

BMJ Open Qualitative study of the views of people living with cardiovascular disease, and healthcare professionals, towards the use of a digital platform to support cardiovascular disease self-management

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ABSTRACT

Objectives This paper focuses on formative research as part of a broader study to develop and evaluate an innovative digital health platform for the self-management of cardiovascular disease (CVD). The primary objective is to better understand the perceptions of key stakeholders towards the proposed platform (Salvio) and to identify the development considerations they may prioritise based on their own experiences of CVD management.

Design A qualitative research study using thematic analysis to explore patterns and themes within the various participant contributions.

Setting Triangulation of data collection methods were used to generate data, including focus group discussions, semistructured interviews and guided conversations.

Participants Participants (n=26) were people with a diagnosis of CVD (n=18) and relevant healthcare professionals (n=8).

Results Findings indicate that the proposed platform would be a beneficial solution for certain groups whose health behaviour change is not currently supported by discrete solutions. Both participant groups perceive the digital health platform more trustworthy than accessing multiple interventions through unsupported digital repositories. Healthcare professionals agreed that they would endorse an evidence-based platform that had been rigorously developed and evaluated. CVD participants prioritised a decision support tool to guide them through the platform, as they perceive an unstructured approach as overly complex. Both participant groups perceived data sharing with certain self-selected individuals (eg, spouse) to be a useful method for gaining support with their health behaviour change.

Conclusions A digital health platform offering a variety of existing, evidence-based interventions would provide users with suitable self-management solution(s) based on their own individual needs and preferences. Salvio could be enhanced by providing adequate support to platform users, guiding the diverse CVD population through a host of digital solutions, ensuring that Salvio is endorsed by trusted healthcare professionals and maintaining connections with usual care. Such a platform would augment existing self-management and secondary prevention services.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Insight gained from multiple stakeholder groups.
- ⇒ Triangulation of methods used for data collection.
- ⇒ Used convenience sampling and users were invited to participate in more than one phase of data collection.
- ⇒ End users, people living with cardiovascular disease (CVD), were not part of the initial conceptualisation of the platform, for example, formulating research questions.
- ⇒ Ethnicity or electronic health literacy of people living with CVD was not collected during phase 1 data collection. Exclusion of healthcare professionals from phase 2 of data collection.

INTRODUCTION

Cardiovascular disease (CVD), including coronary heart disease, is the leading cause of death and disability worldwide.^{1,2} Lifestyle-related health behaviours such as physical inactivity, unhealthy eating, hazardous alcohol use and smoking have been shown to contribute to the development of CVD.^{3–5}

Lifestyle modification is essential for the secondary prevention of CVD. Secondary prevention includes those preventive measures that lead to early diagnosis and prompt treatment of a disease. Recommended lifestyle changes for CVD secondary prevention can include starting and maintaining regular exercise, eating a heart-healthy diet, stopping smoking, adhering to prescribed medication regimens and attending medical appointments. Adhering to recommended lifestyle changes through the self-management of health behaviours is associated with a lower risk of recurrent, adverse cardiovascular-related events and reduced hospital admissions.^{6,7}

Secondary prevention for CVD typically involves referral to structured cardiac



rehabilitation programmes, which exist in hospitals and community centres.^{4 8 9} The structure, length and type of programme offered differs widely by country.¹⁰ Cardiac rehabilitation is a face-to-face multifaceted approach, which aims to support people to foster life-long secondary prevention of CVD through improved self-management.^{9 11} Cardiac rehabilitation involving delivery of exercise, health behavioural support, medication regimens, and risk factor management can reduce recurrent cardiac-related events and all-cause mortality.^{11 12} Despite proven effectiveness, participation in face-to-face programmes is reportedly as low as 10%–30% worldwide.^{10 13 14} Various accessibility, operational and personal barriers have been linked with reduced initiation, adherence and completion rates.^{15–21}

In response to issues of low uptake and adherence to in-person cardiac rehabilitation, flexible home-based digitally supported CVD management has been offered as an evidence-based alternative.²² This approach supports individuals to self-manage their condition away from the hospital environment while effectively improving health outcomes.^{23 24} There are a diverse range of home-based digital health interventions available to help people to self-manage CVD, including web-based programmes, mobile health, telehealth, wearable devices or remote monitoring.^{25–28} Meta-analyses of digital health interventions for CVD management have indicated beneficial effects on the risk of CVD-related outcomes (eg, incidence of myocardial infarction, hospitalisation and all-cause mortality)^{28 29} as well as improvements in CVD-related health behaviours (eg, physical activity, diet).^{30 31}

While there are many digital health solutions available to support CVD management, these existing approaches often have narrow or even singular focuses. This requires people to search for and use multiple solutions to address all components of optimal CVD self-care. In order to address a variety of care needs, currently users are required to engage with multiple discrete digital interventions, which can be burdensome and lead to discontinuation of use.³² A more tailored and individualised approach to digital health could simplify the process of accessing comprehensive self-care tools and enable people with CVD to integrate digital health with their current lifestyle.³³ Furthermore, the use of multiple discrete digital interventions presents difficulties in the organisation and presentation of personal health-related data when self-managing one (or multiple) chronic condition(s).

In response to this challenge, we have proposed a unifying platform that hosts a digitally supported palette of evidence-based health interventions and incorporates a guidance tool to optimise personal relevance and user experiences by helping users find interventions that suit their current needs and preferences.^{25 34} This is of particular importance to people with complex long-term conditions such as CVD who are challenged to manage multiple health behaviour changes and care components. The concept of a unifying digital health platform was informed by behaviour change theoretical frameworks, existing digital health research and expert opinion of

contributing researchers.^{25 34} A recent systematic review³⁴ identified that no such platform currently exists, thus the characteristics of such a platform that would benefit people living with CVD and their treating healthcare professionals are unknown.

Engaging with people who have a lived experience of self-managing CVD can provide insight on the challenges they face on a daily basis and how they address those challenges. Exploring the views of those with a lived experience of CVD enables us to consider what is required to produce meaningful and relevant support solutions. It is essential for those who are designing and developing digital health solutions to remain focused on what matters most for end users, which requires effective communication of users' needs and the collection of adequate information to inform platform development.

Healthcare professionals also play a critical role in supporting their patients to self-manage their condition. Gathering opinions of healthcare professionals with experience in cardiac rehabilitation and supporting patients' CVD self-management will provide powerful contextual influence to enhance platform development.

This study describes the formative research undertaken to inform the digital health platform (termed *Salvio*). This study aimed to explore the needs of people living with CVD in relation to the proposed digital platform and to identify platform features that people living with CVD would prioritise for *Salvio*. Second, this study aimed to explore health professionals' perceptions towards the use of a digital health platform, providing context as supporters of people living with CVD and key stakeholders in cardiac rehabilitation.

METHODS

An iterative research approach was used to ensure that *Salvio* was appropriate for individuals with CVD, the healthcare professionals that are treating them and the organisational context in which they were receiving care.^{35–37} Multimedia online supplemental appendix 1 provides a map of the digital health platform. A vignette in multimedia online supplemental appendix 2 captures the potential use of the digital health platform for John, a hypothetical person currently living with CVD.

Study participants

Participants included people living with CVD (users) and healthcare professionals. Eligibility criteria for users included being an adult (≥ 18 years) with a documented clinical diagnosis of CVD, community dwelling outpatients (ie, clinically stable, not inpatient), have access to the internet and be able to read/understand English. Healthcare professional participants had experience with CVD management in areas such as allied health, cardiology and CVD research.

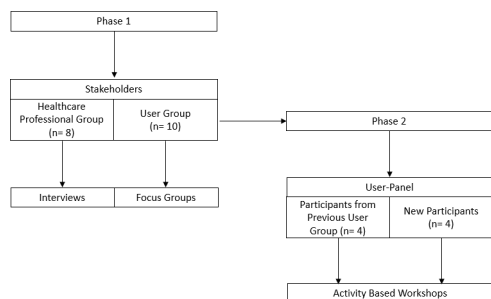


Figure 1 Participant recruitment and participation throughout phases 1 and 2 of data collection.

Recruitment

Purposive and snowball sampling was used to ensure that data were collected from an informed population group who had experienced CVD management. People living with CVD were recruited via word-of-mouth and promotional flyers (multi-media online supplemental appendix 3) at community-based cardiac-related health services, such as cardiac rehabilitation and clinical exercise centres in metropolitan areas of Victoria. Flyers were placed on noticeboards or at the facility entrance. Potential participants contacted the researchers directly via phone or email. People living with CVD who had taken part in previous research and provided consent to be contacted about related future studies were prospectively contacted by researchers. These recruitment strategies were used for both research phases. Furthermore, phase 2 involved recruitment of people living with CVD who had participated in phase 1 and provided informed consent to be contacted about future research. Healthcare professionals were recruited via clinical network contact and word of mouth. A plain language statement was provided to all potential participants, and written informed consent was obtained from all participants prior to data collection. Each participant received a voucher to compensate their time (\$A20). Data were deidentified to address issues of confidentiality. [Figure 1](#) outlines the

recruitment and involvement of participants through all phases of data collection.

Patient and public involvement

This paper draws on the benefits of designing digital health solutions *with* end users, giving due consideration to their proactive engagement throughout the project. User participants were involved in group meetings, decision making and providing feedback on findings as they emerged. They were invited to participate in more than one phase of data collection, which provided them with a greater understanding of the research objectives and processes.³⁸ Phase 2 data collection (activity-based workshops) were developed and informed by the lived experiences of participants.

Data collection

A dual-phase qualitative method study design was used, in which there was a dynamic shift from design and development *for* the user (phase 1) and to design and development *with* the user (phase 2) ([table 1](#)). Phase 1 included a user-centred approach to design and development, whereby users and healthcare professionals were consulted on their needs and preferences. Iterative, user-centred approaches to inform digital intervention design *for* users are widely supported by existing literature.^{39 40} Phase 2 involved platform codesign *with* users, harnessing the unique expertise and lived experience of each individual through participation in activity-based workshops. This research approach has the potential to shorten the communicative distance between researchers and users and advocates an ongoing process of iterative development and evaluation.⁴¹

Phase 1

User group participants took part in focus groups lasting between 60 and 90 min, with ~4 participants per group

Table 1 Outline of data collection procedures

Method	Participants	Data collected	Analysis
Phase 1			
Focus groups	User group	Audio recorded conversations led according to the following themes: current management, type of information, delivery of information, messaging and prompts, delivery method of education, medical information and access, connection to health professional, barriers.	Thematic (inductive)
Semistructured interviews	Healthcare professionals (HPs)	Audio recorded phone-based, one-on-one interviews. Led by questions relating to the following five topics: previous experiences of digital health, supporting patient self-management, valuable features/ functions, digital self-management, access, barriers to use of digital platform.	Thematic (inductive)
Phase 2			
Activity-based workshops	User panel	Guided conversations during platform-design brainstorming were audio recorded. Design and development considerations were discussed to better understand the potential value of the platform for everyday use and incorporation of platform to achieve individual healthcare objectives.	Thematic (deductive)

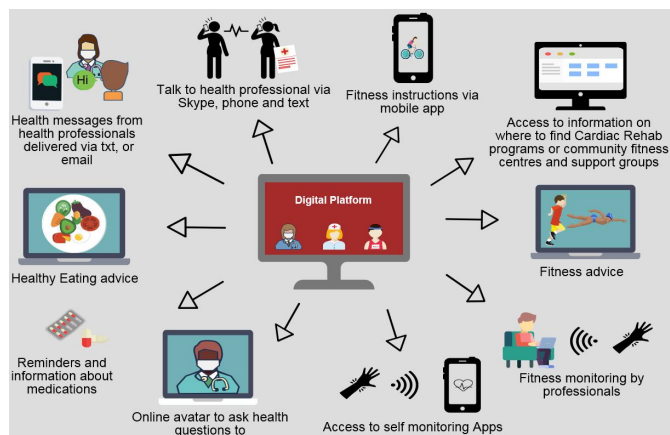


Figure 2 Focus group infographic guide to Salvio digital platform.

(multimedia online supplemental appendix 4). In this study, a digital platform was defined for the participants as a comprehensive online system that offers a range of different support programmes for self-managing their condition, such as online access to healthcare professionals and health-related apps. Participants were also shown an infographic during the focus group (figure 2) to further explain the concept of Salvio and prompt for discussion. The semistructured group discussion (multimedia online supplemental appendix 4) was facilitated and audio-recorded by a research assistant (female, masters qualified) and the recordings were subsequently transcribed and thematically analysed. Sociodemographic characteristics of the user group participants were collected, including age, gender, CVD-related diagnosis and residential suburb.

Semistructured one-on-one interviews were used to elicit healthcare professionals' perceptions and priorities for the Salvio platform. An interview guide was developed (multimedia online supplemental appendix 4), informed by the research questions and a review of pertinent literature. Career-related demographic information was collected from healthcare professionals, including gender, discipline area of expertise and workplace suburb.

Phase 2

Four activity-based workshops were conducted, each 2–3 hours in length. The workshops were audio-recorded. Each session was attended by the lead PhD researcher (SAT), two users and at least one representative from the technology team working on the platform development. This collaborative group engaged in participatory research design activities (table 1, multimedia online supplemental appendix 4), which were used to stimulate discussion and inspire design ideas. Activities were derived from literature pertaining to multiple disciplines, such as participatory design research^{35 42} and user experience design (eg, card sorting, context mapping). Specific to the study aims, the method of using explorative activities such as context mapping, enabled us to fulfil objectives of the study. For example, context mapping is an approach

to design in which people's everyday lives and experiences are used to inform ideation. Users and designers work together on the basis of expertise, that is, developers are experts of the innovation process and users are experts of their own experiences. Explorative techniques are used to learn about the needs, wishes, motivations and experiences, making use of qualitative research, analysis and conceptualisation methods. The specifics of the different activities undertaken are described elsewhere.⁴³ Guided conversations that emerged during these workshops were transcribed by the lead researcher (SAT), and a deductive thematic analysis of the data was conducted.

Data analysis

A systematic thematic analysis of the data was conducted to produce a qualitative description of the participants' viewpoints. The systematic process outlined by Braun and Clarke⁴⁴ guided the thematic analysis through five stages: data familiarisation, generation of initial codes, searching and reviewing themes, defining the themes and producing this report. The chosen methodological approach used a hybrid process of qualitative inductive and deductive thematic analyses to interpret the raw data. In phase 1, an inductive, data-driven approach was used where themes were derived from the raw data and not strictly governed by the specific questions asked.⁴⁴ Coding categories and subcategories were allocated by the lead researcher (SAT) using NVivo V.12 data management software to the saturation point at which no new codes occurred within the data. Themes and quotes were assimilated to draw conclusions. This process was then followed by a deductive analysis of phase 2 data, based on the patterns and themes derived from phase 1 analysis.⁴⁴ Using the phase 1 coding structure to deductively analyse phase 2 data further enriched phase 1 results.

RESULTS

A total of 26 participants contributed to this qualitative inquiry (table 2) and ~17 hours of audio recordings were analysed. User participants (n=18) ranged in age between 57 and 81 years, and five (27%) reported managing another chronic condition in addition to their CVD (eg, chronic renal failure, type II diabetes). Healthcare professional participants (n=8) included a range of experts who were predominately female (75%).

As outlined in table 3, three themes and seven subthemes formed the coding framework for analyses. Participant perceptions of Salvio were grouped according to barriers and facilitators for use, and data on prioritised platform features were collated. Findings from the various participant contributions are presented further.

Facilitators

Users and healthcare professionals identified a number of digital platform characteristics which could positively influence CVD self-management. They felt the platform could improve accessibility to self-management 'support'

Table 2 Participant demographics

Participants	Gender (%female)	Age (years) mean (\pm SD)	Mean decile of relative socioeconomic disadvantage index for local government area (\pm SD)
Phase 1 user group (n=10)	40	69.6 (\pm 6.9)	10 (\pm 0.4)
Phase 2 user panel (n=8)	50	68.3 (\pm 6.8)	9.5 (\pm 0.7)
Participants	Gender (% female)	Expert knowledge areas/vocations	Mean decile of relative socioeconomic disadvantage index for local government area (workplace) (\pm SD)
Healthcare professionals (n=8)	75	<ul style="list-style-type: none"> ▶ Cardiac rehabilitation nurses. ▶ Medical doctors. ▶ Cardiologists. ▶ Physiotherapists. ▶ Senior researchers in CVD management. ▶ Executive committee members from internationally recognised CVD governing bodies and associations. 	8.5 (\pm 1.4)

CVD, cardiovascular disease.

in situations where face-to-face programmes were unavailable.

HP2: ‘there is, for certain groups of people, a benefit for this sort of an approach... a lot of people, while they get referred to rehab, don’t attend, and that’s usually for practical reasons, that they can’t get there, or it’s in working hours’.

User: ‘this would be totally invaluable for people in the country (rural), because you really do feel very alone and absolutely out of the loop’.

Healthcare professionals felt that a comprehensive platform, which would accommodate users’ individual needs and preferences could successfully support a diverse CVD population.

HP4: ‘it would be nice to be able to have it really linked into that patient, you know making it really individualised for them, so the second they put their [information] in, you know, it kind of recognises [what they need]... it really, really focuses on [them]’.

Table 3 Coding framework matrix

Themes	Subthemes	Codes
Perceptions of Salvio that would promote/facilitate engagement	Accessibility to support/resources through Salvio	Accessibility, better programme suitability/tailoring, home-based self-management, repetition/habitual practice, HP communication loop (access)
	Accountability for self-management of CVD	Personal accountability, family involvement (positive), data sharing, accountable to HP
	Linking to healthcare professional (HP) through Salvio	HP endorsement, screening possibilities, managing complex conditions
Barriers to engaging with Salvio	User readiness to engage	Feeling overwhelmed, perceived illiteracy, privacy, recruitment, family involvement (negative), trust, age
	Operational barriers to using Salvio	Technology longevity, internet connectivity, cost, compatibility with usual care
Priorities to consider for next development stage	Support and guidance while using Salvio	Automated support and guidance, HP support and guidance, HP communication loop, interdisciplinary staff approach, preference for people
	Future development of Salvio and delivery considerations	Data sharing, individualisation/choice, compatibility with usual care, timing for delivery, evidence base, managing complex conditions, preferred content/design, using/previously used

CVD, cardiovascular disease.

HP8: 'not everybody comes in the same shaped box... [not recognising that] can put people off really quickly'.

Healthcare professionals also regarded the digital platform as a potential tool to assist users in being more accountable for managing their health condition away from a formal healthcare setting. One healthcare professional (HP8) felt that a platform could support users to 'make some informed choices' and take a 'step in the right direction'.

HP5: 'in cases where their progress isn't so good [in one intervention] ... if they're monitoring their progress through the [platform], it does encourage them to refer themselves on to something that might complement that'.

Users also valued the potential of sharing health behaviour progress with their personal support networks through *Salvio*, including supportive peers (eg, spouse) and healthcare professionals.

User: 'Well because of my eyesight I'm limited to what I can see... but my husband and I, between us, we did use a computer to graph my blood pressure on a daily basis at different times of the day'.

User: 'I have two children and they're both like kookaburras (native Australian bird), they know everything and tell you everything... Dad you should be doing this, Dad you should be doing that'.

User: 'I suppose when you think about it, the [healthcare professionals] need [your] information... the more the better'.

User: 'You have to be able to get your information out [to healthcare professionals] ... especially if you're going to come back and talk to someone on [an on-line communication platform]'.

Healthcare professionals also outlined advantages of data sharing and being linked with patients through a digital platform, including remote screening of patients and improved data sharing within interdisciplinary healthcare teams.

HP1: 'a flagging system, if something came up not quite right then you would contact the [user] to check and see how they were going'.

HP3: 'the most successful are when there is a feedback loop, so it's not just collecting data... closing the loop would be taking that information to show your [HP] or having your [HP] share the link [with other HPs], where they actually look at what you've been doing and give you feedback on that, so it needs to be integrated case management... it doesn't need to be a highly sophisticated linking process or monitoring process, just needs the ability for them to share that information'.

Healthcare professionals also perceived an evidence-based platform as a solution they could confidently endorse, knowing patients were safely managing their CVD between visits through an assortment of trusted digital health interventions.

Barriers

Users and healthcare professionals provided insight on certain barriers they perceived as potentially hindering engagement with a digital platform. Feeling overwhelmed by the task, perceiving themselves as not literate in digital health and trusting the platform content were identified by some users.

User: 'it's not so easy for everybody, you know, [not everybody] is happy with computers and the internet and everything'.

However, others believed these were surmountable. It could be suggested that the viewpoint of users who would engage with *Salvio* and think 'not for me' could be attributable to the rhetoric of the digital divide (age, class, education). Yet, this initial viewpoint has not always manifested in the long run.

User: 'I said I would never look at an email, so don't bother [sending it] ... [but] I became housebound at one stage. And it forced me to. That really did... So, you can't ever say never. Kicking and screaming I suppose, I've been dragged into the 21st century'.

User: 'Look you'd get used to it... and the generation after us would be fine with it... bring it on they'd be saying'.

Related to this, healthcare professionals also specified perceptions of users' digital literacy as a potential barrier, recognising a perceived age-related digital divide and unsupportive family members as potential factors that may influence recruitment. However, healthcare professionals did not think that this was true in practice, stating:

HP3: 'most people have phones, that's not a problem and more and more people are IT (information technology) literate, so I don't think that's a problem at all. And I think IT is being used by older age groups, so again age is not a barrier'.

HP1: 'One elderly lady... her two adult daughters who were I reckon in their 50s or 60s were there, and I couldn't get them to engage with [their] mum... it was like, 'Oh, well this is just, too hard'.

Users and healthcare professionals had contrasting views on privacy. Users suggested that data confidentiality may not be guaranteed on a digital platform, acting as a type of 'big brother over my shoulder'. Healthcare professionals perceived the benefits of data sharing on a comprehensive platform as outweighing unlikely privacy issues, wanting a 'system to work more sensibly in favour of [the user]'. One healthcare professional referred to privacy

concerns as ‘*an urban myth created by, I don’t know what, IT systems?... I don’t know why*’.

HP3: ‘I’m not [worried]... I just think anyone is welcome to hack into my [health information]. They are the most boring pieces of information you could possibly find... I understand other sensitivity issues and that would be the stuff that you’d be [video conferencing] about, you know... that’s fair enough’.

User: ‘but if I were younger and that [health] information got out and somehow it wasn’t secure, and my next potential employer [thought] ‘is he a good employment prospect?’ I’m not obliged to give that information to an employer... but that information could make a difference to my life’.

Healthcare professionals identified operational barriers including the cost of using Salvio and the potential disadvantages of using a platform, which is not properly aligned with usual care, such as cardiac rehabilitation. However, they also highlighted that overcoming these barriers is a manageable endeavour that must be considered.

Priorities

Finally, both users and healthcare professionals discussed the features they would prioritise based on their understanding of the Salvio digital platform. Users highlighted the benefits of having multiple programmes ‘*connected*’ on a single digital platform, which healthcare professionals perceived would ‘*work well*’ and be a helpful solution for diverse self-management.

HP5: ‘at the moment... people can’t choose the [support] that they want to receive... and I think that we’re missing that opportunity... being able to tailor [digital] programs in a patient centred way’.

Both users and healthcare professionals felt that adequate support and guidance in their use of a digital platform was imperative. Suggested approaches included a hybrid strategy of providing automated support and guidance within the platform structure (eg, decision tool) and communicating directly with healthcare professionals through Salvio (eg, data sharing). They valued the concept of automated data sharing with interdisciplinary healthcare systems and described the benefits of incorporating automated decision tools allowing users to individualise Salvio based on their personal requirements.

User: ‘[it needs to be] cleverly constructed...and in some respects, you don’t want to go grinding your way through... that you can’t actually target your requirements’.

Some users were clear in their preference for ‘*people, people every time*’ (ie, human support) within the Salvio support structures but understood that there were limitations to consistently having healthcare workers involved. Discussing their views on an automated digital platform:

User: ‘your doctor has the ability to ask you a question to prompt you to say the things, that’s a live person. An [automated system] may not have that ability to prompt you as well...I’d rather have a real person’.

User: ‘I could understand an [automated system] being used between 10 o’clock at night and 5 in the morning... because if there was something happening to me at that time of the night, I would be happy [to use it for support] ... rather than to sit at home wondering what I’m gonna do... I can see that working as well. It just gives you the option’.

Healthcare professionals described instances where automated systems within existing digital health went unnoticed by the user. In response, they suggested that a digital platform team operating Salvio could sufficiently underpin a mostly automated system. Speaking about their positive experiences with semiautomated digital health interventions:

HP2: ‘[users] were told that it was an unmonitored line... not a two-way communication and that we wouldn’t be responding to messages. However, a lot of them did respond. We got about 400 responses at least... mainly chatter back saying, “Thanks, I’ve got the message, I went for my walk today, my blood pressure’s better”.’

HP6: ‘[users] feeling like they were being watched, even when we knew they weren’t... [it] just brought back the importance of how important the [HP] felt it was for [the user] to continue to monitor and manage their condition’.

One user used the word ‘*fraudulent*’ to describe some of the existing digital health that can be accessed via public digital repositories, which could be detrimental to a person living with CVD. Users felt that their concerns around trusting digital interventions hosted on Salvio could be ameliorated by healthcare professional endorsement of Salvio, feeling supported in the knowledge that a trusted professional gave their approval and that referral ‘*would be incredibly important for the credibility (of the platform)*’.

User: ‘there’s probably apps already on my phone or on the app store that might be useful, but you have no idea looking at them how credible they are... I could flick through an app, but it might be something that if I followed it literally, it might kill me’.

User: ‘It’s probably a good idea just to add a depth of information available to you that you can trust, but probably you’d have to have a reasonable [guidance tool] in there so you don’t end up with rubbish that you aren’t interested in’.

Lastly, discussions revealed that people living with CVD already use digital technology to support aspects of their everyday lives, but Salvio has the potential to address gaps in their habitual CVD self-management practices by

becoming ‘*part and parcel of [their] life*’. Healthcare professionals observed that an evidence-based platform that is compatible with usual care has vast potential and prioritising timing for platform delivery throughout a person’s life is a key factor for success.

HP1: ‘there’s not enough time at [face-to-face programs] to form behavioural change- to get in, to have them consistently forming a habit about their new health strategies, whatever that might be’.

HP4: ‘a progressive plan would be good... it has to be very, very small steps over years. You know, initially you might do a couple of big things, but eventually it’s [a] lifestyle change’.

HP5: ‘the length of time that those [digital] programs can be in place I think is their real benefit, because we know that the face-to-face programs... most of them are sort of ending between six and eight weeks. So, it’s very intensive, but not very good at following people up, and I think the real benefit of a digital [platform] is that you can more efficiently extend the level of contact’.

DISCUSSION

This paper presents key stakeholders’ views on an innovative digital platform for supporting personalised self-management of CVD. Results indicate that people living with CVD and healthcare professionals perceive a digital platform as a potentially trustworthy solution that could guide and support self-management in a diverse CVD population. Results suggest the concept of a unifying digital platform hosting evidence-based effective digital interventions was well received by users with CVD and healthcare providers. The success of *Salvio* could be enhanced by providing adequate support to platform users, guiding the diverse CVD population through a host of digital solutions, ensuring that *Salvio* is endorsed by trusted healthcare professionals and maintaining connections with usual care. Such a platform could augment existing self-management and secondary prevention services. The following three sections outline how the results will lead to improvements of the platform and how it is introduced: user readiness and support; referral and links to usual care; and user diversity and guidance. In doing so, strategic links will be made to existing behaviour change theories and models, in an effort to align with critical aspects of development frameworks for complex digital health solutions.^{37 39 45–47}

Participants’ thoughts on the role of a digital platform in their own life was positive, but perceptions of their own skills and capabilities in using *Salvio* were mixed. This suggests that users are open to digital platform support for CVD self-management but may not feel they have the skills to successfully engage with *Salvio*. These views may reduce user interaction with the digital platform and could be characterised as the user’s readiness to engage.⁴⁸ Readiness for digital health use can be attributed to a number

of factors including the person’s knowledge, skills and attitudes towards the technology, their approach to CVD self-management and the social context in which they are receiving support.⁴⁸ Users in this study questioned their own readiness for digital health and appeared to lack self-efficacy using modern health technology. Specifically, healthcare professionals discussed the users’ (57–81 years) own perceptions of their generational or age-related disadvantage. These findings are congruent with existing literature suggesting that an age-related digital divide could exclude the 70% of older adults (≥65 years) in Australia who are currently managing CVD.⁴⁹ However, the perception of a disadvantage appears to be greater than the divide itself as older users have the skills required to locate health-related support online (>75%). However, few are reportedly confident in their ability to appraise the health information (52%),⁴⁹ which plays a key part in effective electronic health (eHealth) literacy.⁵⁰

The results of our study indicate that feelings of low self-efficacy or readiness have previously acted as barriers and had in some cases delayed users’ engagement with health-related technology. When faced with a situation where usual care is not an option, users were more inclined to overcome personal barriers and draw on digital resources rather than being isolated from care. This aligns with behaviour change literature, which suggests that when the benefits of using a platform far outweigh the burden of the task or feeling overwhelmed, a person in need of CVD self-management support may be more inclined to engage.⁵¹ Offering healthcare professional or social support to digital platform users may ameliorate some of this burden while improving feelings of self-efficacy and readiness. This approach would cater to the potential for user autonomy and personal progress, which is aligned with Bandura’s theory of influencing perceived self-efficacy to optimise behaviour change.⁵² Data sharing with healthcare professionals or peers (eg, friend, spouse, sibling) would create valuable support systems for the user, which is also recognised as critical for supporting behaviour change³³ and may also result in improved accountability.

Healthcare professionals in this study suggested that timing for integrating *Salvio* into users’ habitual practices is a key factor for *Salvio* to be successful. Therefore, suitable referral methods and users engaging at an appropriate time in their health journey should be considered.⁵³ Behaviour change models such as health action process approach (HAPA) and integrated change model (iChange) look at the delivery of support across many phases of behavioural change.^{54 55} The models align with findings from this study, suggesting that user engagement with the right intervention at an appropriate time, and providing user guidance to support action or coping planning for CVD self-management, could optimise platform success. HAPA and iChange also focus on motivation, which speaks to the results of this study indicating that appropriate healthcare professional referral at critical stages could influence their motivation to engage with *Salvio*.^{54 55}

Referral coupled with the assured endorsement from a trusted healthcare professional could improve users' digital readiness to engage with *Salvio*, which involves a belief in one's ability to determine the trustworthiness of online or digitally produced information.⁵⁶ Trustworthiness of digital platform content was openly discussed. Participants were clear that blindly accessing multiple digital health programmes and applications with uncertain quality or credibility was not ideal. Healthcare professionals agreed that they would happily endorse an evidence-based digital platform hosting intervention that had been evaluated for effectiveness in a CVD context. Users felt that this endorsement from a recognised professional or health institute would influence engagement as it would build their trust in *Salvio*. Trustworthiness can be difficult to gauge, but the level of support required through a person's health journey is very important.⁵⁷ Therefore, the creation of a digital platform such as *Salvio* does not strive for complete independence from usual care and centre-based services but seeks to create a level of autonomy and independence that permits a person to self-manage their condition on a daily basis from their own home or community, and in line with their personal needs and preferences. As mentioned by healthcare professionals, this could remove pressure from current face-to-face programmes, without compromising the quality of care. Findings from the study indicate that in response to healthcare professionals' fears of the potential extinction of centre-based cardiac rehabilitation, *Salvio* should be introduced as an adjunct to face-to-face services, not as replacement for centre-based programmes.

Our findings suggest that the wide-ranging self-management support offered via *Salvio* has the potential to reach a diverse community of people living with CVD. Potential future *Salvio* consumers could vary from working urban dwellers to elderly people living in a rural locality, both of whom face barriers to attending face-to-face services and are unsure where to turn for trustworthy digital self-management solutions. Furthermore, a third of users reported a diagnosis of more than one chronic condition, which also introduces complex content suitability considerations. This user variation suggests that flexible approaches to self-management are vital to ensure that individual needs are being met, while accommodating for different levels of ability and health stages.⁵³ These findings are further supported by Social Cognitive Theory, which highlights the influence that individual experience can have on the establishment of a behaviour (eg, engagement with a digital platform).⁵⁸

Individuals who engage with the *Salvio* digital platform would be required to select the hosted digital health interventions that match their personal needs and preferences. Supporting literature indicates that long-lasting positive effects on CVD management and patient empowerment have been reported in user-centred interventions that encourage a sense of autonomy by enabling choice within their strategies.^{59–61} This is also consistent with

behavioural research that shows actively engaging people in decision-making pathways for their CVD management can improve health outcomes through factors such as improved autonomy, empowerment and mastery.^{24 62} Our findings showed a well-constructed platform with a guidance tool that makes personalised intervention recommendations would reduce the potential of users engaging with interventions that do not meet their needs or preferences. The proposed digital guidance tool could provide automated assistance to facilitate decision making, which could potentially reduce the burden of user engagement. Current research is also examining electronic decision support tools, which are being developed and validated to assist with meaningful digital intervention adherence and health behaviour change by providing individualised, real-time assistance.⁶³

Strengths and limitations

The main strengths of this study are the insight gained from multiple stakeholder groups and the triangulation of methods used for data collection to ensure that *Salvio* would be as accessible and valuable as possible to potential end users. Limitations include the use of convenience sampling and the fact that users were invited to participate in more than one phase of data collection. This may increase the potential for bias; however, engaging in one or more activities may also have provided users with a greater understanding of the research objectives and processes. Other limitations also include the exclusion of healthcare professionals from phase 2 of data collection, the fact that people living with CVD were not part of the initial conceptualisation of the platform, for example, formulating research questions, and the point that data on the ethnicity or eHealth literacy of people living with CVD was not collected during phase 1 data collection.

CONCLUSION

This paper has made significant contributions to the current body of knowledge surrounding the use of digital health for sustained self-management of complex chronic conditions. Future research will include using the insight gained from this study to develop and evaluate a platform. The study outlines the perceptions of key stakeholders towards *Salvio* and the factors that need to be prioritised to optimise engagement. In summary, the success of *Salvio* could be enhanced by providing adequate support to platform users, guiding the diverse CVD population through a host of digital solutions, ensuring that *Salvio* is endorsed by trusted healthcare professionals and maintaining connections with usual care. Such a platform would augment existing self-management and secondary prevention services.

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