**Type of submission: Research Article**

**Title: A Qualitative Study of Home-Based and Hybrid Cardiac Rehabilitation During COVID-19**

**Authors:**

Smitha Ganeshan, MD MBA1, Crystal Tse, BS,1 Alexis L Beatty MD, MAS1,2

**Affiliations:**

1 UCSF Department of Medicine, 505 Parnassus Ave, San Francisco, CA 94143

2 UCSF Department of Epidemiology and Biostatistics, 505 Parnassus Ave, San Francisco, CA 94143

**Correspondence:**

Smitha Ganeshan

Mission Hall: Global Health and Clinical Sciences

Box 0560

550 16th Street

San Francisco, CA 94143

Smitha.ganeshan@ucsf.edu

Fax: None

Telephone: 415-476-1000

Keywords: Cardiac rehabilitation, Secondary Prevention, telehealth

**Word Count: 2969**

Tables: 1

Figures: 1

**Supplemental Material**

1. Patient Interview Guide
2. Staff Interview Guide
3. Questionnaires and summary of responses
4. Rapid Analysis Template (final)
5. **Patient Interview Guide**

Thank you for participating in this interview.

Before we begin, do you have any questions?

As a reminder, you can skip questions that you do not want to answer or stop the interview at any time.

The interview will be audio recorded and transcribed so that the research team can review your responses after the interview. We will keep the data we collect confidential, and we will not share your personal information with anyone outside the research team. Is that OK?

*[Start audio recording]*

I started the audio recording. We will now begin with the interview questions.

1. Did you change any of your health habits because of the coronavirus pandemic? If so, how?
	1. Physical activity
	2. Eating
	3. Taking your medications
	4. Managing stress
	5. Tobacco use (if applicable)
2. Did you participate in home cardiac rehab?
	1. If yes – continue with the rest of the interview
	2. If no – Did you talk to any of the cardiac rehab staff about participating in home cardiac rehab? If no – end interview. If yes:
		1. Who did you talk to?
		2. What did you talk about?
		3. What, if any, were your concerns about home cardiac rehab?
	3. If no, end the interview with this question.
3. Tell me about your experience with participating in home cardiac rehab.
	1. How did you hear about it?
	2. Who did you interact with at UCSF?
		1. How was this experience?
	3. What, if anything, concerned you about exercising outside of the cardiac rehab center?
	4. Describe a typical home cardiac rehab session with a provider?
	5. What did you do for exercise?
	6. Did you look at any resources on the internet? If so, what resources were helpful? Not helpful?
	7. Outside of the UCSF staff, did you have any other people supporting you? If so, provide an example of how you were supported.
4. Did you use Zoom for any visits with your CR provider? If yes – Tell me about your experience using Zoom.
	1. What was easy?
	2. What was hard?
5. Did you use the Better Hearts app? If yes -Tell me about your experience using the app?
	1. Describe what happened when you were first introduced to the app.
		1. Who? When? Where? How?
		2. What happened first, second, etc.
		3. What was your initial reaction?
	2. Did you use the app at home?
		1. If yes – tell me about a typical example of using the app at home.
			1. When? Where? What?
			2. Did you need help from anyone to use the app? If yes, please describe.
			3. What did you find most valuable about using the app?
			4. When was the last time you used the app?
		2. If no – what kept you from using the app at home?
6. Did you use the Tiatros program? If yes – Tell me about your experience using Tiatros?
	1. Describe what happened when you were first introduced to the program.
		1. Who? When? Where? How?
		2. What happened first, second, etc.
		3. What was your initial reaction?
	2. Did you use the program at home?
		1. If yes – tell me about a typical example of using the program at home.
			1. When? Where? What?
			2. Did you need help from anyone to use the program? If yes, please describe.
			3. What did you find most valuable about using the program?
			4. When was the last time you interacted with the program?
		2. If no – what kept you from using the program?
7. What can be done to make home cardiac rehab better?
8. Is there anything else important that we haven’t talked about?

*[Generic prompts: If responses are limited or require clarification, probes may be used to elicit more detailed responses. Probes should use words or phrases presented by the participant using one of the following formats:*

*What do you mean by \_\_\_\_\_\_\_?*

*Tell me more about \_\_\_\_\_\_\_?*

*Give me an example of \_\_\_\_\_\_\_?*

*Tell me about a time when \_\_\_\_\_\_\_?]*

Thank you for taking the time to tell us about your experience.

1. **Staff Interview Guide**

Thank you for participating in this interview.

Before we begin, do you have any questions?

As a reminder, you can skip questions that you do not want to answer or stop the interview at any time.

The interview will be audio recorded and transcribed so that the research team can review your responses after the interview. We will keep the data we collect confidential, and we will not share your personal information with anyone outside the research team. Is that OK?

*[Start audio recording]*

I started the audio recording. We will now begin with the interview questions.

1. What steps did your organization take to get home cardiac rehab off the ground?
2. What are all of the things you have to do to start a patient?
* Where in the process were you most likely to get stuck? Why?
* What particular steps led to successful enrollment? Why?
1. Describe what happens in a typical first visit.
2. Describe what happens in a typical weekly visit.
3. What are all of the things you have to do to help a patient use Zoom?
4. What are all of the things you have to do to help a patient use the Better Hearts app?
* Describe the steps for enrolling patients in the program.
* Where are patients most likely to get stuck? Why?
* What steps helped to keep people engaged?
1. Tell me about your experience with the Better Hearts dashboard.
* How did you use it?
* Were other people involved? Who? How?
1. What, if any, other obstacles did you encounter?
2. What, if any, adjustments did you make as time has gone on?
3. Is there anything else important that we haven’t talked about?

*[Generic prompts: If responses are limited or require clarification, probes may be used to elicit more detailed responses. Probes should use words or phrases presented by the participant using one of the following formats:*

*What do you mean by \_\_\_\_\_\_\_?*

*Tell me more about \_\_\_\_\_\_\_?*

*Give me an example of \_\_\_\_\_\_\_?*

*Tell me about a time when \_\_\_\_\_\_\_?]*

Thank you for sharing your experience!

1. **Questionnaires and summary of responses**

Questions rated on 5-point Likert scale

1 – Strongly disagree

2 – Somewhat disagree

3 – Neither agree or disagree

4 – Somewhat agree

5 – Strongly agree

**Patient Better Hearts Questionnaires**

3 reported using and 3 responded to questions.

|  |  |  |
| --- | --- | --- |
| **Statement** | **Construct** | **Summary** |
| I find Better Hearts useful in my daily life. | Performance expectancy | 4.33 |
| I find Better Hearts easy to use. | Effort expectancy | 4.67 |
| People who are important to me think that I should use Better Hearts. | Social influence | 3.33 |
| I have the resources necessary to use Better Hearts. | Facilitating conditions | 5 |
| I have the knowledge necessary to use Better Hearts. | Facilitating conditions | 4.67 |
| Better Hearts is compatible with other technologies I use. | Facilitating conditions | 4 |
| I can get help from others when I have difficulty using Better Hearts. | Facilitating conditions | 4 |
| Using Better Hearts is enjoyable. | Hedonic motivation | 4 |
| Better Hearts is a good value for the money. | Price value | 4 |
| The use of Better Hearts has become a habit for me. | Habit | 4.33 |
| I intend to continue using Better Hearts in the future. | Behavioral intention | 4.33 |
| Using Better Hearts is a good idea. | Attitude | 4.33 |
| I like using Better Hearts. | Attitude | 4.33 |
| How likely are you to recommend Better Hearts to a friend who needs cardiac rehab? (Not likely 1-10 extremely likely) | Net Promoter | 8.67 2 Promoters, 1 Passive |

**Patient Tiatros Questionnaire**

4 reported using and 3 responded to questions.

|  |  |  |
| --- | --- | --- |
| **Statement** | **Construct** | **Summary** |
| I find Tiatros useful in my daily life. | Performance expectancy | 2 |
| I find Tiatros easy to use. | Effort expectancy | 2.33 |
| People who are important to me think that I should use Tiatros. | Social influence | 2.33 |
| I have the resources necessary to use Tiatros. | Facilitating conditions | 4.33 |
| I have the knowledge necessary to use Tiatros. | Facilitating conditions | 2.67 |
| Tiatros is compatible with other technologies I use. | Facilitating conditions | 3.33 |
| I can get help from others when I have difficulty using Tiatros. | Facilitating conditions | 2.33 |
| Using Tiatros is enjoyable. | Hedonic motivation | 2 |
| Tiatros is a good value for the money. | Price value | 2.33 |
| The use of Tiatros has become a habit for me. | Habit | 2 |
| I intend to continue using Tiatros in the future. | Behavioral intention | 1.67 |
| Using Tiatros is a good idea. | Attitude | 2.67 |
| I like using Tiatros. | Attitude | 2 |
| How likely are you to recommend Tiatros to a friend who needs cardiac rehab? (Not likely 1-10 extremely likely) | Net Promoter | 4.673 detractors |

**Staff Better Hearts Dashboard Questionnaire**

5 providers responded to the questionnaire

|  |  |  |
| --- | --- | --- |
| **Statement** | **Construct** | **Summary** |
| I find Better Hearts useful in my job. | Performance expectancy | 4.2 |
| Using Better Hearts increases my productivity. | Performance expectancy | 3.6 |
| I find Better Hearts easy to use. | Effort expectancy | 4 |
| People who are important to me think that I should use Better Hearts. | Social influence | 3 |
| Management has been helpful in the use of Better Hearts. | Social influence | 4.4 |
| The organization has supported the use of Better Hearts. | Social influence | 4.4 |
| I have the resources necessary to use Better Hearts. | Facilitating conditions | 4.8 |
| I have the knowledge necessary to use Better Hearts. | Facilitating conditions | 4.4 |
| Better Hearts is compatible with other technologies I use. | Facilitating conditions | 2.6 |
| I can get help from others when I have difficulty using Better Hearts. | Facilitating conditions | 3.8 |
| Using Better Hearts is enjoyable. | Hedonic motivation | 4 |
| I intend to continue using Better Hearts in the future. | Behavioral intention | 4.2 |
| Using Better Hearts is a good idea. | Attitude | 4.4 |
| I like using Better Hearts. | Attitude | 4 |
| How likely are you to recommend Better Hearts to a colleague? (Not likely 1-10 extremely likely) | Net Promoter | 8.2 3 promoters, 1 passive, 1 detractor |

Note: there was no staff component for Tiatros.

1. **Rapid Analysis Template (final)**

|  |
| --- |
| **General Reflection on Interview** |
|  |

|  |  |  |
| --- | --- | --- |
| **Construct** | **Exemplar Quote(s)** | **Reflection** |
| **Theory of Planned Behavior – use to code for general health behaviors** |
| **Attitudes***Thoughts or feelings about a behavior* |  |  |
| **Beliefs***Acceptance of statements as truths or facts* |  |  |
| **Subjective Norms***Perception that an important person supports a behavior* |  |  |
| **Perceived Behavioral Control***Perception of the ability to perform a behavior* |  |  |
| **Behavioral Intention***Degree to which the subject has a plan to perform the behavior* |  |  |
| **Unified Theory of Acceptance and Use of Technology – use to code for behaviors related to using technology include telephone, Zoom, mobile apps, wearables** |
| **Attitude toward technology***General thoughts or feelings about the technology* |  |  |
| **Performance expectancy***Degree to which using a technology will provide benefits to consumers in performing certain activities* |  |  |
| **Effort expectancy***Degree of ease associated with consumers’ use of technology* |  |  |
| **Facilitating conditions***Consumers’ perceptions of the resources and support available to perform a behavior* | . |  |
| **Social influence***Extent to which consumers perceive that important others believe they should use a particular technology* |  |  |
| **Habit***Extent to which an individual believes the behavior to be automatic* |  |  |
| **Price value***Consumers’ cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them* |  |  |
| **Hedonic motivation***The fun or pleasure derived from using a technology* |  |  |
| **Technology use intention***Degree to which the subject has a plan to use a technology* |  |  |
| **COVID-19** |  |  |
| **Isolation***Statements about feeling isolated or alone*  |  |  |
| **Fear***Statements about fear of virus or circumstances* |  |  |
| **Disruption in Life Activities***Changes in patterns for life activities (e.g., grocery shopping)* |  |  |
| **Cut-off from CR***Statements about abrupt end of CR or loss of contact with program* |  |  |
| **Consolidated Framework for Implementation Research** |
| **Intervention Characteristics** |
| **Intervention source***Perception of key stakeholders about whether the intervention is externally or internally developed* |  |  |
| **Evidence strength and quality***Stakeholders perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes* |  |  |
| **Relative advantage***Stakeholders’ perception of the advantage of implementing the intervention versus an alternative solution* |  |  |
| **Adaptability***The degree with which an intervention can be adapted, tailored, refined, or reinvented to meet local needs* |  |  |
| **Trialability***The ability to test the intervention on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted* |  |  |
| **Complexity***Perceived difficulty of the intervention, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement* |  |  |
| **Design quality and packaging***Perceived excellence in how the intervention is bundled, presented, and assembled* |  |  |
| **Cost***Costs of the intervention and costs associated with implementing the intervention including investment, supply, and opportunity costs* |  |  |
| **Outer Setting** |
| **Patient needs and resources***The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritized by the organization* |  |  |
| **Cosmopolitanism***The degree to which an organization is networked with other external organizations* |  |  |
| **Peer pressure***Mimetic or competitive pressure to implement an intervention, typically because mose or other key peer or competing organizations have already implemented or are in a bid for a competitive edge* |  |  |
| **External policies and incentives***A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting* |  |  |
| **Inner Setting** |
| **Structural characteristics***The social architecture, age, maturity, and size of an organization* |  |  |
| **Networks and communications***The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization* |  |  |
| **Culture***Norms, values, and basic assumptions of a given organization* |  |  |
| **Implementation climate***The absorptive capacity for change, shared receptivity of involved individuals to an intervention, and the extent to which use of that intervention will be rewarded, supported, and expected within their organization* |  |  |
| **Tension for change***The degree to which stakeholders perceive the current situation as intolerable or needing change* |  |  |
| **Compatibility***The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals’ own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.* |  |  |
| **Relative Priority***Individuals’ shared perception of the importance of the implementation within the organization* |  |  |
| **Organizational incentives and rewards***Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary, and less tangible incentives such as increased stature or respect* |  |  |
| **Goals and feedback***The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals* |  |  |
| **Learning climate***A climate in which a) leaders express their own fallibility and need for team members’ assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation* |  |  |
| **Readiness for implementation***Tangible and immediate indicators of organizational commitment to its decision to implement an intervention* |  |  |
| **Leadership engagement***Commitment, involvement, and accountability of leaders and managers with the implementation* |  |  |
| **Available resources***The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time* |  |  |
| **Access to knowledge and information***Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks* |  |  |
| **Characteristics of Individuals** |
| **Knowledge and beliefs about the intervention***Individuals’ attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention* |  |  |
| **Self-efficacy***Individual belief in their own capabilities to execute courses of action to achieve implementation goals* |  |  |
| **Individual stage of change***Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention* |  |  |
| **Individual identification with organization***A broad construct related to how individuals perceive the organization, and their relationship and degree of commitment with that organization* |  |  |
| **Other personal attributes***A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style* |  |  |
| **Process** |
| **Planning***The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance, and the quality of those schemes or methods.* |  |  |
| **Engaging***Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities* |  |  |
| **Opinion leaders***Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention* |  |  |
| **Formally appointed internal implementation leaders***Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role* |  |  |
| **Champions***Individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization* |  |  |
| **External change agents***Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction* |  |  |
| **Executing***Carrying out or accomplishing the implementation according to plan* |  |  |
| **Reflecting and evaluating***Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience* |  |  |
| **Emergent** |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |