

Project Title

Digital Transformation: Cardiac Rehabilitation Anytime Anywhere with Heart-Track™

Project Lead and Members

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Organisation(s) Involved

Tan Tock Seng Hospital

Healthcare Family Group Involved in this Project

Allied Health, Medical, Nursing, Healthcare Administration

Specialty or Discipline (if applicable)

Physiotherapy, Cardiology, Population Health

Aims

To develop a strategy that would focus on:

- Patient empowerment: with knowledge and ability
- Patient motivation: removing barriers, positive reinforcement
- Lifestyle incorporation: embracing CR as a lifestyle change, not just a therapy
- Safety & Effectiveness

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below

Lessons Learnt

We started the journey with an invitation to change, by interviewing CR support group members to understand their pain points with traditional CR programmes and inviting them to participate in prototype development. We provided one-to-one training to our patients to use Heart-Track™. Early engagement and adequate guidance are critical to build trust and confidence in patients to start using something novel.

One of the greatest challenges faced was the change from a traditional clinic-based CR to a virtualized version. We ensured the various stakeholders were engaged through meaningful conversations. We sought to understand the stakeholders' perspectives before making any key decisions.

Conclusion

See poster appended / below

Additional Information

- 2020 National Healthcare Innovation and Productivity (HIP) Best Practice Medal – Automation, IT & Robotics Innovation

Many have commented healthcare is a slow adopter of digital solutions. We believe that “digitisation” in healthcare has to be created with value or meaning to remain sustainable. Healthcare transformation can only be done by first identifying the clinical

gaps and needs, then considering how digitalisation can be integrated with an overall care redesign approach for sustained change.

Digital transformation is a long but definitive journey. Resilience is the key to persevere through the highs and lows of the journey. It is also important to gather input from clinicians and collaborators to achieve collective success in the transformation journey.

Project Category

Technology, Digital Health, Mobile Health, Digital Apps, Sensors, Wearables, Care & Process Redesign, Quality Improvement, Design Thinking

Keywords

Heart-Track, Cardiac Rehabilitation Anytime Anywhere, Exercise Training, Coronary Revascularisation, Patient Empowerment, Collaborative Care

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IMPETUS FOR CHANGE

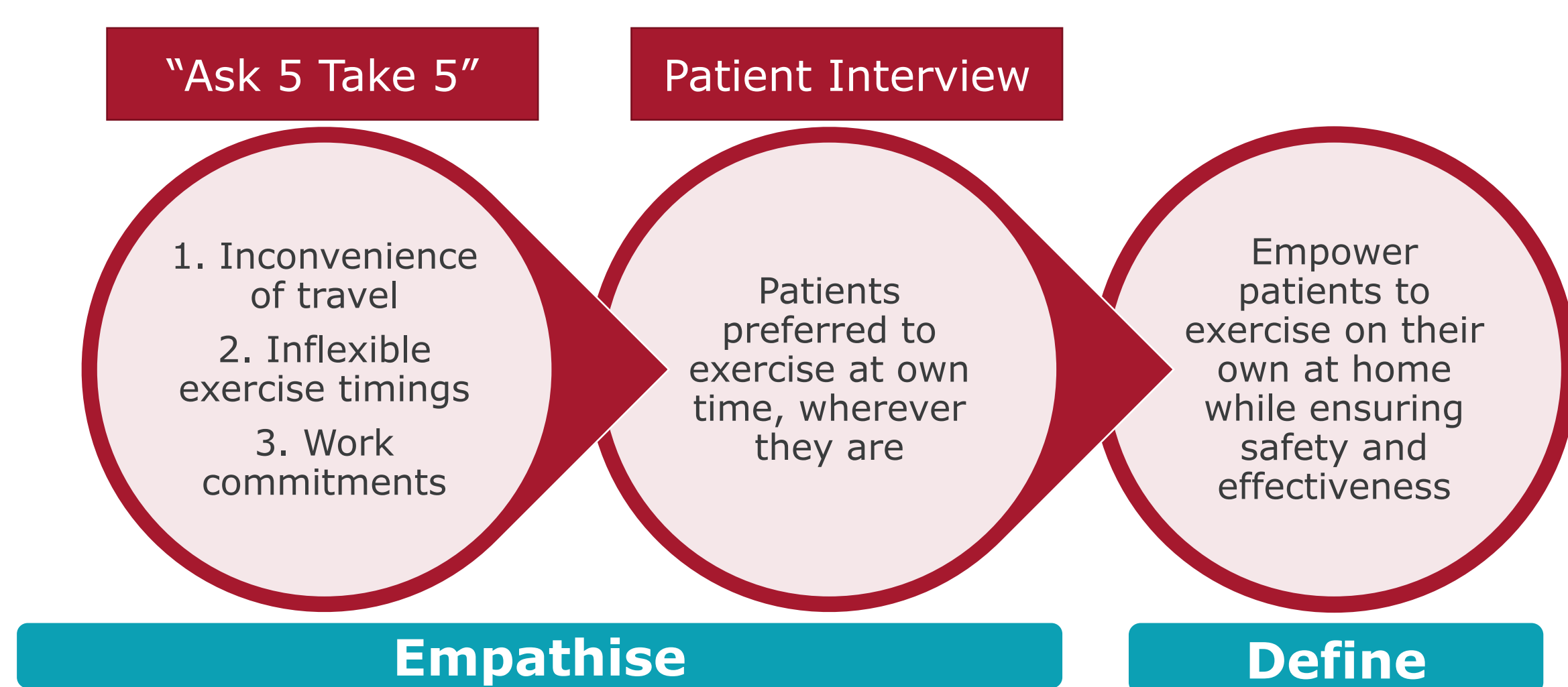
With a rapidly ageing population and the growing burden of chronic diseases, the Singapore healthcare system is strained with an increase in manpower demand for healthcare professionals. Given the shrinking national workforce, there is an urgent need to develop an innovative and sustainable solution while levelling the growing healthcare costs and upholding good healthcare standard and clinical outcomes.

In recent years, advancement of smartphone technology has resulted an exponential increase of smartphone ownership and transformation of business model in many industries. This gave us an opportunity to explore the use of digitalisation in the healthcare industry, to ensure accessible, sustainable and affordable healthcare. The need for digitalisation was further amplified recently during the COVID-19 circuit breaker period.

REASON FOR ACTION

Exercise training is a cornerstone of cardiac rehabilitation (CR), which is strongly recommended for patients after undergoing coronary revascularisation. Patients who attend CR have reduced cardiovascular mortality and better quality of life. Furthermore, it has been evidently shown that for every three patients who undergo CR, one patient does not get readmitted into a hospital for a repeat cardiac event. The ability to perform exercise regularly, safely and effectively is crucial in achieving these benefits.

Data from 2016 to 2018 revealed a low take up rate of CR as well as a downward trend in TTSH. This increases the risk of an imminent cardiac event, potentially increasing burden to the healthcare system, amplifying the need to be future-ready. With this in mind, we embarked on the Design Thinking Process to understand this problem better from the patient perspective (**Empathise**) and to deep dive into how we can empower patients to exercise on their own (**Define**).



INTERVENTION / INNOVATION

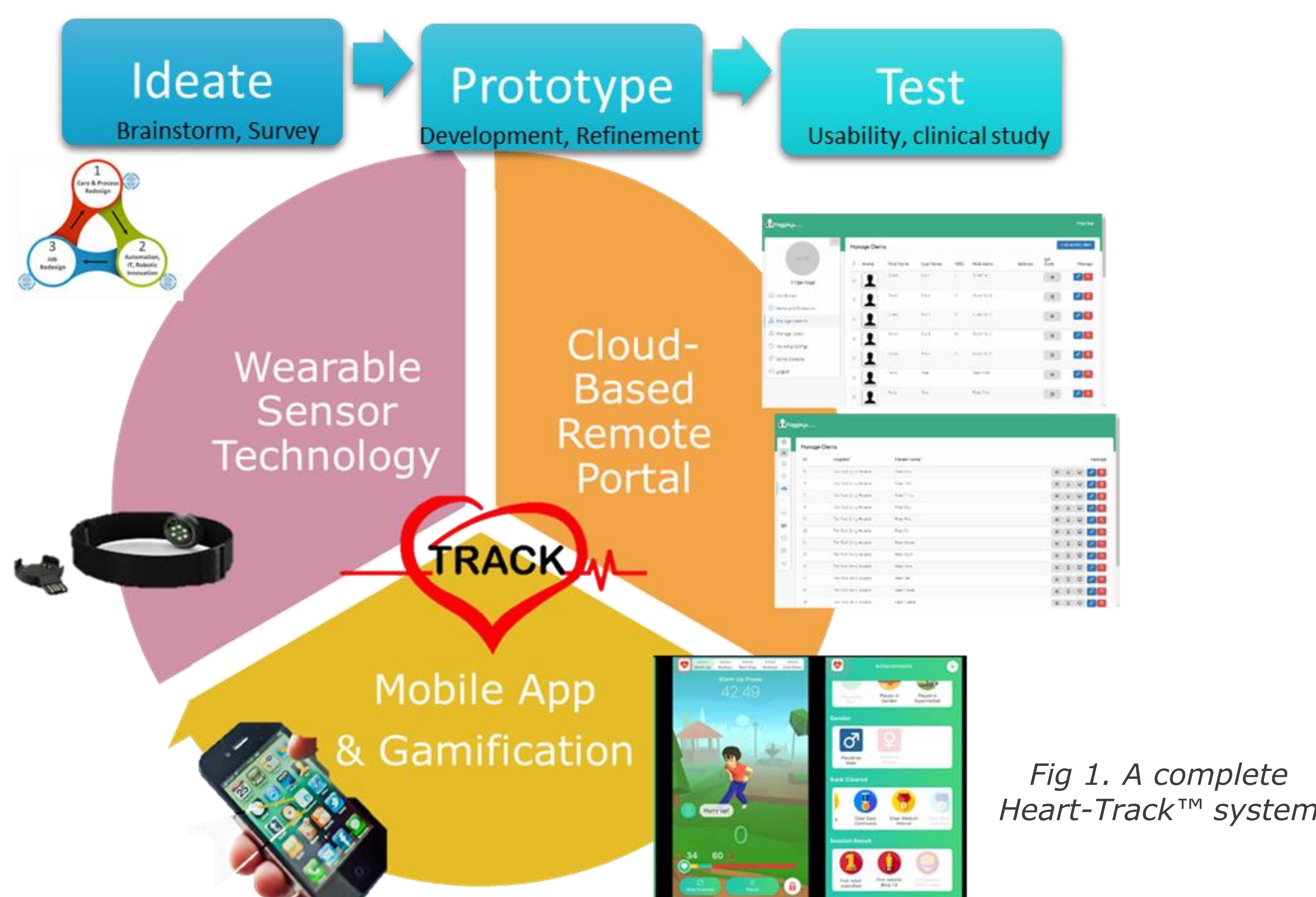


Fig 1. A complete Heart-Track™ system

Ideate: We took reference to TTSH's Innovation Cycle, brainstormed and decided on using Information Technology & automation as our solution. Through a survey, 80% patients prefer using digital solution for CR. Hence, we recognised digitalisation would bring better value to our patients.

Prototype: Heart-Track™ consists of (1) Heart rate (HR) sensor which provides continuous monitoring for safety and effectiveness; (2) Mobile app which delivers personalised CR with inbuilt algorithm for automated exercise prescription and progression; (3) Web portal for remote monitoring; (4) Gamification components to make CR enjoyable to increase exercise compliance (Fig. 1).

INTERVENTION / INNOVATION

Test: We tested different HR sensors in the market and identified a validated and reliable sensor. With the minimally viable prototype, we conducted a feasibility study in August 2018 with CR support group participants to test user friendliness and satisfaction. We further refined the prototype based on their feedback. With this prototype, we embarked on a non-inferiority randomised controlled trial comparing safety and effectiveness between conventional centre-based CR and digitalised CR.

Beyond an IT innovation: Heart-Track™ seeks to revolutionize how health programs can be conducted. Leveraging on wearable technology, mobile app and gamification principles, CR can now be safely and effectively done in the comforts of patient's home and environment while retaining a high element of personalized care. Yet beyond a tech innovation, Heart Track positions itself as a Care Redesign initiative – through a carefully designed patient-activation model, it strives to re-set the heavy reliance on healthcare workers to deliver care, shifting the equation towards patient-led, collaborative care.

RESULTS/ IMPACT OF CHANGES

From our clinical study, preliminary results showed Heart-Track™ is non-inferior to conventional centre-based CR programme in terms of clinical effectiveness and safety with no adverse events reported throughout its use. Overall, 83% of users rated satisfied or very satisfied with Heart-Track™ and they would recommend it to others.

We adopted the "Quadruple Aim Model" (Fig. 2) to measure the impact of change.

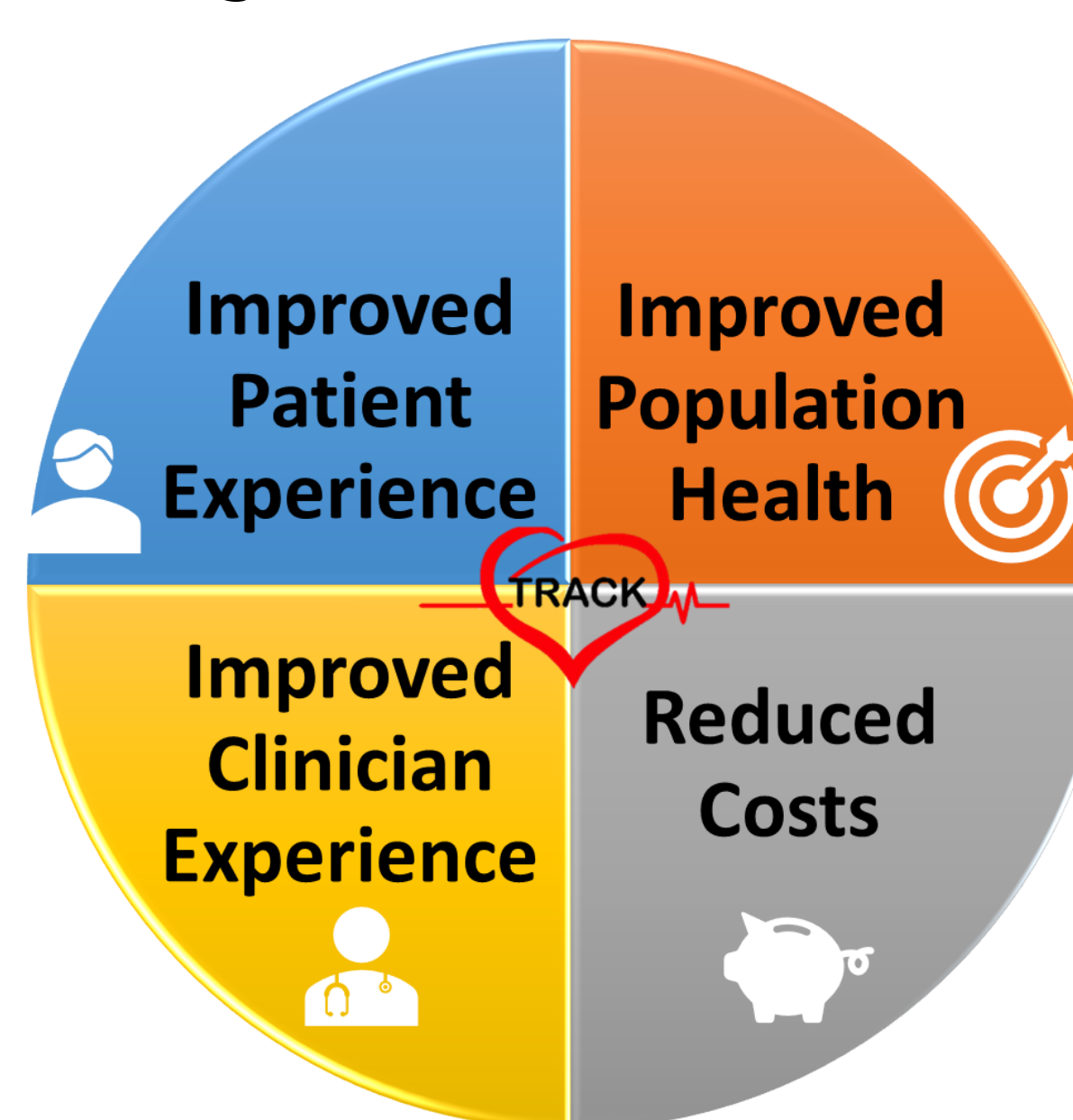


Fig 2. Quadruple Aim Model

Improved Patient Experience

Patients preferred Heart-Track™ as they could exercise safely and effectively anytime anywhere at their convenience. They felt empowered to do self-directed CR through the support of Heart-Track™ and remote monitoring from clinicians.

Improved Population Health

With improved access, compliance and CR enrolment using Heart-Track™, we can improve the outcome and quality of life of the whole patient population and empower them to continue to live well and be active in the community.

Reduced Costs

As a low cost ground up innovation, Heart-Track™ is built to be a cost-efficient option for patients. For patients, instead of paying \$230 for 12 centre-based CR sessions, they can use Heart-Track™ with a minimal cost for an unlimited number of sessions, without incurring transportation cost or needing to apply for time-off from work. Annually, there are 700 patients who require CR service in TTSH. With 70% of patients who are assessed to be suitable and agreeable with Heart-Track™, it translates to an annual indirect cost savings of \$82,320 for physiotherapist manpower.

Improved Clinician Experience

Heart-Track™ has transformed the conventional CR delivery model which relies heavily on clinicians to a future proof digitalized and automated model. This allows clinicians to work efficiently and focus on complex patients. Furthermore, Heart-Track™ allows clinicians to reach out and deliver care to patients with CVD beyond the hospital walls.

EFFECTS OF CHANGES

Heart-Track™ is the first digital prescription and monitoring system that has proven clinical effectiveness and safety in Southeast Asia. It helps to bridge the gap of low CR enrolment and it has potential to cater to a future increase in healthcare demands. In the near future, Heart-Track™ can be the gold standard digitalized model of care in the management of other chronic diseases such as diabetes to empower patients, attain improved health outcomes and improve quality of life through positive health behavioural change.

SPREAD CHANGES

This novel initiative is expected to spread to other institutions and develop a "One Heart-Track™ Care Network" with community partners. With digitalization, we can lower the barriers of entry for community partners to start their own stage 2 CR service. We envision a "Hub & Spoke" model where acute hospitals are the "Hub" to train, support, and distribute Heart-Track™ to the "Spoke" who are the community partners, to manage CR patients who require physical CR classes with community care teams. Together, we can benefit larger patient population in the community.