Target journal: British Journal of Cardiac Nursing

Understanding Cardiac Rehabilitation Delivery in Scotland During Covid-19; Lessons for Future Delivery. A Mixed Methods Study

Sheona McHale PhD [1], Lis Neubeck PhD [1,2], Anne Rowat PhD [3], Susan Dawkes PhD [4], and Coral L Hanson PhD [1]

[1] Centre for Cardiovascular Health, Edinburgh Napier University, Sighthill Campus, Edinburgh EH11 4DN, UK;

[2] Sydney Nursing School, Charles Perkins Centre, Johns Hopkins Road, University of Sydney, Sydney, NSW 2006, Australia

[3] Nursing & Health Care School, University of Glasgow, 57/504 Oakfield Avenue, G12 8LL

[4] School of Nursing, Midwifery and Paramedic Practice, Robert Gordon University, Aberdeen

All authors meet the 4 ICMJE criteria for authorship

Corresponding author: Sheona McHale, Centre for Cardiovascular Health, Edinburgh Napier University, Room 4.B.29, Sighthill Campus, Edinburgh EH11 4DN, UK Telephone: +44 131 4553467 email: s.mchale@napier.ac.uk

Key words: Cardiac rehabilitation, Digital technology, Telerehabilitation, Health services accessibility, COVID-19

Conflicts of interest: The authors declare no conflicts of interest.

ABSTRACT

Background/Aims: Cardiac rehabilitation services were disrupted during early COVID-19 due to limited interpersonal contacts, exercise facility closures, and clinical service reorganisation. This necessitated urgent service redesign. We aimed to understand delivery changes in Scotland, impacts on staff and participant experiences, and implications for future delivery.

Methods: A concurrent mixed methods study was conducted between April-December 2021. A quantitative online survey compared service provision pre-COVID-19 (21 March 2019 – 20 November 2019) with provision during early COVID-19 (21 March 2020 – 20 November 2020). Quantitative data were analysed descriptively. Qualitative semi-structured telephone interviews were conducted with cardiac rehabilitation professionals and participants. These were thematically analysed using the framework approach.

Results: Representatives from 11 services completed the survey, and 11 staff and 17 patients completed interviews. Services reported staffing reductions, delayed initial patient contact, replacing face-to-face rehabilitation with telephone and web-based support, compromised initial assessments and reduced exit assessments. Patients relied more on cardiac rehabilitation due to poor access to other healthcare professionals. There were issues with continuity of care. Technology presented remote service opportunities but also challenges due to poor systems access and technological literacy issues. Services evaluation data were inaccessible.

Conclusions: Scottish cardiac rehabilitation services were adversely impacted by COVID-19 and responded by developing remote options. These can be enhanced by screening patients for technology accessibility and literacy issues and developing online educational videos and downloadable resources. Staff education is needed to encourage technology use, including

exercise monitoring via wearables. A national audit is required to assess delivery and outcomes.

Word count: 3179

INTRODUCTION

Cardiac rehabilitation is an internationally recommended intervention for patients after acute coronary syndrome, heart transplant, valve replacement, and heart failure and exertional angina diagnosis (Ambrosetti et al., 2021; British Association of Cardiovascular Prevention and Rehabilitation, 2023). It reduces cardiovascular mortality, morbidity and unplanned hospital admissions, and improves exercise capacity, quality of life and psychological wellbeing (Dalal et al., 2015). Recommended components include lifestyle risk factor modification, medical risk management, psychosocial management, and health behaviour change and education (British Association of Cardiovascular Prevention and Rehabilitation, 2023; Mehra et al., 2020). Despite the known benefits, uptake and adherence remain suboptimal (Karmali et al., 2014). Sex, age, distance from the service, personal finances, work situation, social support, illness perceptions, and depression all influence participation decisions (Clark et al., 2012). There is emerging evidence that adherence can be improved by unsupervised delivery modes, such as home-based delivery, or modes which do not consist of on-site sessions (Santiago de Araújo Pio et al., 2019). UK usual practice prior to the COVID-19 pandemic was to offer a person-centred approach with multi-modes of cardiac rehabilitation, but uptake remained around 50%. The most common reason given for not taking part was the way the services are delivered (British Heart Foundation, 2019).

Cardiac rehabilitation services were severely disrupted during the early stages of COVID 19. This was due to the limitation of interpersonal contacts, closure of exercise facilities, and reorganisation of clinical services to meet the needs of COVID-19 patients (Besnier et al., 2020). There was an urgent need to reorganise and update cardiac rehabilitation services (Kemps et al., 2020). Recommendations for change included replacing face-to-face sessions with remote assessment and monitoring/guiding (telephone or online) (Kemps et al., 2020; Neubeck et al., 2020), the use of connected technology (e.g., digital trackers, blood pressure

monitors) (Neubeck et al., 2020), better utilising home-based programmes (Drwal et al., 2020), and developing resources that could be delivered synchronously or asynchronously (Neubeck et al., 2020). Understanding how cardiac rehabilitation services responded to delivery challenges related to COVID-19 and how this impacted on staff and patient experiences is important to share learning and aid future service planning.

AIMS

The study aimed to understand changes in cardiac rehabilitation delivery due to COVID-19 in Scotland, how this impacted on staff and participant experiences, and implications for future delivery.

RESEARCH DESIGN

This mixed methods study used a concurrent design where quantitative and qualitative components had equal weighting. It included an online survey completed by Scottish cardiac rehabilitation services, and semi-structured telephone interviews with cardiac rehabilitation professionals and participants. Results are reported using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (Von Elm et al., 2007). A favourable ethical opinion was given by the NHS Health Research Authority North East - Tyne & Wear South Research Ethics Committee (21/NE/0047).

METHODS

SETTING

Cardiac rehabilitation in Scotland is delivered by 14 regional health board areas and prior to COVID-19 the cornerstone of provision was in-person programmes (Divers, 2015). Most were between 6-12 weeks in duration, with one or two education and/or exercise classes per week.

PARTICIPANTS

Eligible participants for the study were (1) Scottish cardiac rehabilitation healthcare professionals and (2) patients eligible for cardiac rehabilitation since the beginning of COVID-19. Within these groups, there were no exclusion criteria. Fourteen cardiac rehabilitation professional representatives from each of the 14 Scottish health boards were identified and invited to participate by an NHS gatekeeper. Nineteen cardiac rehabilitation participants were identified and invited by cardiac rehabilitation professionals within health boards. All potential participants were sent an email or letter containing study information between April and December 2021. They returned signed consent forms to the principal investigator to register. Participation was voluntary.

QUANTITATIVE DATA COLLECTION AND ANALYSIS

Data collection took place between April and November 2021. Data about service delivery models and evaluation were gathered from healthcare professionals via an online Novi Survey (Novi Survey, Cambridge, MA, USA). The survey reflected UK core cardiac rehabilitation delivery standards (The British Association for Cardiovascular Prevention and Rehabilitation, 2017). It compared service provision pre-COVID-19 (21 March 2019 – 20 November 2019) and during COVID-19 (21 March 2020 – 20 November 2020). Information collected included eligible medical conditions, staffing, patient referral, recruitment, assessment, rehabilitation programme provision and availability of service evaluation data. Quantitative data were analysed using SPPS v26 (IBM, New York, NY, USA) to provide descriptive statistics of service delivery.

QUALITATIVE DATA COLLECTION AND ANALYSIS

Data were collected from healthcare professionals and patients via semi-structured telephone interviews between April and December 2021. Topics included patient expectations,

experiences, challenges and benefits of rehabilitation, and staff delivery experiences, challenges, and opportunity during COVID-19 (supplementary file 1). Interviews were transcribed verbatim and thematically analysed (Braun & Clarke, 2006; Braun et al., 2019) using the framework approach (Ritchie et al., 2003). Data were organised using NVivo 20 (QSR International, Melbourne, Victoria, Australia). Two researchers (SM and CLH) familiarised themselves with transcripts by reading and rereading. They then independently openly record preliminary concepts and patterns for four telephone interview transcripts (two for each participant group). After discussion between all researchers, an initial analytical framework was established containing 16 codes. SM analysed another four transcripts before the framework was refined and remaining transcripts analysed. Intermediate categories included initiating cardiac rehabilitation support, access challenges, technology, changing staff roles, and future opportunities. A matrix was created in NVivo 20 to map and explore connections within and between participants and categories. During interpretation, final themes relevant to cardiovascular rehabilitation delivery during COVID-19 were developed.

DATA INTEGRATION

Data were integrated at the study design stage through the alignment of the qualitative interview questions with the quantitative questionnaires, and at the discussion stage where the inferences from both sets of data gave a broader understanding of Scottish cardiac rehabilitation before and during COVID-19 (Creswell & Clark, 2017; Doyle et al., 2016).

RESULTS

QUANTITATIVE FINDINGS

Representatives (n=11) from eleven Scottish health boards completed the online survey. All areas offered cardiac rehabilitation for ACS, coronary revascularisation, and post valve surgery. The majority also offered rehabilitation for heart failure (n=10), post heart transplant

(n=10) and post cardiac defibrillator implantation (n=9). Fewer areas offered rehabilitation for adult congenital heart disease (n=6) or stable angina (n=4). Services reported a 29.1% reduction in staff availability for cardiac rehabilitation delivery during COVID-19, compared to the same period prior to the pandemic.

Models of service provision

All services reported variations in services during the COVID-19 period compared to the pre-COVID 19 period (Table 1).

Table 1: Models of service provision for cardiac rehabilitation in Scottish health boards pre and during COVID 19

System process	Process element	Pre-Covid n (%)	During Covid n (%)
Referral pathway	Referral as inpatient or within 24 hrs of discharge	8 (72.7)	7 (63.6)
	Referral to community / after day case within 72 hours	8 (72.7)	5 (45.4)
	Inpatients encouraged to attend cardiac rehabilitation	8 (72.7)	7 (63.6)
	Patients contacted within three days of referral	8 (72.7)	3 (27.3)
	Re-offer re-entry mechanism for those initially declining	9 (81.8)	6 (54.5)
Initial assessment	Initial assessment within 10 days of receipt of referral	7 (63.6)	5 (45.4)
	Lifestyle risk factors discussed	11 (100.0)	10 (90.9)
	Includes demographics & social determinants, medical history, health status, symptoms, investigation review, psychosocial health; identification of issues that might impact to make lifestyle changes, and medical risk management	11 (100.0)	11 (100.0)
	Partial assessment still allows for cardiac rehabilitation commencement	11 (100.0)	9 (81.8)
	Formal risk stratification for exercise	11 (100.0)	10 (90.9)
	An individualised written care plan	9 (81.8)	8 (72.7)
	On-going assessment and goals review	11 (100.0)	9 (81.8)
Elements of comprehen-sive rehabilitation programme	Education/information	11 (100.0)	11 (100.0)
	Psychosocial support	10 (90.9)	9 (81.8)
	Structured exercise programme	11 (100.0)	7 (63.6)
	Other lifestyle change support (e.g., diet, smoking cessation)	11 (100.0)	11 (100.0)
	Medical risk management	11 (100.0)	11 (100.0)
Types of exercise programme offered	Home-based (including advice for walking programmes)	7 (63.6)	8 (72.7)
	Community-based classes	10 (90.9)	1 (9.1)
	Manual-based	1 (9.1)	1 (9.1)
	Hospital-based classes	6 (54.5)	0 (0.0)
	Web-based (British Heart Foundation cardiac rehabilitation programme)	1 (9.1)	8 (72.7)
	Telephone-support	3 (27.3)	8 (72.7)
	Teleconference-based support	0 (0.0)	2 (18.2)
	Other (App-based, CD)	0 (0.0)	2 (18.2)
	Has a menu-based approach	11 (100.0)	4 (36.4)
Duration of clinically supervised	Individualised	3 (27.3)	-
	8-12 weeks	4 (36.4)	-
	10 weeks	3 (27.3)	1(9.1)
	12 weeks	1 (9.1)	-

exercise programme	No structured clinically supervised exercise programme	-	1(9.1)
Max no. of supervised exercise sessions per week	Individualised	1 (9.1)	-
	1 x per week	5 (45.4)	-
	2 x per week	2 (18.2)	-
	1-2 x per week (in person)	3 (27.3)	1 (9.1)
	1-2 x per week (remote online)	-	2 (18.2)
	Not offered	-	8 (72.7)
Time of sessions	Daytime sessions offered (9.00-17.00)	11 (100.0)	1 (9.1)
	Evening sessions offered (after 17.00)	2 (18.2)	0 (0.0)
BCTs included in exercise programme	Includes goal setting	11 (100.0)	6 (54.5)
	Includes functional capacity testing pre and post programme	10 (90.9)	0 (0.0)
	Includes documented review of exercise progression	11 (100.0)	4 (36.4)
	Includes education	9 (81.8)	3 (27.3)
Final assessment	Final assessment conducted	11 (100.0)	6 (54.5)
	Includes only identified elements from initial assessment	2 (18.2)	0 (0.0)
	Includes lifestyle risk factors, psychosocial health, medical risk management, and identification of unmet goals	11 (100.0)	5 (45.5)
	Includes additional parameters from initial assessment	10 (90.9)	4 (36.4)
	Primary care and referrer informed within 10 working days of programme completion	6 (54.5)	1 (9.1)

Services collected a range of demographic and outcome measures, but these were not consistent, and some outcome measures collection varied during COVID-19 (Table 2). Services were not able to provide accurate summary data of throughput or outcomes.

Table 2: Reported service evaluation data collection

Data category	**Pre- Covid n (%)**	**During Covid n (%)**
Demographic and throughput data collection		
Number of referrals received	10 (90.9)	
Sex of referrals	10 (90.9)	
Age of referrals	7 (63.6)	
Postcode of referrals	5 (45.5)	
Ethnicity of referrals	1 (9.1)	
Medical condition/initiating event for cardiac rehabilitation	9 (81.8)	
Number attending initial assessment	0 (0.0)	
Number attending structured programmes	8 (72.7)	
Number who attend a final assessment	9 (81.8)	
Assessment outcome data collection		
Initial outcome measures recorded for evaluation	6 (54.5)	5 (45.5)
Final assessment measures recorded for evaluation	8 (72.7)	5 (45.5)
Diet outcome measures	11 (100.0)	10 (90.9)
Mediterranean diet score	*2 (18.2)*	*1 (9.1)*
Diet recall	*3 (27.3)*	*3 (27.3)*
Other (portions, likes dislikes, Scottish cardiac rehabilitation assessment workbook, not defined)	*6 (54.5)*	*6 (54.5)*
Physical activity outcome measures (multiple options in some services)	11 (100.0)	8 (72.7)
Shuttle walk test	*8 (72.7)*	*1 (9.1)*
Six-minute walk test	*9 (81.8)*	*2 (18.2)*

Chester step test	*6 (54.5)*	*3 (27.3)*
Self-report measure	*5 (45.5)*	*5 (45.5)*
Other (Scottish cardiac rehabilitation assessment workbook, cycle test, importance, and confidence scales)	*4 (36.4)*	*5 (45.5)*
Psychosocial outcome measures (multiple options in some services)	11 (100.0)	9 (81.8)
Hospital Anxiety and Depression Score	*5 (45.5)*	*4 (36.4)*
Patient Health Questionnaire (4 or 9 items scale)	*5 (45.5)*	*7 (63.6)*
Generalized Anxiety Disorder 7 items scale	*1 (9.1)*	*2 (18.2)*
EuroQuol 5 Dimensions	*1 (9.1)*	*1 (9.1)*
Other (distress thermometer and general wellbeing questions)	*4 (36.4)*	*3 (27.3)*

QUALITATIVE FINDINGS

Participants (n=28) were 11 cardiac rehabilitation staff from 11 health board areas and 17 cardiac rehabilitation patients from 6 health board areas. Two patients who were invited to take part did not respond to the invitation email. Median telephone interview length was 48 (range 35 – 64) minutes for staff and 37 (range 28 – 48) minutes for patients.

Three main themes were developed that represented the challenges and opportunities of changing cardiac rehabilitation delivery during the pandemic: 1) Access to health professional support; 2) Disruption in continuity of care and 3) technology use (Figure 1). We present patient and staff participant views with indicative quotes within tables at the end of each theme.

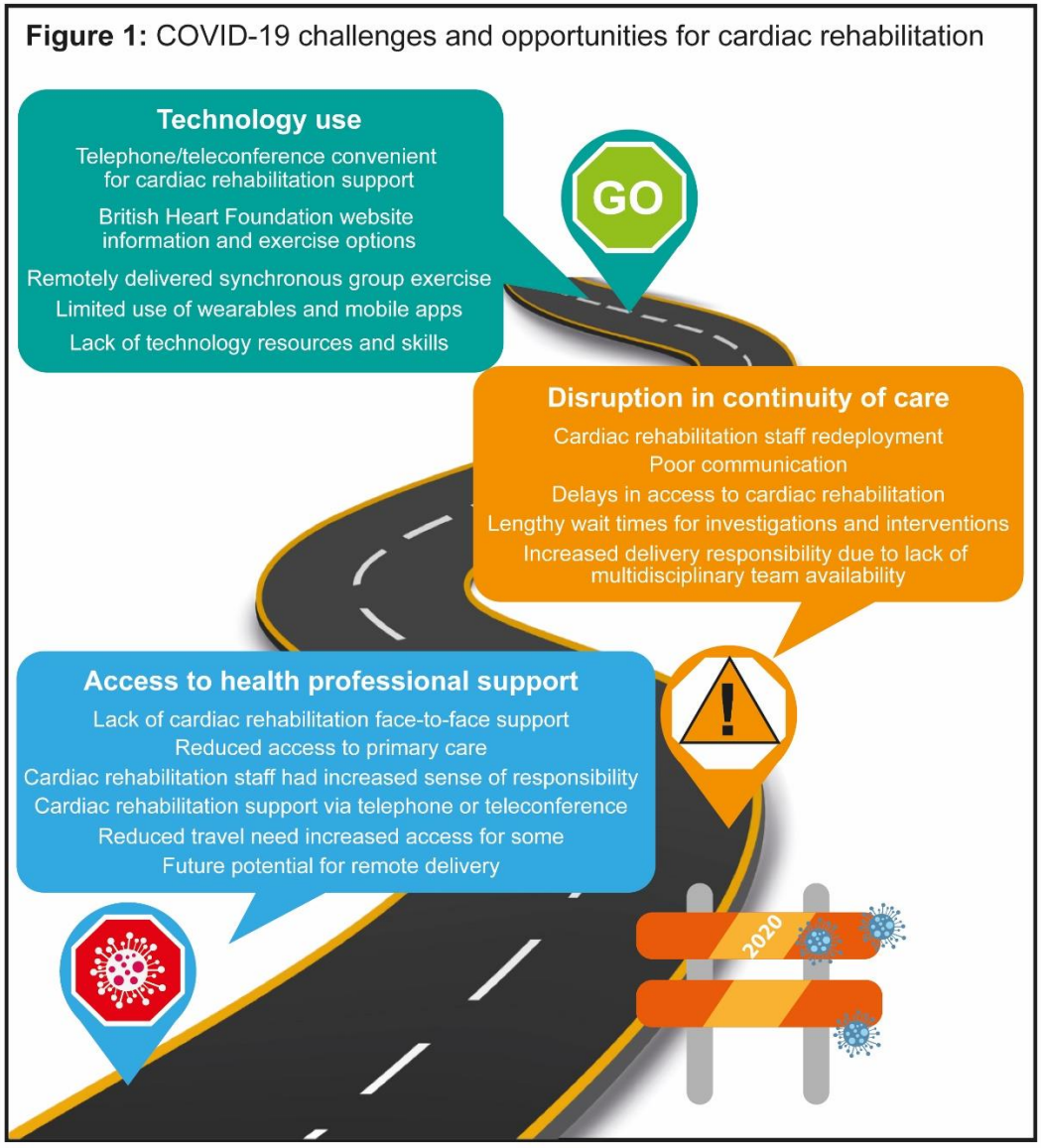

Figure 1: COVID-19 challenges and opportunities for cardiac rehabilitation

Access to health professional support

Patients and staff identified challenges with cardiac rehabilitation access early in the COVID-19 pandemic (indicative quotes, Table 3). Patients reported a lack of face-to-face cardiac rehabilitation, which was mainly replaced by remote support (telephone or teleconference audio-visual calls/meetings). Different access to cardiac rehabilitation was combined with reduced primary care access. Patients reported difficulties in communicating symptoms, negative physical changes, and CVD support needs during telephone appointments with

general practitioners. Some patients avoided primary care and instead contacted cardiac rehabilitation staff for information because they felt they were more accessible and approachable.

Early in the pandemic staff felt an increased sense of responsibility towards patients and expressed concern about the number of telephone/teleconferencing calls and complexity of patient support needs. Staff shared service telephone/teleconferencing contact details during the initial assessment and many patients were given information about the expected number, frequency, and duration of appointments. Patients were satisfied with these arrangements, although a few would have preferred more appointments during the initial weeks. Telephone/teleconference appointments were reported to be convenient for those of who had returned to work, lived in rural areas, were unable to drive, or where travel was restricted due to COVID-19.

The pandemic offered an opportunity for staff to reflect upon pre pandemic delivery and assess against COVID-19 initiatives. Staff reported that using telephone/teleconference calls improved the accessibility and efficiency for patients who reported no cardiac symptoms and felt able to return to usual life. Programme redesign initiatives included reducing the need for patients to attend in-clinic appointments, increasing the offer of telephone/ teleconference appointments, and the completion of timely discharge from cardiac rehabilitation. Staff expressed a need to retain future face-to-face options for those experiencing ongoing cardiac symptoms or complicated physical or emotional recoveries.

Table 3: Access to healthcare professional support indicative quotes

Sub themes	Indicative quotes
Lack of face-to-face cardiac rehabilitation	*"I appreciated the unprecedented times, people working, from home - it was more a kind of support service via the phone." (Patient participant 2)*
	"She said that normally I would have gone down to the hospital, you know, in normal times, and joined a class." (Patient participant 10)

	"And [cardiac rehabilitation professional] was just saying; It's a pity that you can't have the rehab in the old sports centre, like before, and meet five other folk who'd had the same thing done in the last couple of weeks." (Patient participant 11)
Reduced access to primary care	*"Before I got to see the GP, I phoned the receptionist. She says, no, you'll need to wait till Monday and get a phone call from the doctor…." (Patient participant 6)* *"I contacted my GP, I was told that I couldn't have an appointment, it would have to be a telephone consult. I had a list of issues." (Patient participant 7)*
Cardiac rehabilitation telephone support	*"Handy thing was they're at the end of the telephone if you didn't feel well." (Patient Participant 3)* *"I could contact her at any time if I'm feeling down about things and worried… She was putting my mind at ease." (Patient Participant 8)* *"It [telephone support] was more than enough… for me anyway." (Patient Participant 13)*
Remote cardiac rehabilitation support reduced travel requirements	*I preferred the telephone approach because it means that it is accessible...I couldn't drive for a month for a start… much slicker and much more efficient to be perfectly honest (Patient participant 16)* *"[Remote support was] perfect because I went back to work fairly quickly... I would have to take a day off to come back 40 miles to go to some kind of classes or whatever it is." (Patient participant 14)* *"I think there has been a reduction in our non-attendance rates because people aren't having to travel to come." (Staff participant 2)*
Cardiac rehabilitation staff increased sense of responsibility	*"I think they do feel that once they've got our number, it's a great bit of reassurance, they're not abusing it, they just don't know who to turn to." (Staff participant 1).* *"The issues that people were dealing with were that you would be picking up people at crisis points within their own homes… things that were not usual for us in our job." (Staff participant 5).* *"So difficult to swallow, and it took me probably a month to let it go and stop worrying so much." (Staff participant 6).*
Future opportunities for remote cardiac rehabilitation	*"It's definitely pushed us into a menu-based approach… if [teleconference software] suits you better and you're at home 50 miles away from your nearest place, that's fine for your rehab, yeah? Or you just want telephone calls because you're quite confident of just getting back on with your life …." (Staff participant 1)* *"Now we are …mindful of, what's the best strategy for an individual… we're constantly having to remind each other; do they need to come in? Can we do this differently? …we can either home visit, or we can bring somebody into clinic, or we can use our remote monitoring and phone." (Staff participant 8)*

Disruption in continuity of care

Staff and patients reported problems with continuity of care throughout the cardiac rehabilitation journey. Some patients, especially post-surgical patients, perceived that communication of hospital discharge information to outpatient cardiac rehabilitation services was ineffective, leading to delays in initial cardiac rehabilitation access. Staff confirmed a time delay in patients receiving early cardiac rehabilitation. A few services ceased to operate during the initial pandemic period, whilst others operated with limited staff. This had implications for early titration of medication and early intervention to address cardiovascular disease misconceptions. This was combined with reports of waiting months for investigation

results, to speak with cardiologists, or to receive cardiac procedures. Patients spoke about their anxiety and fear of overexerting themselves and/or increasing their risk of rehospitalisation in the absence of early cardiac rehabilitation support, cardiac treatments, or cardiovascular information. This resulted in several patients self-limiting their activities or delaying their return to work.

Staff redeployment to acute and non-acute services due to COVID-19 posed the greatest challenge to providing early cardiac rehabilitation and continuity of care. Often, this resulted in radical changes to cardiac rehabilitation job roles and a reduction in availability of multidisciplinary team members. Staff reported that a resultant lack of role distinction had a negative impact on service quality. For example, patients received generalised rather than individualised support. Staff felt distressed and frustrated that decision makers were not listening to their pleas to remain within cardiac rehabilitation services and maintain quality and continuity of provision.

Table 4: Disruption in continuity of care support indicative quotes

Sub themes	Indicative quotes
Cardiac rehabilitation staff redeployment	*"The service was stopped completely. No cover, nothing." (Staff participant 6).*
	"It was the fact that just about everybody but two nurses (part-time), were redeployed." (Staff participant 8).
	"You're needed here and these folk will just have to get on with it, which … made me quite angry…It was like everything was about COVID, so really it didn't matter that these folk were having MIs, or just out of hospital after cardiac surgery and wondering what to do with their wounds." (Staff participant 1)
Poor communication	*"I think the time that it took for the information to get from (hospital) to the cardiac rehab team, I was kind of left in limbo then. You know… my cousin said to me, have they not been in touch with you yet? Maybe you need to chase them up." (Patient participant 7)*
	"If I go back and think about the period of time now, what I probably would have done is got a list of names, a list of numbers, their specialities and who to call when, so that it's all to hand and I had it stored." (Patient participant 12)
Delays in cardiac rehabilitation access	*"We used to be quite prompt but sometimes patients are home two, three weeks before we are actually getting in touch with them" (Staff participant 4).*
	"I had to fight my corner to get evaluated. They were saying that basically the service was only working on a partial footing based on COVID" (Patient participant 2).
Lengthy wait times for investigations and interventions	*"I received this letter saying that due to COVID, I'm now on a five-month waiting list because of suspension in service that, last year, occurred during COVID." (Patient participant 8)*
	"I got a telephone call the night before I was meant to go [for angioplasty], saying it had been cancelled… they said they had been inundated with cases… I didn't hear from them for a few

	weeks, I started to get a bit anxious. I actually made a phone call to the cardiac team, and they were trying to find out what was going on, but I think it was just because they were far too busy." (Patient participant 9)
Increased delivery responsibility due to lack of multidisciplinary team availability:	*"My role (physiotherapist) turned on its head. I was doing … nursing assessments… I was trying to input as much physio stuff as I could... but was obviously very aware that I didn't want there to be inequality because the patients that I was speaking to would be getting that input, but the ones that (the specialist nurse) was speaking to wouldn't." (Staff participant 3)* *"Everybody is kind of …dabbling in the frame, and sometimes it's difficult to know who's doing what." (Staff participant 6).*

Use of technology

Patients and staff viewed telephone and/or remote one-to-one teleconferencing appointments as a convenient means of gaining cardiac rehabilitation support. Staff felt that teleconferencing offered an opportunity to assess and address patient's functional ability concerns and encourage self-directed exercise. Patients reported few problems with teleconferencing, and only a few stated preferring telephone calls due to technology literacy issues.

Remote group-based teleconferencing appointments for exercise sessions were delivered in two NHS areas but in other areas information governance issues hindered delivery. Where available, staff performed exercise sessions live at home in front of a screen and offered varying levels of difficulty. Poor patient uptake of these sessions was reported. Some felt that the limited social interaction with other patients was the main disadvantage. However, participants who attended these sessions felt safe and supported, and reported being confident using technology, including wearables, such as smart watches. This group tended to have previously attended at least one in-person outdoor exercise-based cardiac rehabilitation session. Staff questioned the suitability of remote exercise, as they did not feel able to effectively individualise patients' exercise movements, intensity levels, interact with wearable technology, such as wearable heart rate trackers, and were worried about the potential for adverse events.

Staff reported that only one app could be accessed via their health board area. The myHeart mobile health app (Blythin et al., 2023) could be remotely accessed in some areas pre- and during the pandemic. The app contained cardiovascular health information and promoted patient self-management. However, staff did not generally recommend myHeart, despite several patients reporting habitual use of mobile health apps. This was because of procurement issues, costs associated with use and staff judgements about app value compared with the freely available British Heart Foundation website (British Heart Foundation, 2023). Most patients were directed to self-manage their exercise via a web-based link to British Heart Foundation videos. Many reported viewing the resource, but few continued beyond the first video. Exercises were perceived to be different to personal preferences, suited to less fit individuals, lacking progression and repetitive.

Early in the pandemic, offering patients remote cardiac rehabilitation support was complicated by the staff inability to securely access patient information remotely due to a lack of resources (e.g., home working equipment, personal telephones, and teleconferencing equipment). Some staff also lacked information technology skills to offer patients remote support. One year into the pandemic most, but not all, staff felt confident to encourage patient use of teleconferencing but perceived that patient preference was for telephone-based support. Reasons for this included a perceived lack of email access, poor internet speeds and/or lack of support to set the service up on home computers.

Table 5: Use of technology indicative quotes

Sub themes	Indicative quotes
Telephone and video calls convenient for support	*"It's just been calls, telephone calls… I'm a Neanderthal, I'm nearly 60 and I can't be sitting on computers, you know what I mean." (Patient participant 9)*
	"They asked if they could do a video call as well (as telephone call)… And had you used a video call …before? No…did you find it easy to use? Oh yes, not a problem" (Patient participant 3)
	"It was Microsoft Teams (video call) and for me it is a part of my job…" (Patient participant 4)
	"I was told…we are going to do it (video call), can you make yourself available for it? …are you familiar with use of equipment for video call? Yes" (Patient participant 14)

British Heart Foundation website information and asynchronous exercise options	*"The nurses on the ward and at the clinics said, if you want any information go to the British Heart Foundation, they are very good, very authoritative" (Patient participant 4)*
	"It was a pre-recorded exercise programme. British Heart Foundation… To start off with it was very hard work, I used to pour with sweat… You had the warm-up, the main bit, and the warm-down. Eventually I got bored with it and I started to skip the warm-up bit and just get onto the exercises because I didn't find it that demanding" (Patient participant 3)
	"They [exercise videos] were from the British Heart Foundation. Yes, that worked extremely well, because as I say I was in isolation anyway shielding, and it was the only sort of form of exercise I could get during the day, and it was great to be doing it in house." (Patient participant 1)
	"I watched it, but I didn't actually use it…. it wasn't my kind of exercise, to be honest." (Patient participant 16)
Remotely delivered synchronous group exercise classes	*"I am totally safe and don't have any issue with that (remote exercise class). My wife is upstairs…but even then, I wouldn't have any issue being on my own because the physio does her bit" (Patient participant 4)*
	"I don't wish to be in the situation of watching someone take unwell and being unable to do something about it. I think even if you have a protocol which means somebody's in the house with that person, you're still putting all the onus on a spouse, a partner or friend to deal with that and I don't wish to do that to another person" (Staff participant 5)
	"Our kind of theory with the group thing is that it's an awful lot easier to make the patient responsible, if you give them that DVD, and then that's it" (Staff participant 6)
Lack of information technology resources and skills:	*"It was challenging at the start because it's new technology and, you know, we weren't used to doing it that way, but actually we very quickly adapted to it"(Staff participant 10)*
	"I don't think we have used digital technology and IT and stuff, I don't think we have used it to the best we maybe could have. But I think a lot of that is the unknown and the fact that you don't have somebody to hand to help you when you are struggling with it. But when you see the policy and the protocol for doing [NHS teleconferencing service] makes your heart sink, all the stuff they do before they get on and actually speak to a patient." (Staff participant 4)
Use of wearables and mobile health apps	*"They had mentioned …about heartbeat, and to get one of these smart watches. They were saying you can get a bit hung up with this sort of stuff… If you can hold a conversation… whether you're overdoing it or not." (Patient participant 13)*
	"My app is... (name of fitness app) and it's got all different things on it. So, there's yoga, there's beginners exercises and then you could build up … it gives you a summary after you finish each session and how much calories you've burnt off, how much energy, your heart rate...." (Patient participant 8)
	"I use an app already for my blood pressure" (Patient participant 7)
	"So we were using myHeart app. And we had been using that prior to COVID, so we've been doing a trial of that… The app itself was great and we thought this was going to be fantastic but actually the patient interaction with that was not great. Patients were happier interacting with the BHF website, which from a financial point of view …is a lot cheaper." (Staff participant 3)
	"I forget the name of the platform, it was an app. We looked at it for rehab, and we were completely impressed. We just thought, the BHF cost us nothing, and was the same." (Staff participant 6).
	"We weren't allowed to use that (mobile health app) from an (NHS health board) perspective because of …security, information governance, and we're still jumping through hoops to get the go-ahead to be able to use that technology." (Staff participant 1)

DISCUSSION

Scottish cardiac rehabilitation services were adversely impacted early in the COVID-19 pandemic by staff redeployment, the closure of in-person services and reduced patient

accessibility to wider healthcare professional support. This resulted in delays in initial patient contact and compromised early patient assessment, and greater time pressure on remaining staff who were responsible for all aspects of cardiac rehabilitation delivery due to reduced multidisciplinary team availability. Technology use (telephone, teleconference, apps and publicly available websites) provided opportunities for remote service redesign. These were mainly well received by patients, although some reported issues with technology literacy. An initial lack of staff technological skills, system accessibility problems and confidence in digital health solutions, hindered early adoption. Patients received remote personal time with cardiac rehabilitation staff, but less individualised exercise prescription due to the cessation of functional capacity testing, and reduced goal setting, programme reviews and exit assessments. Inconsistent data collection meant that services were unable to assess changes to uptake, adherence, or outcome measures. Future delivery suggestions included increasing telephone/teleconference options, reducing in-person appointments where appropriate, and timely cardiac rehabilitation discharge. Staff did not feel confident to use wearables to prescribe and monitor exercise and preferred to recommend a public free website to a mobile app. Future in-person programmes were considered important for those with ongoing cardiac symptoms or complicated physical or emotional recoveries.

Poor digital literacy, lack of digital resources and governance issues were barriers to remote cardiac rehabilitation implementation for staff in this study. Lack of organisational and system support, onerous governance processes, and staff acceptance of telehealth solutions have been previously reported as barriers to technology-enabled care (Brewster et al., 2014; Cartledge et al., 2022; O'Doherty et al., 2021; Taylor et al., 2021). As a result, delivery in this study was often limited to staff-intensive telephone/teleconference-based one-to-one support, similar to other studies (de Melo Ghisi et al., 2021; Marzolini et al., 2021; O'Doherty et al., 2021). This was problematic because of time pressure created by staffing reductions and

increased patient reliance on cardiac rehabilitation due to limited access to other healthcare professionals. Recommendations about using mobile apps and home monitoring using connected technology in remote delivery models (Kemps et al., 2020; Neubeck et al., 2020) were rarely implemented. This is despite evidence that home-based cardiac rehabilitation using technology-based options is as at least as effective as centre-based rehabilitation in increasing exercise functional capacity (Anderson et al., 2017; Avila et al., 2018; Dorje et al., 2019; Ramachandran et al., 2022; Ruku et al., 2021), adherence/compliance (Varnfield et al., 2014), and physical activity (Claes et al., 2020). We suggest that use of technology needs to be integrated into education and training programmes to increase staff acceptance, knowledge, skills and confidence to support future remote delivery of cardiac rehabilitation. There is a particular need for education about how to prescribe and monitor intensity using wearables to address safety concerns in prescribing remote exercise in high risk or vulnerable populations reported in this and other studies (Marzolini et al., 2021).

Patients in this study mostly welcomed telehealth cardiac rehabilitation options, particularly those who had returned to work, lived in rural areas or who did not drive. Staff suggested that remote options should remain as services returned to pre-pandemic status. To improve future remote delivery, Scottish cardiac rehabilitation services should develop a more comprehensive offer, given the reported limited use of technology in this study, and others (O'Doherty et al., 2021). This offer may include screening for comfort with/access to technology, multidisciplinary video consultation assessments, weekly virtual interactive group sessions, online educational videos and downloadable resources, remote monitoring via wearables, and medical risk factor management through liaison with primary care (University Health Network Foundation, no date; Western Health and Social Care Trust, no date). To optimise remote delivery, services should encourage self-management by focusing on realistic goal setting, actions plans and transition points, emphasise emotional wellbeing early

on, encourage interaction in group sessions, incorporate existing digital resources, and ensure that content is respectful and inclusive of different cultures (Ghisi et al., 2023). Remote delivery may not be acceptable nor accessible to all and may increase the risk of digital exclusion and reduce patient choice of delivery (Heponiemi et al., 2020). Once programmes are established, services should ensure that traditional cardiac rehabilitation care delivery standards are met (British Association of Cardiovascular Prevention and Rehabilitation, 2023; Moulson et al., 2020).

Audit and evaluation are promoted as core components of cardiac rehabilitation (Piepoli, 2017), but in our study services reported inconsistent data collection and were unable to provide summary statistics. National registries are important to define service delivery characteristics, quality and outcomes (Poffley et al., 2017), but currently there is no Scottish cardiac rehabilitation registry, as acknowledged in the Heart Disease Action (Scottish Government, 2021). Scotland is not part of the UK National Audit for Cardiac Rehabilitation, which has previously allowed for assessment of outcomes such as the implementation of minimum standards (Doherty et al., 2017), how the timing of cardiac rehabilitation affects psychological outcomes (Sumner et al., 2018), and the effect of centralising services (Doherty et al., 2015). At a national level there is a need to define local data collection. This should include 1) service delivery characteristics (e.g., mode of delivery, approach to individualisation), 2) demographic and throughput data (e.g., number of referrals, and uptake, attendance, and adherence) and 3) consistent, validated psychosocial, diet, and physical activity outcome measures. These data have a critical role in understanding delivery and supporting quality improvement for people with heart disease (Scottish Government, 2021) .

CONCLUSIONS:

Scottish cardiac rehabilitation services were adversely impacted by COVID-19 and responded by developing remote delivery options. In the future, multi-modal cardiac rehabilitation offers can benefit from the inclusion of remote delivery options. These can be enhanced by developing a way to screen patients for comfort with/access to technology and online educational videos and downloadable resources. Staff education is needed to encourage technology use, including remote exercise monitoring via wearables. A national audit is required to assess delivery and outcomes.

ACKNOWLEDGEMENTS

We wish to acknowledge the cardiac rehabilitation staff from the 11 health boards in Scotland who gave up their time to take part in this study during a very challenging period. We would also like to thank the patients who generously shared their views and experiences of cardiac rehabilitation during COVID-19.

REFERENCES

Ambrosetti, M., Abreu, A., Corrà, U., Davos, C. H., Hansen, D., Frederix, I., Iliou, M. C., Pedretti, R. F. E., Schmid, J.-P., Vigorito, C., Voller, H., Wilhelm, M., Piepoli, M. F., Bjarnason-Wehrens, B., Berger, T., Cohen-Solal, A., Cornelissen, V., Dendale, P., Doehner, W., . . . Zwisler, A.-D. O. (2021). Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. *European journal of preventive cardiology*, *28*(5), 460-495. https://doi.org/10.1177/2047487320913379

Anderson, L., Sharp, G. A., Norton, R. J., Dalal, H., Dean, S. G., Jolly, K., Cowie, A., Zawada, A., & Taylor, R. S. (2017). Home-based versus centre-based cardiac rehabilitation. *Cochrane Database of Systematic Reviews*(6).

Avila, A., Claes, J., Goetschalckx, K., Buys, R., Azzawi, M., Vanhees, L., & Cornelissen, V. (2018). Home-Based Rehabilitation With Telemonitoring Guidance for Patients With Coronary Artery Disease (Short-Term Results of the TRiCH Study): Randomized Controlled Trial. *Journal of medical Internet research*, *20*(6), e225-e225. https://doi.org/10.2196/jmir.9943

Besnier, F., Gayda, M., Nigam, A., Juneau, M., & Bherer, L. (2020). Cardiac Rehabilitation During Quarantine in COVID-19 Pandemic: Challenges for Center-Based Programs. *Archives of Physical Medicine and Rehabilitation*, *101*(10), 1835-1838. https://doi.org/https://doi.org/10.1016/j.apmr.2020.06.004

Blythin, A., Elkes, J., Walters, R., Bhogal, A., & Thompson, I. (2023). Observing Digital Cardiac Rehabilitation using myHeart During the First Wave of COVID-19: A Real-World Multicentre Evaluation. *J Card Pulm Rehabi*, *7*(193), 2.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qual Res Psychol*, *3*(2), 77 - 101.

Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2019). Thematic Analysis. In *Handbook of Research Methods in Health Social Sciences* (pp. 843-860): Springer Singapore.

Brewster, L., Mountain, G., Wessels, B., Kelly, C., & Hawley, M. (2014). Factors affecting front line staff acceptance of telehealth technologies: A mixed-method systematic review. *Journal of advanced nursing*, *70*(1), 21-33.

British Association of Cardiovascular Prevention and Rehabilitation. (2023). *The BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation 2023 (4th Edition),* . Retrieved 06/04/2023 from https://www.bacpr.org/__data/assets/pdf_file/0021/64236/BACPR-Standards-and-Core-Components-2023.pdf

British Heart Foundation. (2019). *The National Audit of Cardiac Rehabilitation Quality and Outcomes Report 2019*. Bhf.org.uk. https://www.bhf.org.uk/informationsupport/publications/statistics/national-audit-of-cardiac-rehabilitation-quality-and-outcomes-report-2019

British Heart Foundation. (2023). *At home BHF cardiac rehab exercise videos*. Retrieved 28/06/2023 from https://www.bhf.org.uk/informationsupport/support/cardiac-rehabilitation-at-home/cardiac-rehabilitation-exercise-videos

Cartledge, S., Rawstorn, J. C., Tran, M., Ryan, P., Howden, E. J., & Jackson, A. (2022). Telehealth is here to stay but not without challenges: a consultation of cardiac rehabilitation clinicians during COVID-19 in Victoria, Australia. *European Journal of Cardiovascular Nursing*, *21*(6), 548-558.

Claes, J., Cornelissen, V., McDermott, C., Moyna, N., Pattyn, N., Cornelis, N., Gallagher, A., McCormack, C., Newton, H., Gillain, A., Budts, W., Goetschalckx, K., Woods, C., Moran, K., & Buys, R. (2020). Feasibility, Acceptability, and Clinical Effectiveness of a Technology-Enabled Cardiac Rehabilitation Platform (Physical Activity Toward Health-I): Randomized Controlled

Trial. *Journal of medical Internet research*, *22*(2), e14221-e14221. https://doi.org/10.2196/14221

Clark, A. M., King-Shier, K. M., Thompson, D. R., Spaling, M. A., Duncan, A. S., Stone, J. A., Jaglal, S. B., & Angus, J. E. (2012). A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral. *American Heart Journal*, *164*(6), 835-845.e832. https://doi.org/https://doi.org/10.1016/j.ahj.2012.08.020

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Dalal, H. M., Doherty, P., & Taylor, R. S. (2015). Cardiac rehabilitation. *BMJ (Clinical research ed.)*, *351*, h5000-h5000. https://doi.org/10.1136/bmj.h5000

de Melo Ghisi, G. L., Xu, Z., Liu, X., Mola, A., Gallagher, R., Babu, A. S., Yeung, C., Marzolini, S., Buckley, J., & Oh, P. (2021). Impacts of the COVID-19 pandemic on cardiac rehabilitation delivery around the world. *Global Heart*, *16*(1).

Divers, F. (2015). Scoping of cardiac rehabilitation services in Scotland 2015. *Edinburgh: Scottish Government*.

Doherty, P., Harrison, A. S., Knapton, M., & Dale, V. (2015). Observational study of the relationship between volume and outcomes using data from the National Audit of Cardiac Rehabilitation. *Open heart*, *2*(1), e000304. https://doi.org/10.1136/openhrt-2015-000304

Doherty, P., Salman, A., Furze, G., Dalal, H. M., & Harrison, A. (2017). Does cardiac rehabilitation meet minimum standards: an observational study using UK national audit? *Open heart*, *4*(1), e000519. https://doi.org/10.1136/openhrt-2016-000519

Dorje, T., Zhao, G., Tso, K., Wang, J., Chen, Y., Tsokey, L., Tan, B., Scheer, A., Jacques, A., & Li, Z. (2019). Smartphone and social media-based cardiac rehabilitation and secondary prevention in China (SMART-CR/SP): a parallel-group, single-blind, randomised controlled trial. *The Lancet Digital Health*, *1*(7), e363-e374.

Doyle, L., Brady, A.-M., & Byrne, G. (2016). An overview of mixed methods research–revisited. *Journal of research in nursing*, *21*(8), 623-635.

Drwal, K. R., Forman, D. E., Wakefield, B. J., & El Accaoui, R. N. (2020). Cardiac Rehabilitation During COVID-19 Pandemic: Highlighting the Value of Home-Based Programs. *Telemedicine and e-Health*, *26*(11), 1322-1324. https://doi.org/10.1089/tmj.2020.0213

Ghisi, G. L. d. M., Aultman, C., Konidis, R., Sandison, N., & Oh, P. (2023). Developing a group-based virtual education curriculum for cardiac rehabilitation and the associated toolkit to support implementation in Canada and across the globe. *Heart & Lung*, *57*, 80-94. https://doi.org/https://doi.org/10.1016/j.hrtlng.2022.08.011

Heponiemi, T., Jormanainen, V., Leemann, L., Manderbacka, K., Aalto, A.-M., & Hyppönen, H. (2020). Digital divide in perceived benefits of online health care and social welfare services: national cross-sectional survey study. *Journal of medical Internet research*, *22*(7), e17616.

Karmali, K. N., Davies, P., Taylor, F., Beswick, A., Martin, N., & Ebrahim, S. (2014). Promoting patient uptake and adherence in cardiac rehabilitation. *Cochrane Database of Systematic Reviews*(6). https://doi.org/10.1002/14651858.CD007131.pub3

Kemps, H. M. C., Brouwers, R. W. M., Cramer, M. J., Jorstad, H. T., de Kluiver, E. P., Kraaijenhagen, R. A., Kuijpers, P. M. J. C., van der Linde, M. R., de Melker, E., Rodrigo, S. F., Spee, R. F., Sunamura, M., Vromen, T., Wittekoek, M. E., Kemps, H. M. C., Brouwers, R. W. M., Cramer, M. J., Jorstad, H. T., de Kluiver, E. P., . . . Cardiac Rehabilitation of the Netherlands Society of, C. (2020). Recommendations on how to provide cardiac rehabilitation services during the COVID-19 pandemic. *Netherlands Heart Journal*, *28*(7), 387-390. https://doi.org/10.1007/s12471-020-01474-2

Marzolini, S., de Melo Ghisi, G. L., Hébert, A.-A., Ahden, S., & Oh, P. (2021). Cardiac rehabilitation in Canada during COVID-19. *CJC open*, *3*(2), 152-158.

Mehra, V. M., Gaalema, D. E., Pakosh, M., & Grace, S. L. (2020). Systematic review of cardiac rehabilitation guidelines: Quality and scope. *European journal of preventive cardiology*, *27*(9), 912-928. https://doi.org/10.1177/2047487319878958

Moulson, N., Bewick, D., Selway, T., Harris, J., Suskin, N., Oh, P., Coutinho, T., Singh, G., Chow, C.-M., Clarke, B., Cowan, S., Fordyce, C. B., Fournier, A., Gin, K., Gupta, A., Hardiman, S., Jackson, S., Lamarche, Y., Lau, B., . . . Krahn, A. D. (2020). Cardiac Rehabilitation During the COVID-19 Era: Guidance on Implementing Virtual Care. *Canadian Journal of Cardiology*, *36*(8), 1317-1321. https://doi.org/https://doi.org/10.1016/j.cjca.2020.06.006

Neubeck, L., Hansen, T., Jaarsma, T., Klompstra, L., & Gallagher, R. (2020). Delivering healthcare remotely to cardiovascular patients during COVID-19: a rapid review of the evidence. *European Journal of Cardiovascular Nursing*, *19*(6), 486-494.

O'Doherty, A. F., Humphreys, H., Dawkes, S., Cowie, A., Hinton, S., Brubaker, P. H., Butler, T., & Nichols, S. (2021). How has technology been used to deliver cardiac rehabilitation during the COVID-19 pandemic? An international cross-sectional survey of healthcare professionals conducted by the BACPR. *BMJ Open*, *11*(4), e046051.

Piepoli, M. (2017). 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). *International journal of behavioral medicine*, *24*(3), 321-419. https://doi.org/10.1007/s12529-016-9583-6

Poffley, A., Thomas, E., Grace, S. L., Neubeck, L., Gallagher, R., Niebauer, J., & O'Neil, A. (2017). A systematic review of cardiac rehabilitation registries. *European journal of preventive cardiology*, *24*(15), 1596-1609. https://doi.org/10.1177/2047487317724576

Ramachandran, H. J., Jiang, Y., Tam, W. W. S., Yeo, T. J., & Wang, W. (2022). Effectiveness of home-based cardiac telerehabilitation as an alternative to Phase 2 cardiac rehabilitation of coronary heart disease: a systematic review and meta-analysis. *European journal of preventive cardiology*, *29*(7), 1017-1043.

Ritchie, J., Lewis, J., & O'Connor, W. (2003). Carrying out Qualitative Analysis. In J. Ritchie & J. Lewis (Eds.), *Qualitative research practice: A guide for social science students and researchers* (pp. 220-262). Sage.

Ruku, D. M., Thi, T. H. T., & Chen, H.-M. (2021). Effect of center-based or home-based resistance training on muscle strength and VO2 peak in patients with HFrEF: A systematic review and meta-analysis. *Enfermería Clínica*.

Santiago de Araújo Pio, C., Chaves, G. S. S., Davies, P., Taylor, R. S., & Grace, S. L. (2019). Interventions to promote patient utilisation of cardiac rehabilitation. *Cochrane Database of Systematic Reviews*(2). https://doi.org/10.1002/14651858.CD007131.pub4

Scottish Government. (2021). *Heart Disease Action Plan 2021*. Scottish Government.

Sumner, J., Böhnke, J. R., & Doherty, P. (2018). Does service timing matter for psychological outcomes in cardiac rehabilitation? Insights from the National Audit of Cardiac Rehabilitation. *European journal of preventive cardiology*, *25*(1), 19-28. https://doi.org/10.1177/2047487317740951

Taylor, A., Caffery, L. J., Gesesew, H. A., King, A., Bassal, A.-r., Ford, K., Kealey, J., Maeder, A., McGuirk, M., & Parkes, D. (2021). How Australian health care services adapted to telehealth during the COVID-19 pandemic: a survey of telehealth professionals. *Frontiers in public health*, *9*, 648009.

University Health Network Foundation. (no date). *Health e-University, Virtual Cardiac Rehabilitation (VCR) Program*. Retrieved 30 March 2023] from https://www.healtheuniversity.ca/EN/CardiacCollege/myVCR

Varnfield, M., Karunanithi, M., Lee, C.-K., Honeyman, E., Arnold, D., Ding, H., Smith, C., & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in

postmyocardial infarction patients: results from a randomised controlled trial. *Heart (British Cardiac Society)*, *100*(22), 1770-1779. https://doi.org/10.1136/heartjnl-2014-305783

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet*, *370*(9596), 1453-1457.

Western Health and Social Care Trust. (no date). *Our Hearts Our Minds Virtual Programme*. Retrieved 30 March 2023] from