to preventing recurrent coronary heart disease events in Australia. Policy statment from the Australian Cardiovascular Health and Rehabilitation Association, Med. J. Aust. 190 (2009) 683-686.

[9] S. Woodruffe, L. Neubeck, R. Calrk, K. Gray, C. Ferry, J. Finan, S. Sanderson, T. Briffa, Australian Cardiovascular Health and Rehabilitation Association (ACRA) Core Componenets of Cardiovascular Disease Prevention and Cardiac Rehabiliation, Heart Lung Circ. (2015).

[10] H.M. Dalal, A. Zawada, K. Jolly, T. Moxham, R.S. Taylor, Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis, Brit Med J 340 (2010) b5631.

[11] L. Anderson, R.S. Taylor, Cardiac rehabilitation for people with heart disease: an overview of Cochrane systematic reviews, Cochrane Database Syst Rev 12 (2014) CD011273.

[12] R.A. Clark, N. Coffee, D. Turner, K.A. Eckert, D. van Gaans, D. Wilkinson, S. Stewart, A.M. Tonkin, Access to cardiac rehabilitation does not equate to attendance, Eur. J. Cardiovasc. Nurs. 13 (2014) 235-42.

[13] M. Jelinek, D. Thompson, C. Ski, S. Bunker, M. Vale, 40 yers of cardiac rehabilitation and secondary prevention in post-cardiac ischaemic patients. Are we still in the wilderness?, Int. J. Cardiol. 179 (2015) 153-159.

[14] H. Kristina, T. Patrik, L. Bertil, Time trends and gender differences in prevention guideline adherence and outcome after myocardial infarction: Data from the SWEDEHEART registry, Eur J Prev Cardiol 23 (2015) 340-348.

[15] M. Boyde, K. Grenfell, R. Brown, S. Bannear, N. Lollback, J. Witt, L. Jiggins, L. Aitken, What have our patients learnt after being hospitalised for an acute myocardial infarction?, Aust. Crit. Care 28 (2014) 134-139.

[16] J. Redfern, E.R. Ellis, T. Briffa, S.B. Freedman, High risk-factor level and low risk-factor knowledge in patients not accessing cardiac rehabilitation after acute coronary syndrome, Med. J. Aust. 186 (2007) 21-5.

[17] A.C. Jackson, R.O. Higgins, B.M. Murphy, M. Rogerson, M.R. Le Grande, Cardiac Rehabilitation in Australia: A Brief Survey of Program Characteristics, Heart Lung Circ. (2017).

[18] L. Anderson, G.A. Sharp, R.J. Norton, H. Dalal, S.G. Dean, K. Jolly, A. Cowie, A. Zawada, R.S. Taylor, Home-based versus centre-based cardiac rehabilitation, The Cochrane Library (2017).

[19] J.A. Whitty, S. Stewart, M.J. Carrington, A. Calderone, T. Marwick, J.D. Horowitz, H. Krum, P.M. Davidson, P.S. Macdonald, C. Reid, P.A. Scuffham, Patient preferences and willingness-to-pay for a home or clinic based program of chronic heart failure management: findings from the Which? trial, PLoS One 8 (2013) e58347.

[20] E.W. de Bekker-Grob, M. Ryan, K. Gerard, Discrete choice experiments in health economics: a review of the literature, Health Econ. 21 (2012) 145-72.

[21] F.R. Johnson, E. Lancsar, D. Marshall, V. Kilambi, A. Muhlbacher, D.A. Regier, B.W. Bresnahan, B. Kanninen, J.F.P. Bridges, Constructing experimental designs for discrete-choice experiments: Report of the ISPOR Conjoint Analysis Experimental Design Good Research PracticesTask Force, Value Health 16 (2013) 3-13.

[22] J.M. Rose, A.T. Collins, M.C.J. Bliemer, D.A. Hensher, Ngene [Computer Program], ChoiceMetrics Pty Ltd, 2012.

[23] NLOGIT, Econometric Software, Inc, Plainview, NY, 2016.

[24] M. Bech, D. Gyrd-Hansen, Effects coding in discrete choice experiments, Health Econ. 14 (2005) 1079-83.

[25] L.H. Tang, S. Kikkenborg Berg, J. Christensen, J. Lawaetz, P. Doherty, R.S. Taylor, H. Langberg, A.-D. Zwisler, Patients' preference for exercise setting and its influence on the health benefits gained from exercise-based cardiac rehabilitation, Int. J. Cardiol. 232 (2017) 33-39.

[26] M. Varnfield, M. Karunanithi, C.-K. Lee, E. Honeyman, D. Arnold, H. Ding, C. Smith, D.L. Walters, Smartphone-based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: results from a randomised controlled trial, Heart (2014).

[27] R. Buys, J. Claes, D. Walsh, N. Cornelis, K. Moran, W. Budts, C. Woods, V.A. Cornelissen, Cardiac patients show high interest in technology enabled cardiovascular rehabilitation, BMC Med. Inform. Decis. Mak. 16 (2016) 95.

[28] M.M. McCarthy, M.V. Vaughan Dickson, M.D. Chyun, Barriers to Cardiac Rehabilitation in Women With Cardiovascular Disease: An Integrative Review, J. Cardiovasc. Nurs. 26 (2011) E1-E10.

[29] B. Bjarnason-Wehrens, G. Grande, H. Loewel, H. Voller, O. Mittag, Gender-specific issues in cardiac rehabilitation: do women with ischaemic heart disease need specially tailored programmes?, Eur. J. Cardiovasc. Prev. Rehabil. 14 (2007) 163-171.

[30] H. Kaisen, L. Wei, H. Dingxiu, H. Baotao, X. Dan, P. Yong, H. Yong, H. Hongde, C. Mao, H. Dejia, Telehealth interventions versus center-based cardiac rehabilitation of coronary artery disease: A systematic review and meta-analysis, Euro J Prev Cardiol 22 (2014) 959-971.

[31] L.S. Marzolini, L.S. Grace, L.D. Brooks, L.D. Corbett, L.S. Mathur, L.R. Bertelink, L.V. Skeffington, L.D. Alter, L.P. Oh, Time-to-Referral, Use, and Efficacy of Cardiac Rehabilitation After Heart Transplantation, Transplantation 99 (2015) 594-601.

[32] S. Marzolini, C. Blanchard, D.A. Alter, S.L. Grace, P.I. Oh, Delays in Referral and Enrolment Are Associated With Mitigated Benefits of Cardiac Rehabilitation After Coronary Artery Bypass Surgery, Circ. Cardiovasc. Qual. Outcomes 8 (2015) 608.

[33] R.A. Clark, A. Conway, V. Poulsen, W. Keech, R. Tirimacco, P. Tideman, Alternative models of cardiac rehabilitation: a systematic review, Euro J Prev Cardiol 22 (2015) 35-74.

[34] E. De Gruyter, G. Ford, B. Stavreski, Economic and social impact of increasing uptake of cardiac rehabilitation services–a cost benefit analysis, Heart Lung Circ. 25 (2016) 175-183.

Figure 1: Example of one question within the choice sets

We would like you to read the following examples of cardiac rehabilitation programs and choose which **ONE** of these 2 programs you are interested in.

A	B
The program is	The program is
Longer program of eight weeks	Short program of four weeks
Run out of business hours	Run in business hours
Starts within two weeks of discharge	Starts six weeks after discharge
I would like to exercise with a group via the internet using "telehealth"	I would like to exercise with a group of men and women
I would like to receive healthy lifestyle information by listening to a talk from health care professionals and participating in a group discussion	I would like to receive healthy lifestyle information by a Smart phone App
□ I would prefer this program	**□ I would prefer this program**

□ I would not attend either program

Figure 2: Frequency of opting out of a CR Program

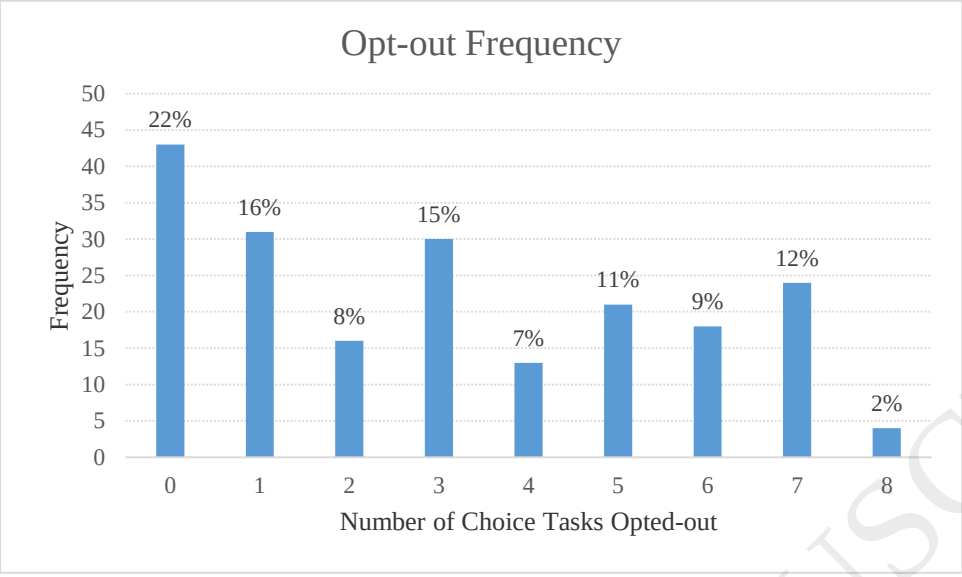

Figure 3: Histogram Detailing Respondent Willingness to Pay for Travel, a Home Session or a Centre- Based Session

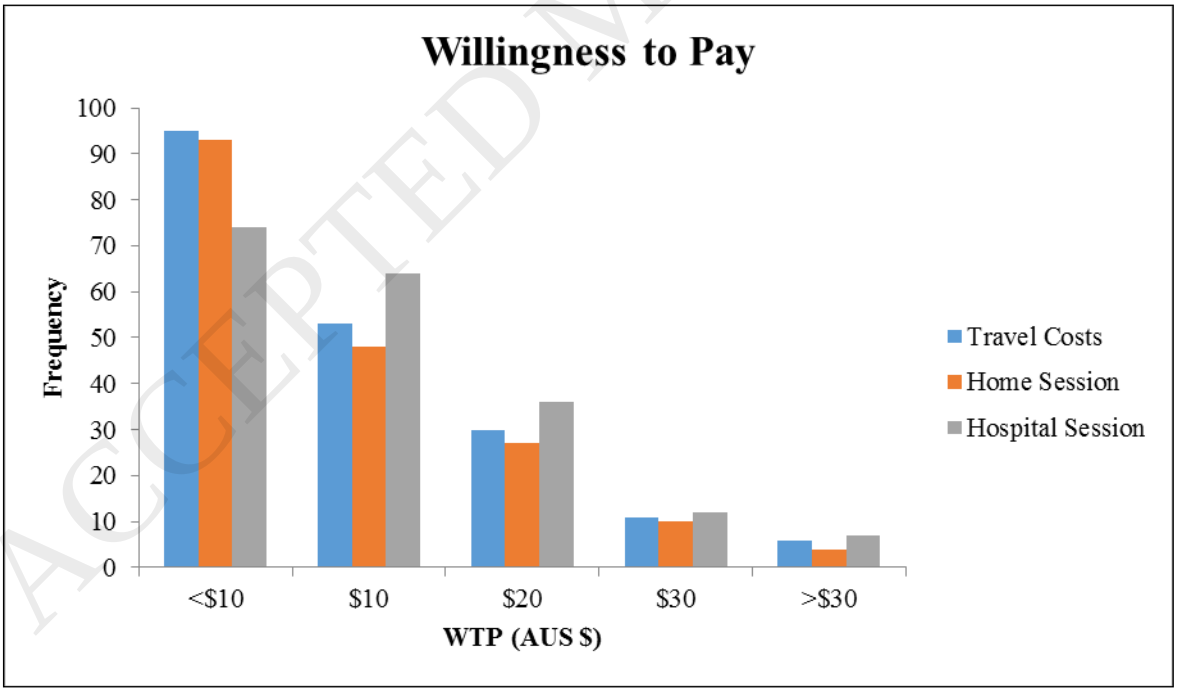

Table 1: DCE Attributes and Levels

Attribute	Levels
Program Length	Four weeks
	Eight weeks
Program Time	In working hours
	Out of working hours
Program Start	Within two weeks of hospital discharge
	Six weeks after hospital discharge
Program Exercise	With a group of women only or men only
	With a mixed group
	On your own using written or internet information
	With a group via the internet using "telehealth"
Healthy Lifestyle Information	Health professionals giving a talk and a group discussion
	On your own using written or internet information
	One-on-one discussion with health professional
	Information provided by a smart phone App

Table 2: Respondent Characteristics for DCE (*n*=200)

Demographic	Category	N (%)
Age	≤60	108 (54)
	>60	92 (46)
Gender	Female	43 (21.5)
	Male	157 (78.5)
Marital Status	Married	152 (76)
	Not Married	48 (24)
Education	≤Year 12	111 (55.5)
	Trade/Cert	47 (23.5)
	University	42 (21)
Employment	Unemployed	101 (50.5)
	Employed	99 (49.5)
Living Arrangement	Alone	22 (11)
	Friends/Family	178 (89)
Diagnosis	Percutaneous Coronary Intervention	137 (68.5)
	Surgical Treatment	35 (17.5)
	Medical Treatment	28 (14)
Income*	≤AUS$40,000	71 (42)
	>AUS$40,000	98 (58)
Previous CR	No	178 (89)
	Yes	22 (11)

Percentages may not add to 100 due to rounding error

*Income was missing for 31 participants

Table 3: **Latent class model**

	Latent class 1		**Latent class 2**		**Latent class 3**		**Latent class 4**		**Latent class 5**	
	Probability=28.4%		*Probability=13.2%*		*Probability=18.4%*		*Probability=13.5%*		*Probability=26.4%*	
Attribute	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*
Constant	-0.97022	0.1211	1.02629	0.9980	3.94766	0.9753	1.26054	0.6480	-1.38446	0.4068
Program Length										
4 weeks	-0.02665		0.41262		0.74271		-0.32459		-0.04360	
8 weeks	0.02665	0.8647	-0.41262	0.2335	-0.74271	<0.001***	0.32459	0.1220	0.04360	0.5962
Program Time										
In working hours	-0.05306		0.48976		-0.05711		0.33301		-0.46141	
Out of working hours	0.05306	0.7757	-0.48976	0.2609	0.05711	0.6894	-0.33301	0.1144	0.46141	<0.001***
Program Start										
Within 2 weeks of hospital discharge	0.36415		-1.53259		-0.07102		0.93656		-0.15843	
Six weeks after hospital discharge	-0.36415	0.0051**	1.53259	<0.001***	0.07102	0.53260	-0.93656	0.0018**	0.15843	0.0682
Program Exercise										
With a group of women only or men only	0.79615		1.23651		-0.32360		0.90786		-0.08284	
With a mixed group	0.75397	0.0011**	1.96573	<0.001***	-0.47822	0.05580	0.77782	0.2429	-0.08336	0.6777
On your own using written or internet information	-0.15591	0.5432	-1.23026	0.0662	1.00520	<0.001***	-0.52306	0.2793	0.11295	0.4757
With a group via the internet using "telehealth"	-1.39421	<0.001***	-1.97198	0.0213*	-0.20338	0.5548	-1.16262	0.0468*	0.05325	0.7440
Healthy Lifestyle Information										
Health professionals giving a talk and a group discussion	0.67962		1.03021		-0.31131		1.77978		-0.06143	

	Latent class 1		**Latent class 2**		**Latent class 3**		**Latent class 4**		**Latent class 5**	
	Probability=28.4%		*Probability=13.2%*		*Probability=18.4%*		*Probability=13.5%*		*Probability=26.4%*	
Attribute	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*
On your own using written or internet information	-0.49808	0.0637	-0.03359	0.9694	0.05815	0.8704	-0.38613	0.4692	-0.14331	0.4063
One-on-one discussion with health professional	1.26211	<0.001***	1.11485	0.01*	-0.48245	0.1412	-0.25798	0.6475	0.30228	0.1381
Information provided by a smart phone App	-1.44365	<0.001***	-2.11147	0.0027**	0.73561	0.0931	-1.13567	0.0030**	-0.09754	0.6341
Age										
≤60 years old	0.38070		1.08264		0.13882		-3.85590		0.20340	
>60 years old	-0.38070	0.0573	-1.08264	0.2377	-0.13882	0.7207	3.85590	0.0320*	-0.20340	0.5444
Gender										
Female	0.18211		-1.26318		0.27244		-3.00852		-0.39839	
Male	-0.18211	0.5838	1.26318	0.2568	-0.27244	0.3637	3.00852	0.1081	0.39839	0.3215
Marital Status										
Married	0.09754		-1.07333		-0.71922		-0.94894		-0.66919	
Not Married	-0.09754	0.7909	1.07333	0.5611	0.71922	0.2121	0.94894	0.4732	0.66919	0.2133
Employment Status										
Unemployed	0.28190		0.54847		0.14340		-1.68465		0.92975	
Employed	-0.28190	0.2713	-0.54847	0.3839	-0.14340	0.6718	1.68465	0.2337	-0.92975	0.0626
Education										
≤Year 12	0.21401		-0.52194		-1.25946		-3.98798		-0.98885	
Trade/Certificate	0.27901	0.2656	-0.96918	0.9309	1.85793	<0.001***	6.18359	0.0495*	-0.20838	0.6908
University	-0.49302	0.1146	1.49112	0.9466	-0.59847	0.0324*	-2.19561	0.2454	1.19723	0.1561
Living Arrangement										
Alone	1.35064		-1.24920		-1.46006		-0.64751		-3.03203	

	Latent class 1		**Latent class 2**		**Latent class 3**		**Latent class 4**		**Latent class 5**	
	Probability=28.4%		*Probability=13.2%*		*Probability=18.4%*		*Probability=13.5%*		*Probability=26.4%*	
Attribute	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*
Friends/Family	-1.35064	0.0048**	1.24920	0.4251	1.46006	0.0273*	0.64751	0.7729	3.03203	0.0485*
Diagnosis										
Percutaneous Coronary Intervention	0.07894		-2.06466		-0.57579		1.51868		1.68210	
Surgical Treatment	-0.91219	0.0116**	-3.72754	0.9927	-0.59584	0.4361	-3.93905	0.1545	-0.20794	0.6665
Medical Treatment	0.83325	0.0587	5.79220	0.9943	1.17163	0.1873	2.42037	0.3822	-1.47416	0.0029**
Income										
≤AUS$40,000	0.46122		0.42162		0.70644		2.82376		-0.43429	
>AUS$40,000	-0.46122	0.0330*	-0.42162	0.5923	-0.70644	0.0958	-2.82376	0.0412*	0.43429	0.3991
Previous CR										
No	0.23160		0.08002		-3.95240		1.21647		-0.78868	
Yes	-0.23160	0.4463	-0.08002	0.9932	3.95240	0.9753	-1.21647	0.2496	0.78868	0.1924
Model Fits										
AIC	1.828									
Log Likelihood	-1353.21									
Pseudo R-Squared	0.23									

*p<0.05, **p<0.01, ***p<0.001

Reference category

Table Footnote: The sign of the coefficient reflects whether the attribute level had a positive or negative effect on choice, and the comparative size of the coefficient indicates the strength of preference.

Table 4: **Preferences and characteristics of latent classes 1-5**

	Preferences and Associations with Program Uptake
Latent Class	
1	Prefers program start within two weeks of hospital discharge Prefers program exercise with a group of women only or men only or a mixed group, and dislikes exercise via 'telehealth' Prefers healthy lifestyle information delivered via one-on-one discussion with a health professional, and dislikes information via a Smart phone App More likely to take up CR program if: Live alone Lower income ≤AUS$40,000 Have undergone PCI
Latent Class	
2	Prefers program start six weeks after hospital discharge Prefers program exercise with a mixed group, and dislikes exercise via 'telehealth' Prefers healthy lifestyle information delivered via one-on-one discussion with a health professional, and dislikes information via a Smart phone App
Latent Class	
3	Prefers program length of four weeks Prefers program exercise on your own using written or internet information More likely to take up CR program if: Have a trade/certificate rather than degree (less likely if left school < Year 12) Live with friends/family
Latent Class	
4	Prefers program start within two weeks of hospital discharge Dislikes program exercise via 'telehealth' Dislikes healthy lifestyle information provided via a Smart phone App More likely to take up CR program if: Older (>60 years) Have a trade/certificate Lower income ≤AUS$40,000
Latent Class	
5	Prefers program time out of working hours More likely to take up CR program if: Live with friends/family Received PCI

Table 5: Preference for CR Program setting

	Frequency	Strength of Preference	
	N (%)	Mean (SD)	Median (IQR)
Home-based	85 (42.7)	7.2 (2.3)	7 (5)
Hospital/community based	114 (57.3)	7.5 (2.0)	8 (5)

1 missing response

Table 6: Willingness to pay (WTP) responses for sample and by sociodemographic variables

		Willingness To Pay (AU$) per visit or session Frequency N (%)					
		Travel Park†		Hospital/Community‡		Home§	
		<$10	≥$10	<$10	≥$10	<$10	≥$10
ALL		95 (48.7)	100 (51.3)	74 (20.7)	119 (79.3)	93 (51.1)	89 (48.9)
SUBGROUP							
Age	≤60 years old	45 (42.5)	61 (57.5)	34 (32.4)	71 (67.6)	45 (45.5)	54 (54.5)
	>60 years old	50 (56.2)	39 (43.8)	40 (45.5)	48 (54.5)	48 (57.8)	35 (42.2)
			p=0.056		*p=0.063*		*p=0.096*
Gender	Female	26 (60.5)	17 (39.5)	24 (58.5)	17 (41.5)	28 (71.8)	11 (28.2)
	Male	69 (45.5)	83 (54.6)	50 (32.9)	102 (67.1)	65 (45.5)	78 (54.5)
			p=0.081		*p=0.003***		*p=0.004***
Marital Status	Married	69 (46.3)	80 (53.7)	54 (36.2)	95 (63.8)	70 (49.0)	73 (51.0)
	Not Married	26 (56.5)	20 (43.5)	20 (45.5)	24 (54.5)	23 (59.0)	16 (41.0)
			p=0.226		*p=0.269*		*p=0.267*
Education	≤Year 12	55 (51.4)	52 (48.6)	45 (42.9)	60 (57.1)	53 (54.1)	45 (45.9)
	Trade/Cert	18 (43.9)	23 (56.1)	15 (36.6)	26 (63.4)	18 (45.0)	22 (55.0)
	University	22 (46.8)	25 (53.2)	14 (29.8)	33 (70.2)	22 (50.0)	22 (50.0)
			p=0.685		*p=0.299*		*p=0.617*
Employment	Unemployed	53 (54.6)	44 (45.4)	44 (46.3)	51 (53.7)	50 (56.2)	39 (43.8)
	Employed	42 (42.9)	56 (57.1)	30 (30.6)	68 (69.4)	43 (46.2)	50 (53.8)
			p=0.100		*p=0.025**		*p=0.180*
Living Arrangement	Alone	13 (65.0)	7 (35.0)	12 (63.2)	7 (36.8)	13 (72.2)	5 (27.8)
	Friends/Family	82 (46.9)	93 (53.1)	62 (35.6)	112 (64.4)	80 (48.8)	84 (51.2)
			p=0.124		*p=0.019**		*p=0.059*
Diagnosis	Surgical Treatment	17 (51.5)	16 (48.5)	12 (37.5)	20 (62.5)	18 (72.0)	7 (28.0)
	Medical Treatment	15 (53.6)	13 (46.4)	15 (53.6)	13 (46.4)	15 (57.7)	11 (42.3)
	Percutaneous Coronary Intervention	63 (47.0)	71 (53.0)	47 (35.3)	86 (64.7)	60 (45.8)	71 (54.2)
			p=0.770		*p=0.196*		*p=0.043**
Income	≤AUS$40,000	42 (60.0)	28 (40.0)	31 (45.6)	37 (54.4)	35 (57.4)	26 (42.6)
	>AUS$40,000	39 (40.2)	58 (59.8)	30 (30.9)	67 (69.1)	44 (47.8)	48 (52.2)
			*p=0.012**		*p=0.055*		*p=0.247*
Previous CR	No	84 (48.6)	89 (51.4)	67 (39.2)	104 (60.8)	83 (51.2)	79 (48.8)
	Yes	11 (50.0)	11 (50.0)	7 (31.8)	15 (68.2)	10 (50.0)	10 (50.0)
			p=0.898		*p=0.504*		*p=0.917*

*p<0.05, **p<0.01, ***p<0.001
P-value derived from Pearson Chi-Square test via SPSS
Missing values: 5†; 7‡; 18§