"Heart-track" cardiac rehabilitation device prototype designed for exercise training post coronary revascularisation: an usability study

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ABSTRACT:

BBackground: Percutaneous Coronary Intervention (PCI) is a common surgical procedure for heart attack patients. International guidelines recommend that all patients complete phase two (outpatient) cardiac rehabilitation (CR) after PCI, as it plays a critical role in reducing five-year cardiovascular mortality and the risk of cardiovascular-related hospital admission. Patients in our institution have suboptimal exercise compliance and effectiveness during cardiac rehabilitation. Root cause analysis identified 'lack of commitment', 'lack of care monitoring and continuity' and 'lack of motivation and engagement' to be key contributing factors. Yet, healthcare resource limitations necessitate innovation for care continuity and patient engagement. "Heart-track", a novel, app-based innovation was created. By 'game-ifying' cardiac rehabilitative exercise training program, "Heart-track" guides and tracks cardiac rehabilitation at home at patient's comfort.

Purpose: To explore experiences of app usability in terms of content, functionality and design of the prototype "Hearttrack" app to improve user experience.

Methods: Twelve community-dwelling adults who are also active member of cardiac rehab support group, aged above 50, and undergone coronary revascularization for acute myocardial infarction at least 1 year before were recruited. Participants were introduced to "Heart-Track" mobile app system and its navigational characteristics with standardised instructions. Each participant then performed a self-directed Cardiac rehabilitation session using the app. Participants rated their experience with the hardware and software components of "Heart Track", and their acceptance of it as a cardiac rehabilitation tool. Descriptive analysis of quantitative responses was analysed using IBM SPSS software version 19.0 (Armonk, NY: IBM Corp).

Results: Twelve participants (1 female), 68.08 ±5 years old were included. All participants had no chest pain or shortness of breath at rest or during activity when recruited. 91.7% had participated in conventional cardiac rehabilitation programs. There were three participants (25.0) who had no internet connections; nonetheless, eleven of them used a smartphone with 33.3% among them had used for more than ten years. Among the eleven participants who used smartphone, there were 83.3% of them used mobile application as well, and more than half of them used mobile application less than 10 years. It was observed that the engagement mean score, functionality mean score and Aesthetics mean score of the Mobile Application Rating Scale (MARS) were equal or more than three in average (Mean (SD) for Engagement mean

score: 3.17 (0.44), Functionality mean score: 3.46 (0.47); Median (IQR) for Aesthetics mean score: 3.00 (1.00)), indicating a reasonably positive feedback for the three respective sections. It was also interesting to see that there were two participants reported that they would not recommend the application to anyone, while the rest would recommend the application to at least few people or more who might benefit from it.

For the system, although majority of the participants agreed that the application was easy to learn, there were 3 participants who felt that the software was difficult to learn. Almost all of them can navigate the application easily (91.7%). It was interesting to see that there were almost equal proportion on the participants who agreed and disagreed that the application was enjoyable (agree vs disagree: 58.3% vs 41.7%), the organisation interfaces was clear (agree vs disagree: 33.3% vs 66.6%) and they could recover easily when error was made (agree vs disagree: 58.3% vs 41.7%). The overall satisfaction with Heart-Track is 2.85/5. 75% of the participants agreed that the app helped them to exercise at higher intensity. On average, each participant played 4 sessions within a week.

Conclusions: *Majority of participants responded favourably and found the software system easy to use. Majority founds application was easy to learn, however, the app interfaces and error recovery need to be further improved. As expected, participants' responses were neutral for overall satisfaction. Despite this, most of the participants reported that they were rather comfortable using the mobile application for exercising, and they also agreed that the application had helped them to exercise at a higher intensity.*

Implications: *This pilot study helps us understand how healthy, Asian older adults perceive the use of novel innovative applications like "Heart-Track". Overall response to hardware and software features of "Heart-Track" was favourable. Further analysis of participants' qualitative feedback would be valuable for prototype refinement of "Heart Track", before our upcoming clinical study. Further demographic analysis will also help us identify what kind of patient is suitable and prefer.Mr. Ashton Neoh Eng Chuan is a senior physiotherapist from Tan Tock Seng Hospital (TTSH), Singapore with extensive clinical experience in in-patient orthopedic setting and out-patient musculoskeletal clinic. He has a master's in clinical Physiotherapy (manipulative therapy) from Curtin University, Australia and has been actively involved in clinical research, clinical data collection and analysis. He is the primary investigator, co-inventor, or co-investigator in many innovation researches and received funding's to run those researches. He is also the Innovation Champion of the TTSH physiotherapy department and clinical lead for the Singapore National Healthcare Group (NHG) Center of Medical Technology Innovation (cmti).*

BIOGRAPHY

Mr. Ashton Neoh Eng Chuan is a senior physiotherapist from Tan Tock Seng Hospital (TTSH), Singapore with extensive clinical experience in in-patient orthopedic setting and out-patient musculoskeletal clinic. He has a master's in clinical Physiotherapy (manipulative therapy) from Curtin University, Australia and has been actively involved in clinical research, clinical data collection and analysis. He is the primary investigator, co-inventor, or co-investigator in many innovation researches and received funding's to run those researches. He is also the Innovation Champion of the TTSH physiotherapy department and clinical lead for the Singapore National Healthcare Group (NHG) Center of Medical Technology Innovation (cmti).