

***“Why would you not listen? It is like being given the winning lottery numbers and deciding not to take them”: semi-structured interviews with post-acute myocardial infarction patients and their significant others exploring factors that influence participation in cardiac rehabilitation and long-term exercise training***

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# **“Why would you not listen? It is like being given the winning lottery numbers and deciding not to take them”: semi-structured interviews with post-acute myocardial infarction patients and their significant others exploring factors that influence participation in cardiac rehabilitation and long-term exercise training**

**Purpose:** Despite the clinical benefits, coronary artery disease patient participation rates in cardiac rehabilitation (CR) and long-term exercise are poor. This study explored the factors related to participation in these interventions from the perspectives of post-acute myocardial infarction (AMI) patients and their significant others.

**Methods:** Semi-structured interviews were performed with post-AMI patients (number ( $n$ ) = 10) and their significant others ( $n$  = 10) following phase-III and phase-IV CR. Reflexive thematic analysis with an inductive orientation was utilised to identify themes within the dataset (ClinicalTrials.gov identifier: NCT03907293).

**Results:** The overarching theme of the data was a perceived need to improve health, with the participants viewing health benefits as the principal motive for participating in CR and long-term exercise training. Three further themes were identified: motivation, extrinsic influences, and CR experience. These themes captured the underlying elements of the participants’ decision to take part in CR and long-term exercise training for the purpose of health improvements.

**Conclusion:** An AMI collectively impacts the attitudes and beliefs of patients and their significant others in relation to CR participation, long-term exercise, and health. The factors identified in this study may inform strategies to promote patient enrollment in CR and adherence to long-term exercise.

Keywords: cardiac rehabilitation; long-term exercise; enrollment; adherence; coronary artery disease; acute myocardial infarction; significant others; qualitative study

## **Introduction**

Coronary artery disease (CAD) is a leading cause of mortality and morbidity worldwide [1]. This form of cardiovascular disease (CVD) may result in myocardial ischaemia secondary to diminished myocardial perfusion [2]. The clinical manifestations are acute coronary syndromes (ACS) comprising unstable angina pectoris, acute myocardial infarction (AMI; non-ST-segment elevation myocardial infarction (NSTEMI) or ST-segment elevation myocardial infarction (STEMI)), or sudden cardiac death [3]. Importantly, an increased survival rate following AMI has contributed to a residual population of CAD patients at risk of suffering recurrent cardiovascular complications [4,5]. As such, effective secondary prevention strategies are imperative for improving long-term prognosis of CAD patients [6,7].

Cardiac rehabilitation (CR) represents a principal secondary prevention strategy [8,9]. This programme serves as a method of delivering evidence-based management in order to alleviate the psychological and physiological ramifications of CVD [10]. Supervised exercise training is the primary component of CR, with these sessions being supplemented with optimal pharmacological therapy, psychological support (i.e. stress management), and lifestyle advice [11-13]. Whilst CR services may vary across the globe [14], the standard structure of this programme in the United Kingdom (UK) consists of four phases [15] (see table 1). In terms of prognostic benefit, participation in CR has been associated with a reduction in mortality and morbidity in CAD patients [16-20]. Importantly, the results of a recent network meta-analysis highlighted the

centrality of exercise training as the key component of CR by identifying beneficial effects on the risk of all-cause mortality, risk of total-AMI, and risk of fatal-AMI [20], which emphasises the important role of exercise in the secondary prevention of CAD. Not surprisingly, CR is a Class 1 level A recommendation in clinical guidelines for this patient population [9,21].

Despite the clinical benefits, CR programmes are underutilised by patients worldwide [22-24]. This poor participation in CR is detrimental as many eligible patients may fail to receive optimal secondary prevention strategies and the guidance required to implement positive lifestyle adjustments (i.e. long-term exercise training). Indeed, the literature indicates that a large majority of CAD patients across Europe lead an unhealthy lifestyle (smoking, not adhering to dietary guidelines, and sedentary behaviour) [25]. In addition, of those patients who participate in CR, many may experience difficulties with long-term maintenance of exercise training following programme completion [26,27]. Notably, without sustained adherence to exercise, the cardioprotective physiological adaptations induced by CR may be lost [28,29].

Participation in CR is affected by a variety of intrinsic and extrinsic factors; a recent systematic review of quantitative studies performed by Resurrección et al. [30] illuminated the complexity of this decision by identifying sixty-three factors associated with barriers to participation in CR, which were divided into the following five categories: intrapersonal factors (i.e. older age, female gender, low socioeconomic status, comorbidities, depressive symptoms, low-self efficacy for managing disease, and poor perceived benefit of CR), interpersonal factors (i.e. unmarried, unemployed or

retired, and low social and practical support), clinical factors (i.e. smoker, higher body mass index, poor functional capacity, uncontrolled cholesterol levels, diabetes mellitus, previous history of CVD, and disease severity), logistical factors (i.e. longer travel times, being a non-driver, lack of transport, and living in a rural or geographically inaccessible area), and healthcare system factors (i.e. lack of referral to CR and low strength of endorsement from physicians). Given the evidence to support the prognostic benefit of CR [16-20] and long-term exercise training in CAD patients [31-33], identifying methods of promoting participation may result in a reduced burden of CAD by improving CVD risk profiles, with concomitant societal and economic benefits through lower rates of premature mortality, fewer hospital readmissions, and improved quality of life [34]. To assist with the development of these strategies, more work is needed to identify and understand the factors that influence participation in CR and adherence to long-term exercise training in CAD patients.

Qualitative research methods are utilised to develop a better understanding of complex, subjective processes by enabling key knowledge holders to share their personal experiences and perceptions [35]. Systematic reviews of qualitative studies conducted by Clark et al. [36] and Campkin et al. [37] concluded that social support (i.e. offering advice and exercising with the patient) from significant others (i.e. spouses, family members, or personal friends) was an integral factor for promoting participation in CR and adherence to long-term exercise training in CAD patients, with recent qualitative studies corroborating this finding [38-40]. Indeed, the role of the significant other during the rehabilitation process has received increasing attention; significant others are inherently positioned to be affected by the patients' disease (i.e. emotional distress) [41]; CAD patients and their spouses often share similar dietary intakes,

physical activity levels, and CVD risk factors [42,43]; CAD patients have reported that the quality of their recovery was dependent on the level of social support received from family and friends [44]; and frequent contact with friends and relatives has been associated with greater medication adherence [45]. Thus, the dyad may influence each other when coping with CAD.

Whilst patient enrollment in CR and participation in long-term exercise training may be influenced by significant others [36,37], the studies in this area have primarily focused on the perspective of the patient [38-40]. Therefore, the aim of this study was to investigate the factors influencing participation in CR programmes and long-term exercise training from the perspectives of both CAD patients and their significant others. This novel qualitative knowledge may generate a deeper understanding of barriers and facilitators to CR enrollment and long-term exercise training, which may guide the development of interventions to promote CAD patient participation.

## **Methods**

A critical realist epistemological approach was adopted, whereby the impossibility of understanding objects except under particular descriptions is acknowledged [46]. This epistemological approach enabled the generation of rich descriptions of individual experience in a relatively under-researched field. The reporting of data in this study adhered to the standards for reporting qualitative research [47]. Ethical approval was obtained from the Office for Research Ethics Committees Northern Ireland (reference number: 18/NI/0213). All participants included in the study provided informed consent. Anonymity and confidentiality were ensured by removing identifying information from

transcripts and limiting access to participant data to the research team. This study was registered on ClinicalTrials.gov (identifier: NCT03907293).

### ***Description of CR programme***

Table 1 provides a description of the structure of the phase-III and phase-IV CR programmes that were delivered. All CR centres complied with national service guidelines [12].

[Table 1 near here]

### ***Participants and recruitment***

This study involved post-AMI patients referred to phase-III CR programmes at the Belfast Health and Social Care Trust (BHSCT) or South Eastern Health and Social Care Trust (SEHSCT) in Northern Ireland. The centres that facilitated the phase-III CR programmes were certified for achieving national CR delivery standards [48].

Following the completion of phase-III CR, patients were routinely offered an opportunity to participate in phase-IV CR programmes held at local fitness centres and gyms. A convenience sampling method was utilised for recruitment of participants to this study. The selection strategy is presented in table 2. Post-AMI patients recruited to a pilot prospective cohort study being conducted by the research team (not yet published) were invited to take part in an interview. Patients who enrolled in CR were invited to participate in this qualitative study following programme completion, whilst

the patients who refused CR were invited during their participation in the quantitative study. Interested patients received a verbal explanation of the study protocol and were supplied with participant information sheets (PIS). Each interested patient was asked to invite a significant other (i.e. a family member, spouse, or close friend) who was primarily involved throughout the rehabilitation period to participate in this study. The PIS informed the individuals to consider their willingness to participate for a “cooling-off” period of at least 1-week before independently contacting the researcher (Mr Gareth Thompson (GT)). The “cooling-off” period allowed the individuals to evaluate potential questions or uncertainties related to participation and provided the individuals with time to consider their willingness to participate to circumvent a possible coerced decision from being made. Upon contact, any questions were answered and if the potential participant was happy to continue, a suitable time and venue for the interview to take place was arranged, such as: the participant’s home or a clinical site. Informed consent was received from the individuals before the interviews were performed. Recruitment terminated when the research team believed that data saturation had been achieved, whereby the collection of additional data did not necessarily add to the overall story [49]. Ten participants per group (patient and significant other) were recruited, which provided sufficient data for answering the research question as the identified themes were common across and within both patient and significant other data sets. This sample size was in line with recommendations by Braun and Clarke [50] for a study of this type and scope.

[Table 2 near here]



## ***Data collection***

### *Sample characteristics*

Sample characteristics were recorded to set the evidence in context. Information regarding CR participation and clinical characteristics (i.e. form of AMI suffered and intervention received) of patients were obtained from the data recorded during the quantitative study. Prior to a semi-structured interview, gender, age, race, and relation of each participant were recorded.

### *Semi-structured interviews*

The researcher (GT) facilitated semi-structured interviews with patients and their significant others in a private room at a time and location that was suitable for them. Following the completion of 10 (5 dyads) semi-structured in-person interviews, the COVID-19 pandemic resulted in the remainder of data collection comprising semi-structured telephone interviews (10 interviews, 5 dyads). Semi-structured interviews were chosen over other methods of qualitative data collection (i.e. focus groups) to facilitate a comprehensive exploration of an individual's personal perspective, attitude, and feelings towards the phenomena being investigated [51]. Patients and significant others were interviewed separately to prevent the data that were captured from being influenced by the presence of the other participant, and to offer a private space to discuss potentially sensitive topics [52]. A semi-structured interview guide shaped by relevant literature was developed [38,39], which contained open-ended questions that

reflected the objectives of the study (see tables 1 and 2 in supplemental online material 1).

The semi-structured interview guide aimed to explore the factors that influence participation in CR and long-term exercise by stimulating discussions related to the impact of an AMI, knowledge of exercise, influence of significant others, CR experience, and health management. In addition, participants were asked to define and discuss the purpose of phase-III and phase-IV CR to investigate if level of understanding influenced participation. Whilst a semi-structured interview guide was used, there was flexibility for the participants to speak freely around the matters raised. Probes were solely utilised to elicit additional information when required [53]. To avoid leading or influencing a participant during a semi-structured interview, the researcher (GT) sustained a neutral demeanor by withholding personal beliefs or attitudes that may affect the participant's responses, suspending judgement, and controlling non-verbal behaviour [54]. As the semi-structured interviews progressed, the interview guide was iteratively developed by reframing the questions / probes as necessary in accordance with the matters discussed by the participants, which ensured an opportunity to explore the phenomenon in greater depth. All semi-structured interviews were audio recorded, then transcribed verbatim by the researcher (GT), and verified by the participants. Pseudonyms were assigned to participants to safeguard anonymity. Two periods (..) in a quote from a participant represent a pause in speech.

### ***Data analysis***

Given the paucity of literature, this qualitative study employed an exploratory approach to generate a rich understanding of the investigated phenomena by examining the views

and opinions of the participants. Reflexive thematic analysis was utilised to methodically identify, organise, and report patterns (themes) within the dataset. This method was selected due to its theoretical flexibility in conjunction with well established guidelines for conducting the analysis [55]. In line with the exploratory nature of the study, an inductive orientation to identifying themes was implemented, which enabled the analysis to be freely guided by the data without trying to import ideas, concepts, or theories [56].

Whilst an inductive approach was utilised, the data analysis was inevitably shaped by the subjectivities and theoretical lenses of the researchers involved (GT, CH, and IW). Thus, researchers should make their respective positions explicit when presenting qualitative research to contextualise the data collection and analysis processes [57]. For transparency, the research team were not involved with delivering CR or care to patients and had no prior experience in this area of CR research. However, GT was familiar with the participants and the CR programmes that they attended, was acquainted with the nurses who delivered the CR programmes, and possessed an academic understanding of the role of exercise in the secondary prevention of CAD. Therefore, GT's position was that he approved of CAD patient participation in CR and exercise training. Moreover, GT was familiar with barriers and facilitators to CR and long-term exercise in CAD patients by virtue of reviewing the available literature in this field.

Data analysis of the interview transcripts was facilitated by NVivo software (QSR International Pty Ltd. Version 12). An iterative approach was employed, whereby data analysis was performed after each interview. The data-driven inductive thematic

analysis was performed by two members of the research team (GT and Professor Ciara Hughes (CH)) and followed the recommendations of Braun and Clarke [56]. Initially, both researchers (GT and CH) became familiar with the data by independently reading the transcripts multiple times. Subsequently, the researchers (GT and CH) independently assigned codes to blocks of text that represented a coherent thought or idea (data extract). Coding was performed at both semantic and latent levels to facilitate an in-depth analysis of the data. All identified codes were agreed by consensus during a research team meeting. Themes that represented meaningful patterns were then generated by combining codes and further checking them against the data set and other themes, initially by individual researchers (GT and CH), and then agreed by consensus with another member of the research team who had also read the transcripts (Dr Iseult Wilson (IW)). Several of the initial codes became sub-themes of overarching themes. Both researchers (GT and CH) collectively reviewed and checked the full set of potential themes against the data set to determine if important ideas were missing. Moreover, the themes were defined and named to ensure that the meaningful data was clearly and comprehensively captured, with all decisions being agreed by consensus between the research team (GT, CH, and IW).

Qualitative findings are generated at the intersection between the data and a researcher's subjective interpretation [58]. Thus, in order to ensure rigour, the research team attempted to confirm the credibility of their interpretation of the participants' responses by seeking validation of the data by the interviewees [58]. The participants were sent descriptive summaries of the qualitative analysis and asked to contact the research team if they disagreed with any of the findings. In addition, the research team invited the participants to a virtual group meeting following the initial analysis to

discuss the themes/ sub-themes and seek agreement of content. The purpose of these respondent validation exercises was to check if the qualitative findings accurately and credibly reflected the thoughts, feelings, and experiences of the participants.

### *Reflexivity*

Reflexivity relates to the assessment of the influence of the researcher's preconceptions, assumptions, and experiences on the phenomena being investigated [59]. Various measures were implemented to ensure rigour by mitigating the influence of preconceptions on data collection and analysis. Firstly, the interview guide comprised broad, open-ended questions to allow the participants to speak freely around the topics raised. It was then iteratively developed, which allowed the questions to be reframed in accordance with the matters discussed by the participants. GT made every effort not to lead participants during interviews, and the transcripts were also checked with this in mind. Finally, throughout data collection and analysis, GT and CH actively searched for negative cases or statements that were different to their preconceptions (i.e. benefits of CR), and met to discuss the content of the interviews, consider the topics raised by the participants, and agree on the main findings by consensus with another member of the research team (IW).

### **Results**

In total, 10 patients and 10 significant others were interviewed. The characteristics of the participants are presented in table 3. Interview duration ranged from 28-81 minutes (median, 49.5 minutes).

[Table 3 near here]

### ***Qualitative findings***

The overarching theme from the data was a perceived need to improve health, with the participants viewing health benefits as the principal motive for participating in CR and long-term exercise training: “Improving my health was the most important reason for deciding to take part in the cardiac rehabilitation programmes and exercise” (Samuel, STEMI patient, 72 years old). Three further themes were identified: motivation, extrinsic influences, and CR experience (see table 4). These themes captured the underlying elements of the participants’ decision to take part in CR and long-term exercise training for the purpose of health improvements. All themes were similar across patients and significant others.

[Table 4 near here]

### ***Motivation***

The experience of an AMI encouraged participants to improve their health by partaking in CR and long-term exercise. Several sub-themes that represent motivating factors were identified.

### ***Emotional response to AMI***

The traumatic experience of an AMI was often a driving force behind the patients' decisions to participate in the CR programmes and long-term exercise training, which served as an attempt to prevent a recurrent AMI and the consequential psychological distress: "I wanted to do whatever I could to avoid the distress of another heart attack, so I decided to take part in the cardiac rehabilitation programmes and exercise as much as possible to improve my health" (Frank, STEMI patient, 65 years old). In addition to encouraging significant others to support the patients with their recovery, the AMI drew the attention of the significant others towards their own health. The cardiovascular complication that was suffered by the patients served as a "wake-up" call for many of the significant others by emphasising the relationship between exercise and health: "When something like a heart attack happens, you realise the importance of exercising regularly in order to maintain your health" (Kathryn, significant other (wife), 51 years old).

#### *Contact with specialist staff*

The acquisition of care from specialist CR nurses encouraged patients to participate in phase-III CR. This contact served as a method for patients to receive confirmation that they were recovering adequately from their AMI: "I thought about the opportunity to have my health monitored by the nurses to make sure that I was recovering properly. I thought that this service would provide me with reassurance that I was okay" (Brian, NSTEMI patient, 37 years old). Across the specialist services provided, receiving supervision from a knowledgeable professional during a structured exercise programme was a key attraction to phase-III and phase-IV CR: "The structured design of the exercise sessions was also a reason as I knew that the form of exercise would be

beneficial for my health, and it would also allow me to become familiar with what form of exercise has to be done in order for my health to improve” (Robert, STEMI patient, 52 years old). The significant others shared this opinion: “I think that the supervised element of the programme was very important as it made sure that patients were exercising safely and taught them about what type of exercise was suitable for improving their [patients] health” (Noah, significant other (brother), 60 years old).

### *Education*

Patients highlighted a requirement to receive information regarding their condition post-AMI. The educational component of the phase-III CR programme was viewed as a method of achieving this guidance: “I also decided to go to the phase-III cardiac rehabilitation programme because of the educational sessions. I knew that I would receive the information needed to improve my lifestyle during these talks” (Brian, NSTEMI patient, 37 years old). Additionally, significant others acknowledged that patients decided to participate in phase-IV CR in order to receive additional support with exercise: “Derrick was uncertain about exercising on his own after the phase-III [CR] programme. Derrick saw the phase-IV [CR] programme as a method of getting more support with knowing how to exercise after phase-III [CR]” (June, significant other (wife), 70 years old).

### *Social opportunities*

Patients frequently mentioned that social elements influenced their decision to participate in phase-III and phase-IV CR. There was a sense that the CR programmes



would foster a social environment that promotes camaraderie, which in turn, would motivate patients to exercise through enhanced enjoyment, a sense of accountability, and emotional relief by confiding in their peers: “I undoubtedly prefer a group-based environment for exercise. The social aspect of this allows me to enjoy the exercise, and the peer-pressure or accountability factor definitely helps.. social benefits and enjoyment are my primary reasons for taking part in long-term exercise.. the health benefits are a plus” (William, NSTEMI patient, 77 years old).

### *Extrinsic influences*

Factors that influenced the decision to engage in CR and long-term exercise extended beyond the participants’ intrinsic perception to a broader, extrinsic context. Three sub-themes related to extrinsic influences were recognised.

#### *Weather conditions*

For the majority of participants, the weather conditions determined the suitability of exercising outdoors: “I enjoy walking outside, that form of exercise makes me feel better as I like to experience the fresh air and sights, so if the weather is poor, then that might stop me from going out for a walk” (Carol, NSTEMI patient, 63 years old) and “I also believe that Anna will do more walking whenever the weather improves” (Eleanor, significant other (mother), 87 years old).

#### *Trusting the referral from a healthcare professional*

With a desire for their health to improve post-AMI, both the patients and their significant others valued and trusted the guidance from healthcare professionals. Indeed, receiving a positive recommendation to participate from a healthcare professional during the referral process was often considered an indisputable reason to enroll in phase-III CR: “When I was in hospital the cardiac nurse discussed and invited me to the phase-III [CR] programme. My consultant also encouraged me to attend the [phase-III CR] programme. I valued this advice that was given by medical professionals as they would only do so for justified reasons, with your health and recovery being prioritised. Why would you not listen? It is like being given the winning lottery numbers and deciding not to take them” (Thomas, NSTEMI patient, 52 years old). This attitude extended to the acquisition of a referral to phase-IV CR, with patients feeling compelled to participate by virtue of the CR nurses’ suggestion: “A nurse even told me about the phase-IV [CR] programme before I started phase-III [CR], so I had my decision to attend phase-IV [CR] made at the beginning of the phase-III [CR] programme.. I thought, I will definitely be going to that” (Anna, NSTEMI patient, 57 years old).

All patients mentioned that they had received a description of the elements of the CR programmes during the referral process. Although, a few patients suggested that receiving more information regarding the positive effect of CR on health may enhance uptake, with insights into the experiences of CR graduates supplementing this knowledge: “I think patients would be more likely to take part [in CR programmes] if they understood how the cardiac rehabilitation programmes would improve their health. I believe that having someone explain their experience of the programmes and how the programmes affected their health would encourage patients to take part as they would be inspired to make the same recovery” (Derrick, NSTEMI patient, 70 years old).

### *Significant others' understanding of the "supporter" role post-AMI*

Significant others cared deeply about the wellbeing of the patients, with a commitment to safeguarding the health of patients through a fear of losing them. Importantly, patients consistently discussed the importance of social support from significant others, with numerous patients claiming that it constituted a primary reason for their recovery: "Ian was determined to help me recover after my heart attack. He called at my house to speak to me about any concerns that I had and offered to help with anything that had to be done around the house. I really appreciated this support. I don't think I would have recovered without it" (Carol, NSTEMI patient, 63 years old). However, patients commonly stated that they independently decided to participate in phase-III and phase-IV CR as their significant others possessed a poor understanding of the purpose and structure of the programmes: "I decided to take part in the cardiac rehabilitation programmes by myself as Violet didn't receive any information about them, so she wouldn't have been able to help with my decision because she didn't know anything about the programmes" (Frank, STEMI patient, 65 years old). Nevertheless, it was generally believed that the provision of information regarding the CR programmes to significant others would empower them with the knowledge to support patients with their decision to participate: "I think significant others could help patients to take part in cardiac rehabilitation programmes if they [significant others] had a better understanding of what is being offered. This would allow them [significant others] to advise or encourage patients to take part" (Thomas, NSTEMI patient, 52 years old). Significant others also reported a lack of knowledge regarding the role of exercise post-AMI, which resulted in them offering a "wrapping in cotton wool" form of protection by attempting to discourage the patients from being active due to concerns about exercise-induced

cardiovascular complications. In turn, patients relayed the lifestyle education they received at the phase-III CR programme to significant others. The realisation that exercise induced health benefits post-AMI frequently encouraged significant others to support the patients with remaining active: “At the beginning, I thought that exercise was bad for Brian’s heart. I was afraid that he would exert himself too much, so I told him to slow down and to stop being active. Brian then told me that exercise was beneficial for his health after a heart attack, which was the information that he received at the phase-III cardiac rehabilitation programme. I then changed my attitude about Brian being active and tried to support him with taking part in exercise by offering to do it with him” (Michael, significant other (brother), 37 years old).

### ***CR experience***

The decision to partake in long-term exercise was an evolving process, influenced by ongoing experience and observation during CR participation. Two sub-themes related to CR experience were identified: comprehension of the health benefits of exercise post-AMI, and self-belief.

#### *Comprehension of the health benefits of exercise post-AMI*

Following the completion of phase-III and phase-IV CR, patients had developed an appreciation for the capacity of exercise to enhance their health, with many patients now accepting exercise as an essential component of their lifestyle. The lifestyle education received at phase-III CR enabled both patients and their significant others to develop an understanding of the cardioprotective effect of exercise post-AMI. This knowledge served as motivation for long-term exercise adherence in order to

circumvent recurrent cardiovascular complications: “It [phase-III CR] changed my attitude about exercise. I didn’t think about the health benefits of exercise before my heart attack. The educational talks taught me about how important exercise is for maintaining good health and stopping another heart attack. I am now determined to exercise regularly to improve my health and stop another heart attack.. I believe that it [exercise] is something that I have to do for my health. I think about exercise in the same way as my medication, it [exercise] has to be done each day to stay healthy” (Paul, STEMI patient, 64 years old). In addition to the comprehension of the role of exercise post-AMI, the physical perception of health improvements promoted adherence to exercise: “I think that Robert’s experience of his health improving because of exercising after a heart attack has provided him with motivation to participate in long-term exercise training” (Lisa, significant other (unmarried partner), 50 years old).

### *Self-belief*

The CR period exerted an upward spiralling effect on the self-belief of patients in their ability to exercise. By trusting the referral from the healthcare professional, patients engaged in the CR programmes for the purpose of improving their health. These programmes enabled patients to assimilate knowledge about how to exercise effectively post-AMI, with physical perceptions of improvements in health serving as tangible verification of the benefits of doing so. These experiences positively reinforced the belief of patients in their capacity to exercise, with confidence in this ability being gradually developed over the course of the phase-III and phase-IV CR programmes. With this newly found confidence, patients believed that were capable of adhering to long-term exercise training, and pushed back when significant others suggested for

them to rest or “slow down”. Saliently, this behaviour was indicative of “higher-order” learning [60], with the patients applying their knowledge of the role of exercise post-AMI through committing to long-term participation and sharing this understanding with their significant others: “Thomas could see the improvements in his health and wellbeing, the guidance and exercise during the cardiac rehabilitation programmes lifted him from a state of feeling vulnerable to a state of positivity and confidence. Thomas now believes that he is capable of exercising in a way that will improve his health over the long-term” (Kathryn, significant other (wife), 51 years old). Moreover, patients and significant others also claimed that performing an exercise modality that was enjoyable would enhance self-belief, which would serve as an incentive for long-term adherence: “I think that the most important factor is your attitude, you must have an interest and enjoy exercise to commit to it over the long-term. Finding forms of exercise that you enjoy and feel comfortable doing can help with this” (Robert, STEMI patient, 52 years old).

## **Discussion**

The overarching theme was a need to improve health. Following the patients’ AMI, both members of each dyad recognised the importance of improving their health for the purpose of circumventing future cardiovascular complications, with health benefits serving as the primary reason for participating in CR and long-term exercise. Aspects related to motivation, extrinsic influences, and CR experience underpinned these decisions. Interestingly, we identified a link between the factors identified in this study and each element of the Theoretical Domains Framework (TDF). The TDF is a comprehensive, integrative framework of behavior change theories [61], which has been

shown to effectively determine theoretical constructs for exercise maintenance [62]. Saliiently, as both patients and their significant others reported factors related to the TDF, the findings of this study underscore the relevance of these theoretical domains for CR participation and long-term exercise adherence.

The emotional response to an AMI by patients and their significant others appeared to serve as a principal motivating factor for engaging in CR and exercise adherence to obtain an improvement in health. This finding relates to the *emotion* domain of the TDF, whereby an individual attempts to manage a personally significant event through a complex reaction pattern comprising experiential, behavioural, and physiological elements [61]. Importantly, the literature suggests that cardiac events are a psychologically distressing experience, which may be perceived as an existential threat that results in the transformation of the patients' priorities and perspectives in life [63]. Indeed, Holder et al. [64] showed that an increased awareness of mortality following a cardiac event encouraged CAD patients to implement healthy lifestyle changes. However, to the best of our knowledge, this is the first qualitative study to clearly report that this impact extends to the significant others, with the emotional distress also triggering a determination to support the CAD patients with their recovery. These findings emphasise the important role of significant others during the post-AMI period. Although, there is also literature to suggest that the emotional response by CAD patients to a cardiac event may serve as a barrier to participation in CR, with some individuals choosing to live in the present, thereby disregarding their health in the future and the personal relevance of CR or exercise by extension [65]. Thus, this inconsistent influence of emotional distress on CR participation and exercise following a cardiovascular complication warrants additional investigation, with the perspectives of

significant others also being further explored. Nonetheless, healthcare professionals may promote participation in CR by advising CAD patients to derive motivation to improve their health from the emotional response to a cardiac complication.

Motivation to improve health was not limited to inherent emotional responses to an AMI. The patients considered the potential benefits of CR for their health when deciding to enroll, which comprised receiving care from specialist staff, education regarding their condition, support with exercise in a safe environment, and social opportunities that would foster inspiration and peer-support. These anticipated benefits served as external sources of motivation to participate in CR, and represented multiple domains of the TDF, such as: *memory, attention, and decision processes; social / professional role and identity; intentions; and social influences* [61]. In addition, it is worth acknowledging that “anticipated benefits” are consistent with established theories of health behaviour change, which assert that favourable attitudes about a certain behaviour (Theory of Planned Behaviour) [66] or expectations for positive outcomes (Health Action Process Approach) [67] promote the execution of a target behaviour. Importantly, there is evidence to suggest that the quality of the referral process and the patients’ interpretation of the strength of the recommendation may be variable [38]. In this study, the patients suggested that receiving more information about the health benefits of CR during the referral process may improve uptake, with insights into the experiences of CR graduates supplementing the strength of the recommendation. As such, to promote participation in CR, healthcare professionals should raise awareness of health literacy during the referral process by discussing the health benefits of CR and harnessing social influences by including CR graduates (i.e. testimonies or peer-to-peer discussions). To assist with this practice, research departments at hospital sites or local



universities should offer educational sessions on the current scientific evidence regarding the cardioprotective effects of CR and long-term exercise to CR facilitators, which may empower these healthcare professionals with the knowledge required to optimally discuss the associated health benefits with patients during the CR referral process.

The importance of social support post-AMI was frequently discussed by the respondents, with patients attributing elements of practical (i.e. physical assistance with daily tasks), informational (i.e. reminders about medication), and emotional (i.e. confiding in each other about concerns or worries) support from significant others as primary reasons for their recovery. Whilst previous research has identified social support from spouses and family members as a factor that influences participation in CR and exercise maintenance [36,37], the findings of this study indicate that significant others receive insufficient information regarding the purpose of CR and long-term exercise. This deficiency in information rendered some significant others incapable of assisting the patients with their decision to participate in phase-III and phase-IV CR. Moreover, a deep concern about the wellbeing of patients coupled with a poor comprehension of the health benefits of exercise post-AMI often resulted in the significant others attempting to discourage the patients from being active due to concerns about exercise-induced cardiovascular complications. Saliiently, this perspective was revised after the patients supplied information regarding the lifestyle education received at phase-III CR, with significant others developing a supportive attitude towards long-term exercise post-AMI (i.e. offering to exercise with the patient). Indeed, previous research has demonstrated a poor supply of information to significant others/ caregivers of CAD patients [68], stroke survivors [69], and cancer patients [70].

Importantly, in the UK, the standards and core components for CR published by the British Association for Cardiovascular Prevention and Rehabilitation recommend for significant others to be invited to participate in CR activities (i.e. educational sessions) whenever possible, and for patients and their significant others to play an active role in the educative process [12]. As such, the information deficiency for significant others may be attributed to a practice that is based on the individualised view of the patient, irrespective of the context and influence of significant others [71]. Moreover, the delivery of CR services is a complex process [72]. Therefore, time constraints and/ or existing workloads for CR staff may also impede the provision of information to significant others, with evidence to suggest that communication between healthcare professionals, cardiac patients, and significant others is problematic (i.e. lack of empathy, lack of respect, use of medical terminology, giving ambiguous messages, and misunderstanding) during patient education [73]. Nonetheless, there is a paucity of research regarding the challenges or barriers that are faced by healthcare professionals when supplying significant others with information related to CR and long-term exercise. Future research in this area may identify methods of assisting healthcare professionals with the provision of information regarding the health benefits and purpose of CR and long-term exercise to significant others. Altogether, investigations of CR participation and long-term exercise adherence should select a theory that captures dimensions of *social influence* (i.e. TDF [61]). Practically, healthcare professionals should attempt to include significant others in the referral process for CR. This approach may prevent the influential role of significant others post-AMI from being overlooked or neglected by ensuring they are empowered with the knowledge (i.e. health benefits of exercise) required to promote patient participation in CR and long-term exercise.

In line with previous research [39,74,75], establishing a link between exercise and health benefits post-AMI encourages long-term exercise participation, which relates to the *beliefs about consequences* and *reinforcement* domains of the TDF [61]. However, the current study adds depth to the literature by delineating how the experiences of phase-III and phase-IV CR participation influence the development of this association. The respondents reported that participation in these CR programmes conferred knowledge and a physical perception of the health benefits of exercise post-AMI. Collectively, these experiences enabled patients to become confident in their ability to exercise effectively, which motivated them to embrace long-term exercise for the purpose of health benefits. These findings represent multiple domains of the TDF, such as: *belief about capabilities, skills, knowledge, optimism, goals, and behavioural regulation* [61]. Thus, CR facilitators should ensure that patients develop these key behavioural skills (i.e. providing assistance with establishing exercise goals or an association between exercise and health benefits for ill-health avoidance), which may promote long-term exercise participation. However, there is a paucity of research regarding the level of understanding (i.e. comprehension of suitable exercise modalities, session frequency, session duration, and exercise intensity) required for long-term exercise participation in CAD patients. The elucidation of this topic may identify methods of enhancing CR delivery to ensure patients are equipped with the necessary knowledge for long-term exercise adherence.

The affective experiences that individuals associate with exercise are key determinants of participation [76] and adherence [77]. Indeed, the respondents reported that positive emotions (i.e. improved mood) encouraged them to exercise, with appealing exercise modalities fostering adherence through enhanced enjoyment. This

observation regarding the influence of emotions on long-term exercise participation is consistent with previous literature [37,39]. As such, CR facilitators should encourage patients to acknowledge their positive experiences during exercise and assist with the identification of an enjoyable exercise modality. By doing so, patients may associate positive affective experiences with exercise, which may be conducive to long-term adherence.

Rigour of the study was enhanced by three members of the research team (GT, CH, and IW) agreeing on all decisions pertaining to data analysis by consensus, which contributed to the generation of meaningful patterns with greater explanatory power through the consideration of multiple individual perspectives. Sufficient data were obtained for answering the research question as the identified themes were common across and within both patient and significant other data sets. Good practice was adhered to through the research team iteratively developing the interview guide as the semi-structured interviews progressed, and offering the participants an opportunity to comment on the findings through the provision of descriptive summaries and an invitation to a virtual group meeting. In terms of conducting the semi-structured interviews, the patients and significant others were interviewed separately to prevent coercion or the presence of an individual influencing the response of the other person. Additionally, the significant others were not limited to intimate partners, which allowed other relationships to be acknowledged (i.e. mother-daughter or brother-brother dyads). However, several limitations should be considered when interpreting the results. Firstly, the majority of participants did not confirm receipt of the descriptive summaries and invitation to the virtual group meeting, with no individuals agreeing to partake in the latter. Technological requirements and/ or conditions related to the COVID-19

pandemic may have deterred participation in the beforementioned member checking activities. Nevertheless, participant verification of the findings following the analysis was not achieved. Secondly, the participants were a convenience-based sample from two Health and Social Care Trusts in Northern Ireland, which may limit generalisability to other locations. However, the convenience sampling method was pragmatically chosen due to the time constraints that were imposed by the PhD research project, and in consideration of the possibility of generating rich qualitative data by virtue of the level of familiarity between the researcher and the sample population [78]. Additionally, the sample comprised only English speakers and all participants were white. The inclusion of a more diverse sample in terms of language and race may have resulted in the identification of additional themes. Only two female patients agreed to participate, and all patients had participated in phase-III and phase-IV CR. Therefore, future research should consider exploring the perspectives of female patients and their significant others, and attempt to capture the opinions of patients who refused to participate in CR and/ or long-term exercise and their significant others, which may add valuable perspectives on the current topic. Finally, the requirement to perform a number of interviews via telephone calls due to the COVID-19 pandemic may have partially diminished the richness of data collected [79].

## **Conclusion**

The qualitative findings of this study reveal how an AMI collectively impacts the attitudes and beliefs of patients and their significant others in relation to CR participation, long-term exercise, and health. Health benefits served as the primary reason for participating in CR and long-term exercise, with aspects related to

motivation, extrinsic influences, and CR experience underpinning these decisions. Importantly, the factors reported by patients and significant others were consistent with the TDF, which suggests that multiple theoretical constructs are associated with participation in CR and long-term exercise. Altogether, the study of CAD patient enrollment in CR and adherence to long-term exercise remains crucial due to the poor participation rates. Future research should seek to define and test strategies of enhancing patient participation in CR and long-term exercise that incorporate comprehensive theoretical frameworks (i.e. TDF) to capture the full scope of influencing factors, with particular attention being paid to the *social influence* of significant others.

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## References

- [1] Naghavi M, Abajobir AA, Abbafati C, et al. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*. 2017;390(10100):1151-1210.
- [2] Hansson GK. Inflammation, atherosclerosis, and coronary artery disease. *N Engl J Med*. 2005;352(16):1685-1695.
- [3] Ambrose JA, Singh M. Pathophysiology of coronary artery disease leading to acute coronary syndromes. *F1000Prime Rep*. 2015;7:08-08.
- [4] Koch MB, Davidsen M, Andersen LV, et al. Increasing prevalence despite decreasing incidence of ischaemic heart disease and myocardial infarction. A national register based perspective in Denmark, 1980–2009. *Eur J Prev Cardiol*. 2015;22(2):189-195.
- [5] Smolina K, Wright FL, Rayner M, et al. Long-term survival and recurrence after acute myocardial infarction in England, 2004 to 2010. *Circ Cardiovasc Qual Outcomes*. 2012;5(4):532-540.
- [6] Briffa T, Hickling S, Knuiman M, et al. Long term survival after evidence based treatment of acute myocardial infarction and revascularisation: follow-up of population based Perth MONICA cohort, 1984-2005. *BMJ*. 2009;338:b36.
- [7] Bata IR, Gregor RD, Wolf HK, et al. Trends in five-year survival of patients discharged after acute myocardial infarction. *Can J Cardiol*. 2006;22(5):399-404.

[8] Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016;37(29):2315-2381.

[9] Knuuti J, Wijns W, Saraste A, et al. 2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes: The Task Force for the diagnosis and management of chronic coronary syndromes of the European Society of Cardiology (ESC). Eur Heart J. 2020;41(3):407-477.

[10] Dalal HM, Doherty P, Taylor RS. Cardiac rehabilitation. BMJ. 2015;351:h5000.

[11] National Institute for Health and Care Excellence. Myocardial Infarction: Cardiac Rehabilitation and Prevention of Further Cardiovascular Disease. London: National Institute for Health and Care Excellence: 2013. Available from: <https://www.nice.org.uk/guidance/cg172/resources/myocardial-infarction-cardiac-rehabilitation-and-prevention-of-further-cardiovascular-disease-pdf-35109748874437>

[12] British Association for Cardiovascular Prevention and Rehabilitation. The BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation 2017 (3rd Edition). England: British Association for Cardiovascular Prevention and Rehabilitation: 2017. Available from: [https://www.bacpr.com/resources/BACPR\\_Standards\\_and\\_Core\\_Components\\_2017.pdf](https://www.bacpr.com/resources/BACPR_Standards_and_Core_Components_2017.pdf)

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- [13] Piepoli MF, Corrà U, Adamopoulos S, et al. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery: a policy statement from the cardiac rehabilitation section of the European Association for Cardiovascular Prevention & Rehabilitation. Endorsed by the Committee for Practice Guidelines of the European Society of Cardiology. *Eur J Prev Cardiol.* 2014;21(6):664-681.
- [14] Supervia M, Turk-Adawi K, Lopez-Jimenez F, et al. Nature of cardiac rehabilitation around the globe. *EClinicalMed.* 2019;13:46-56.
- [15] Bethell H, Lewin R, Dalal H. Cardiac rehabilitation in the United Kingdom. *Heart.* 2009;95(4):271-275.
- [16] Anderson L, Oldridge N, Thompson DR, et al. Exercise-based cardiac rehabilitation for coronary heart disease: Cochrane systematic review and meta-analysis. *J Am Coll Cardiol.* 2016;67(1):1-12.
- [17] Abell B, Glasziou P, Hoffmann T. The contribution of individual exercise training components to clinical outcomes in randomised controlled trials of cardiac rehabilitation: a systematic review and meta-regression. *Sportsmed-open.* 2017;3(1):19.
- [18] Anderson L, Sharp GA, Norton RJ, et al. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev.* 2017;(6): CD007130.
- [19] Rauch B, Davos CH, Doherty P, et al. The prognostic effect of cardiac rehabilitation in the era of acute revascularisation and statin therapy: A systematic review and meta-analysis of randomized and non-randomized studies—The Cardiac Rehabilitation Outcome Study (CROS). *Eur J Prev Cardiol.* 2016;23(18):1914-1939.

- [20] Kabboul NN, Tomlinson G, Francis TA, et al. Comparative effectiveness of the core components of cardiac rehabilitation on mortality and morbidity: A systematic review and network meta-analysis. *J Clin Med*. 2018;7(12):514.
- [21] Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur Heart J*. 2016;37(29):2315-2381.
- [22] Kotseva K, Wood D, Backer GD, et al. Use and effects of cardiac rehabilitation in patients with coronary heart disease: results from the EUROASPIRE III survey. *Eur J Prev Cardiol*. 2013;20(5):817-826.
- [23] Beatty AL, Truong M, Schopfer DW, et al. Geographic variation in cardiac rehabilitation participation in Medicare and Veterans Affairs populations: opportunity for improvement. *Circulation*. 2018;137(18):1899-1908.
- [24] Turk-Adawi KI, Grace SL. Narrative review comparing the benefits of and participation in cardiac rehabilitation in high-, middle-and low-income countries. *Heart, Lung and Circulation*. 2015;24(5):510-520.
- [25] Kotseva K, De Backer G, De Bacquer D, et al. Lifestyle and impact on cardiovascular risk factor control in coronary patients across 27 countries: Results from the European Society of Cardiology ESC-EORP EUROASPIRE V registry. *Eur J Prev Cardiol*. 2019;26(8):824-835.

- [26] Blanchard CM, Giacomantonio N, Lyons R, et al. Examining the steps-per-day trajectories of cardiac rehabilitation patients: a latent class growth analysis perspective. *J Cardiopulm Rehabil Prev.* 2014;34(2):106-113.
- [27] Sweet SN, Tulloch H, Fortier MS, et al. Patterns of motivation and ongoing exercise activity in cardiac rehabilitation settings: A 24-month exploration from the TEACH study. *Annals Behav Med.* 2011;42(1):55-63.
- [28] Theodorou AA, Panayiotou G, Volaklis KA, et al. Aerobic, resistance and combined training and detraining on body composition, muscle strength, lipid profile and inflammation in coronary artery disease patients. *Res Sportsmed.* 2016;24(3):171-184.
- [29] Vona M, Codeluppi GM, Iannino T, et al. Effects of different types of exercise training followed by detraining on endothelium-dependent dilation in patients with recent myocardial infarction. *Circulation.* 2009;119(12):1601-1608.
- [30] Resurrección DM, Moreno-Peral P, Gómez-Herranz M, et al. Factors associated with non-participation in and dropout from cardiac rehabilitation programmes: a systematic review of prospective cohort studies. *European Journal of Cardiovascular Nursing.* 2019;18(1):38-47.
- [31] Lahtinen M, Toukola T, Junttila MJ, et al. Effect of changes in physical activity on risk for cardiac death in patients with coronary artery disease. *Am J Cardiol.* 2018;121(2):143-148.
- [32] Stewart RA, Held C, Hadziosmanovic N, et al. Physical activity and mortality in patients with stable coronary heart disease. *J Am Coll Cardiol.* 2017;70(14):1689-1700.

[33] Biscaglia S, Campo G, Sorbets E, et al. Relationship between physical activity and long-term outcomes in patients with stable coronary artery disease. *Eur J Prev Cardiol.* 2020;27(4):426-436.

[34] De Gruyter E, Ford G, Stavreski B. Economic and social impact of increasing uptake of cardiac rehabilitation services—a cost benefit analysis. *Heart, Lung and Circulation.* 2016;25(2):175-183.

[35] Hennink M, Hutter I, Bailey A. *Qualitative research methods.* London (UK): SAGE Publications Limited; 2020.

[36] Clark AM, King-Shier KM, Thompson DR, et al. A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral. *Am Heart J.* 2012;164(6):835-845.

[37] Campkin LM, Boyd JM, Campbell DJ. Coronary artery disease patient perspectives on exercise participation. *J Cardiopulm Rehabil Prev.* 2017;37(5):305-314.

[38] Rouleau CR, King-Shier KM, Tomfohr-Madsen LM, et al. A qualitative study exploring factors that influence enrollment in outpatient cardiac rehabilitation. *Disabil Rehabil.* 2018;40(4):469-478.

[39] Sweet SN, Perrier M, Saunders C, et al. What keeps them exercising? A qualitative exploration of exercise maintenance post-cardiac rehabilitation. *Int J Sport and Exercise Psychol.* 2019;17(4):381-396.

[40] Hanna A, Yael E, Hadassa L, et al. "It's up to me with a little support"—Adherence after myocardial infarction: A qualitative study. *Int J Nurs Stud.* 2020;101:103416.

- [41] Son H, Thomas SA, Friedmann E. Longitudinal changes in coping for spouses of post–myocardial infarction patients. *West J Nurs Res.* 2013;35(8):1011-1025.
- [42] Macken LC, Yates B, Blancher S. Concordance of risk factors in female spouses of male patients with coronary heart disease. *J Cardiopulm Rehabil Prev.* 2000;20(6):361-368.
- [43] Yates BC, Rowland S, Mancuso K, et al. Reducing cardiovascular risk in spouses of cardiac patients: a randomized controlled trial. *West J Nurs Res.* 2015;37(1):85-102.
- [44] Pryor T, Page K, Patsamanis H, et al. Investigating support needs for people living with heart disease. *J Clin Nurs.* 2014;23(1-2):166-172.
- [45] Mondesir FL, Carson AP, Durant RW, et al. Association of functional and structural social support with medication adherence among individuals treated for coronary heart disease risk factors: Findings from the REasons for Geographic and Racial Differences in Stroke (REGARDS) study. *PloS one.* 2018;13(6):e0198578.
- [46] Bhaskar R. *A realist theory of science.* Brighton: Harvester Press; 1978.
- [47] O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med.* 2014;89(9):1245-1251.
- [48] British Heart Foundation. *NACR Certification 2019.* London: British Heart Foundation: 2019. Available from:  
<http://www.cardiacrehabilitation.org.uk/docs/Certification%20Supplement.pdf>.
- [49] Corbin J, Strauss A. *Basics of qualitative research: Techniques and procedures for developing grounded theory.* London (UK): Sage Publications Limited; 2014.

- [50] Braun V, Clarke V. Successful qualitative research: A practical guide for beginners. London (UK): SAGE Publications Limited; 2013.
- [51] Taylor SJ, Bogdan R, DeVault M. Introduction to qualitative research methods: A guidebook and resource. New York (NY): Wiley; 2015.
- [52] Taylor B, De Vocht H. Interviewing separately or as couples? Considerations of authenticity of method. *Qual Health Res.* 2011;21(11):1576-1587.
- [53] Fylan F. Semi-structured interviewing. *Handb Res Methods Clin Health Psychol.* 2005;5(2):65-78.
- [54] Darawsheh W, Stanley M. Reflexivity in research: Promoting rigour, reliability and validity in qualitative research. *Int J Therapy Rehabil.* 2014;21(12):560-568.
- [55] Braun V, Clarke V, Hayfield N, et al. Thematic analysis. *Handb Res Methods Health Soc Sci.* 2019:843-860.
- [56] Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77-101.
- [57] McNair R, Taft A, Hegarty K. Using reflexivity to enhance in-depth interviewing skills for the clinician researcher. *BMC Med Res Methodol.* 2008;8(1):73.
- [58] Parahoo K. *Nursing research: principles, process and issues.* 3<sup>rd</sup> ed. Basingstoke (UK): Palgrave Macmillan; 2014
- [59] Jootun D, McGhee G, Marland GR. Reflexivity: promoting rigour in qualitative research. *Nurs Stand.* 2009;23(23):42.

- [60] Anderson LW, Krathwohl DR, Airasian PW, et al. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives (abridged ed.). New York (NY): Addison Wesley Longman; 2001.
- [61] Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*. 2012;7(1):1-17.
- [62] Amireault S, Godin G, Vézina-Im L. Determinants of physical activity maintenance: a systematic review and meta-analyses. *Health Psychology Review*. 2013;7(1):55-91.
- [63] Simoný CP, Pedersen BD, Dreyer P, et al. Dealing with existential anxiety in exercise-based cardiac rehabilitation: a phenomenological-hermeneutic study of patients' lived experiences. *J Clin Nurs*. 2015;24(17-18):2581-2590.
- [64] Holder GN, Young WC, Nadarajah SR, et al. Psychosocial experiences in the context of life-threatening illness: the cardiac rehabilitation patient. *Palliat Support Care*. 2015;13(3):749-756.
- [65] Bäck M, Öberg B, Krevers B. Important aspects in relation to patients' attendance at exercise-based cardiac rehabilitation—facilitators, barriers and physiotherapist's role: a qualitative study. *BMC Cardiovasc Disord*. 2017;17(1):77.
- [66] Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179-211.

[67] Schwarzer R, Lippke S, Luszczynska A. Mechanisms of health behavior change in persons with chronic illness or disability: the Health Action Process Approach (HAPA). *Rehabil Psychol*. 2011;56(3):161.

[68] Jackson L, Leclerc J, Erskine Y, et al. Getting the most out of cardiac rehabilitation: a review of referral and adherence predictors. *Heart*. 2005;91(1):10-14.

[69] Pindus DM, Mullis R, Lim L, et al. Stroke survivors' and informal caregivers' experiences of primary care and community healthcare services—a systematic review and meta-ethnography. *PLoS One*. 2018;13(2):e0192533.

[70] McCarthy B. Family members of patients with cancer: what they know, how they know and what they want to know. *Eur J Oncol Nurs*. 2011;15(5):428-441.

[71] Gannik D. Situational disease: elements of a social theory of disease based on a study of back trouble. *Scand J Prim Health Care*. 2002;20(1):25-30.

[72] Fernandez RS, Davidson P, Griffiths R, et al. Improving cardiac rehabilitation services—Challenges for cardiac rehabilitation coordinators. *Eur J Cardiovasc Nurs*. 2011;10(1):37-43.

[73] Farahani MA, Sahragard R, Carroll JK, et al. Communication barriers to patient education in cardiac inpatient care: A qualitative study of multiple perspectives. *Int J Nurs Pract*. 2011;17(3):322-328.

[74] Martin AM, Woods CB. What sustains long-term adherence to structured physical activity after a cardiac event? *J Aging Phys Act*. 2012;20(2):135-147.



[75] Thow M, Rafferty D, Kelly H. Exercise motives of long-term phase IV cardiac rehabilitation participants. *Physiother.* 2008;94(4):281-285.

[76] Ekkekakis P, Petruzzello SJ. Acute aerobic exercise and affect. *Sportsmed.* 1999;28(5):337-347.

[77] Williams DM. Exercise, affect, and adherence: an integrated model and a case for self-paced exercise. *J Sport Exercise Psychol.* 2008;30(5):471-496.

[78] Koerber A, McMichael L. Qualitative sampling methods: A primer for technical communicators. *J Bus Technical Communication.* 2008;22(4):454-473.

[79] Johnson DR, Scheitle CP, Ecklund EH. Beyond the In-Person Interview? How Interview Quality Varies Across In-person, Telephone, and Skype Interviews. *Soc Sci Comput Rev.* 2019:0894439319893612

Table 1. Standard structure of CR in the UK [15].

Phase	Description
I	Prescription of secondary prevention medication and invitation to participate in phase-III CR.
II	Period of recovery at home prior to the initiation of phase-III CR; education regarding healthy living and encouragement to increase physical activity levels are also provided.
III	A comprehensive CR programme is delivered by a multidisciplinary team to supervised groups in outpatient hospital clinics or community centres. A course of supervised, graduated exercise training is the centrepiece, which often comprises 20 – 60 minutes of moderate-intensity circuit training. The supervised exercise component is also supplemented by optimal pharmacological therapy, psychological support, and lifestyle advice. The programmes typically involve weekly attendance at group sessions for approximately 8-weeks. Prior to being discharged from the programme, strategies for long-term compliance with exercise and healthy lifestyle adjustments would be discussed, and patients would be offered an opportunity to enter a phase-IV CR programme.
IV	Phase-IV constitutes the lifelong maintenance of positive lifestyle habits (i.e. long-term exercise training). To assist with this, phase-IV CR programmes are facilitated by qualified exercise instructors at fitness centres and gyms in the private sector. This programme is typically 12-weeks in duration, and serves as a continuation of supervised exercise training for patients in a community setting. Patients usually attend one supervised group-based exercise session per week, with the form of exercise being similar to phase-III CR. Upon completion, patients are informed of appropriate exercise-maintenance schemes that are available within their local communities.

CR: cardiac rehabilitation.

Table 2. Selection strategy.

<b>Patient</b>	<b>Significant other</b>
Declined or agreed to participate in a phase-III CR programme or phase-IV CR programme.	Nominated by the patient and willing to participate.
Sufficient English language skills to understand and participate in an interview discussion.	Impacted or involved throughout the rehabilitation period.
Over 18 years of age.	Sufficient English language skills to understand and participate in an interview discussion.
Identified significant other provides informed consent to participate in the study.	Over 18 years of age.
	Patient provides informed consent to participate in the study.

CR: cardiac rehabilitation.

Table 3. Participant characteristics.

<i>N (%) or Median (range)</i>				
	CAD patients ( <i>n</i> = 10)		Significant others ( <i>n</i> = 10)	
Age (years)	64 (37-77)		56 (29-87)	
Gender (% male)	80		40	
Race (% white)	100		100	
Form of AMI suffered	STEMI	4	N/A	
	NSTEMI	6		
Reperfusion therapy	PCI	10	N/A	
	CABG	0		
CR participation	DNA	0	N/A	
	Phase-III	10		
	Phase-IV	10		
Relation to patient	N/A		Mother	1
			Wife	4
			Unmarried partner	1
			Brother	2
			Son	2

CAD: coronary artery disease; *n*: number; %: percentage; N/A: not applicable; AMI: acute myocardial infarction; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction; CABG: coronary artery bypass graft; PCI: percutaneous coronary intervention; CR: cardiac rehabilitation; and DNA: did not attend.

Table 4. Themes and sub-themes associated with participation in CR and long-term exercise training.

<b>Overarching theme</b>	
A need to improve health	
<b>Themes</b>	<b>Sub-themes</b>
Motivation	Emotional response to AMI
	Contact with specialist staff
	Education
	Social opportunities
Extrinsic influences	Weather conditions
	Trusting the referral from a healthcare professional
	Significant others' understanding of the "supporter" role post-AMI
CR experience	Comprehension of the health benefits of exercise post-AMI
	Self-belief

AMI: acute myocardial infarction; CR: cardiac rehabilitation; and CAD: coronary artery disease.