

Evaluating A Preventive Heart Health Programme For Women At Midlife: Protocol For An Interrupted Time Series Design

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Abstract

Cardiovascular disease (CVD) is the leading cause of death in women and the risk factors can be compounded by hormonal changes, especially in menopause transition. Positive health promotion through behavioural change strategy may be the most effective approach to reduce CVD mortality and morbidity. As healthcare providers play a critical role in identifying and managing CVD risk factors in women, this highlights the need to explore and assess the barriers and facilitators to implementing preventive heart health care in Singapore. A prospective mixed-methods study utilising both quantitative and qualitative research methods for programme implementation and evaluation through an interrupted time series (ITS) study design with a focus on behavioural change will be conducted. An A-B-A reversal design will be used to assess the feasibility and acceptability of behavioural change strategy to increase heart-healthy habits. 100 women aged 45-65 years-old will be recruited. Quantitative data regarding participants' clinical status, symptoms, and self-administered surveys will also be collected. 15 participants and healthcare providers will be engaged for a qualitative semi-structured survey and interview for the exploratory evaluation of this study. This study aims to implement and evaluate the effectiveness of a preventive heart health programme targeted for women with CVD risk factors.

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Original Manuscript

Evaluating A Preventive Heart Health Programme For Women At Midlife: Protocol For An Interrupted Time Series Design

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Abstract

Cardiovascular disease (CVD) is the leading cause of death in women and the risk factors can be compounded by hormonal changes, especially in menopause transition. Positive health promotion through behavioural change strategy may be the most effective approach to reduce CVD mortality and morbidity. As healthcare providers play a critical role in identifying and managing CVD risk factors in women, this highlights the need to explore and assess the barriers and facilitators to implementing preventive heart health care in Singapore. A prospective mixed-methods study utilising both quantitative and qualitative research methods for programme implementation and evaluation through an interrupted time series (ITS) study design with a focus on behavioural change will be conducted. An A-B-A reversal design will be used to assess the feasibility and acceptability of behavioural change strategy to increase heart-healthy habits. 100 women aged 45-65 years-old will be recruited. Quantitative data regarding participants' clinical status, symptoms, and self-administered surveys will also be collected. 15 participants and healthcare providers will be engaged for a qualitative semi-structured survey and interview for the exploratory evaluation of this study. This study aims to implement and evaluate the effectiveness of a preventive heart health programme targeted for women with CVD risk factors.

Trial Registration

Registered on ClinicalTrials.gov on July 28, 2023, NCT05967000.

Keywords

Preventive health, health coaching, behavior change, lifestyle modifications, perimenopause, cardiovascular

Introduction

Cardiovascular disease (CVD) is a global public health crisis accounting for 32% of all deaths

globally and it is projected that 23.6 million people will die from CVD by 2030 (1). CVD attributed to approximately 30% of all deaths in Singapore in 2021 (2), and was the top disease burden in 2010 responsible for approximately 20% of total disease and injury burden (3).

Although women tend to develop CVD 10 years later in life than men, the health outcomes for women including mortality and prognosis are often poorer (4–6). CVD is the leading cause of death in women (1,7), and 1 in 3 women die from heart-related conditions (8). In Singapore, CVD in women causes more morbidity and mortality than breast and cervical cancer (9). This disease burden is expected to increase as Singapore's population ages and with more women outliving men. Primary and secondary prevention such as therapeutic lifestyle changes in tandem with a multidrug regimen targeting major CVD risk factors are established measures to lower the burden of CVD (10,11).

Women with risk factors such as diabetes or hypertension have a higher risk for heart attacks than men with similar risk factors (12). The incidence of fatal CHD is higher in older women (13), while the improvement in CHD morbidity and mortality in younger women (<55 years) has not increased (14,15). Clinical studies have found that women with coronary heart disease (CHD) have a higher burden of cardiovascular risk factors than men (14,16). Moreover, there are women-specific CVD risks such as previous pregnancy complications, breast cancer, or premature menopause (17). While men have a two-fold higher incidence of coronary heart disease and related mortality than women, with increasing age, this gap in mortality and morbidity shrinks as elderly women experience greater incidences of heart disease (13).

Unique conditions like microvascular ischemia and takotsubo cardiomyopathy disproportionately affect menopausal women (18). Yet CVDs in women are underdiagnosed and undertreated (19). Women frequently underestimate their CVD risks, and physicians are often unaware and more likely

to downplay their risks (20,21). Women are either often labelled as anxious, or symptoms are blamed on menopause (18). Women are less likely to be on statins or receive optimal medical therapy (18). In Singapore, there is an alarming decline in awareness of the severity of CVD, in the recent 2020 Singapore Heart Foundation Women's Heart Health Survey, only 9% of respondents were aware that CVD was the leading cause of death for women in Singapore, a decrease from an already low number of 10% in 2016 (22).

A woman's risk for heart disease accelerates during menopause transition (23). During this transition, women experience disruptive changes to both their reproductive organs and physical and psychological wellbeing. Management issues range from short-term symptoms such as insomnia and palpitations, to intermediate issues such as bone health, or longer-term issues of developing CVD. Endocrine and metabolic changes associated with menopausal transition such as increased abdominal fat accumulation, increased insulin resistance, dyslipidaemia and endothelial dysfunction, suggest predisposition to an increased CVD risk (23). Early management of the traditional risk factors of CVD is essential and the American Heart Association has guidelines for multidisciplinary care to prevent CVD in women (17,24). Other countries, such as Canada, have dedicated groups to tackle this problem (21,25). While it has been established that collaborative clinics between cardiologists, gynaecologists and women's heart centres are essential even for the well-woman (26), strategies focusing on CVD risk reduction in younger women are essential to reduce the high cardiovascular burden in South Asian women (26).

Motivational interviewing strategies in health coaching can help patients achieve optimal cardiovascular health through inculcating various healthy habits and supporting lifestyle changes: diet, physical activity, nicotine avoidance, sleep, weight maintenance, blood lipids, glucose, and blood pressure control (24). Moreover, a personalised and culturally-appropriate approach would be

beneficial in supporting augmented cardiovascular preventive efforts in the years preceding menopause (24), leading to an improvement in health outcomes and quality of life (QOL) in women undergoing menopause. Hence, there is a need to assess the viability of implementing a preventive women's heart health programme and investigate the barriers and facilitators for implementing such a service in Singapore.

This study could illustrate how health coaching can be developed as an additional clinical support to enhance positive health promotion in Singapore. There is a need for programmes of behavioural modification to be trialled in a controlled fashion and assessed rigorously for efficacy. Employing health services research and implementation science will be crucial in driving this strategy. Promising strategies on behaviour modification can be tested using multicentre implementation trials. The implementation of this programme in Singapore has wider implications due to the ethnic differences in disease burden. Contextualising the customary practices and lifestyle factors including diet, exercise, smoking and psychosocial stress are important. Cultural attitudes to treatment adherence may also be important and necessitates the health outcomes of patients.

This protocol paper describes a prospective mixed methods study to assess the viability and effectiveness of implementing a preventive women's heart health programme using a behavioural change strategy to increase heart-healthy habits in women.

Experimental Design

Aim, setting and design

Specific Aims

Aim 1: Identify barriers and facilitators associated with sustaining a preventive heart health programme among women.

Hypothesis: The preventive women's heart health programme could 1) improve awareness of CVD and 2) encourage adoption of positive heart health behaviour and habits.

Aim 2: Identify micro, meso, macro level factors associated with the provision of a women's preventive heart health program.

Hypothesis: Receipt of preventive heart health will be associated with 1) micro level factors (e.g. daily procedures and interactions between patients and healthcare providers) 2) meso level factors (e.g. local health service, community elements such as patient and healthcare provider attitudes and support) and 3) macro level factors (e.g. health education policies, healthcare accessibility, healthcare affordability).

Aim 3: Understand provider and patient perceptions of the provision and utilisation preventive heart healthcare among women.

Hypothesis: Patterns of preventive heart healthcare utilisation and delivery are influenced by patient and provider perceptions and experiences.

Setting

This study is conducted in a Women's Heart Health Clinic in a restructured public hospital in Singapore.

Design

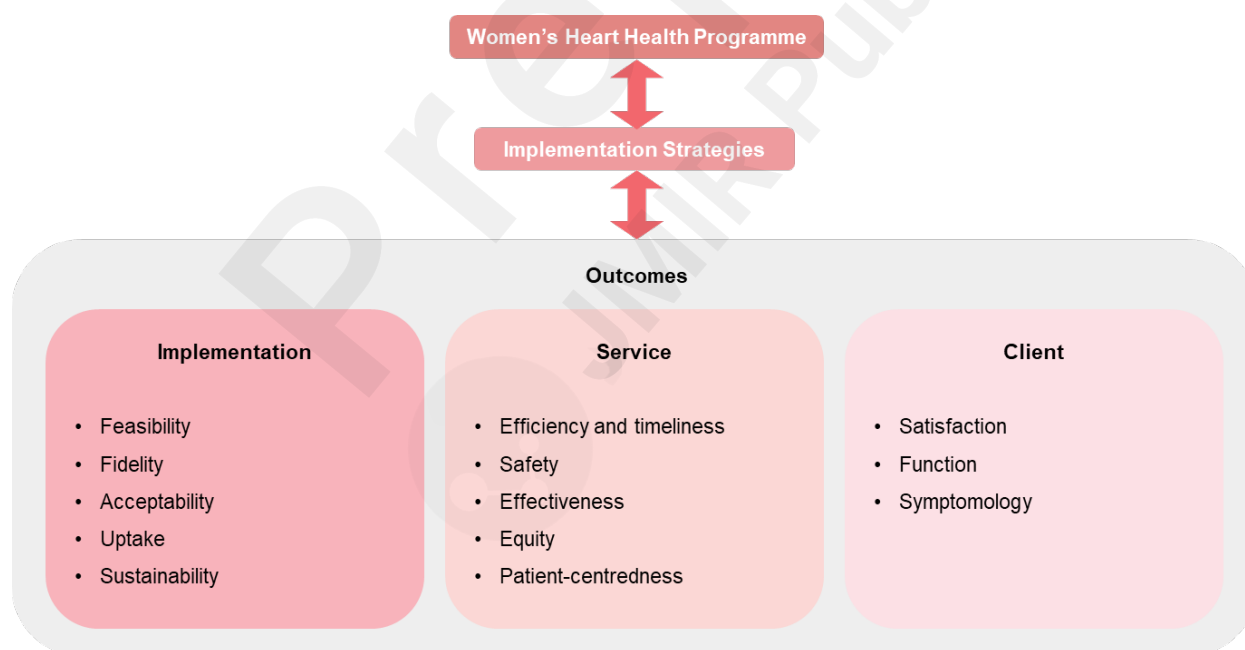
This study uses a mixed-methods design augmenting quantitative analyses with qualitative assessments of patients and healthcare providers through an interrupted time series (ITS) study design. The study will be conducted over a period of 12 months.

Conceptual Framework

The proposed research will use various implementation science frameworks to answer question regarding future scale-up and long-term sustainability of the intervention if it is determined to be effective. These conceptual frameworks will aid in evaluating how individual and contextual variables influence programme implementation and acceptability.

We adopted the Proctor framework (Figure 1) (27) to ensure inclusion of essential implementation science outcomes and measurements with respect to users, stakeholders, and context of the intervention, which were then measured using a mixed-methods approach of validated quantitative scales and in-depth interviews where applicable.

Figure 1. Framework adapted from Proctor's conceptual model of implementation research (27)



The in-depth questionnaires were constructed from both the Theoretical Domains Framework (TDF) (28) and Capability, Opportunity, Motivation and Behaviour (COM-B) models (29) to understand the

underlying individual and contextual determinants that can positively impact programmes employing behaviour change strategies; and how individuals move towards adopting and maintain health behaviour changes.

In addition, we used the RE-AIM (Reach, Effectiveness, Adoption, Implementation and Maintenance) framework (30) to guide the planning and evaluation of the program to identify the contextual barriers and facilitators for implementation success. This involves gaining insight from previous evidence, and key stakeholders in healthcare at the macro, meso and micro levels (illustrated in Additional File 1) to understand how multiple interventions can be effectively packaged, integrated, and delivered within the outpatient clinics.

Investigating at the micro level would allow us to relate to the day-to-day practices and interactions between the patients and the healthcare provider. While at meso level, it would allow us to understand the local health service, community factors such as attitudes and support from patients and healthcare providers in the women's heart health programme. Exploring the macro level would help identify the interrelated network between all core stakeholders within the healthcare system that are essential to the success of this programme. Findings elucidated at the respective levels will then be used to improve the current pilot programme strategies iteratively and address barriers identified where possible. A systematic review of women's heart health policies will also be done to enhance understanding of current recommendations and gaps at a macro level. The systematic review protocol is not included in this study.

Participants

Using a purposive sampling strategy, 120 English-speaking participants aged 45-65 years' old who attend the Women's Heart Health clinic will be invited to participate in this study. Women who are

pregnant, out of the menopause transition of 45 to 65 years of age or unable to provide informed consent will be excluded from the study. Quantitative data regarding participants' clinical status, symptoms, and self-administered surveys will be collected at three timepoints – baseline (month 0), follow-up (month 6), and the end of the study (month 12). Upon recruitment and pre-intervention assessment at the baseline visit, participants will undergo personalized health coaching. Compliance is tracked with health logging and follow-ups. Participants will also undergo interviews and surveys to evaluate changes in physical activity, diet scores, and QOL.

For the semi-structured survey and interview, we aim to engage at least 5 women between 45 to 65 years old who have attended the preventive heart health programme to participate in the interview sessions. 10 healthcare providers aged 21 years and above involved in this preventive heart health programme will also be interviewed for the exploratory evaluation of this study.

Qualitative interviews will be conducted with these participants and healthcare providers using a semi-structured questionnaire carried out either in person, over the telephone or via video call to obtain feedback and explanatory data about the programme.

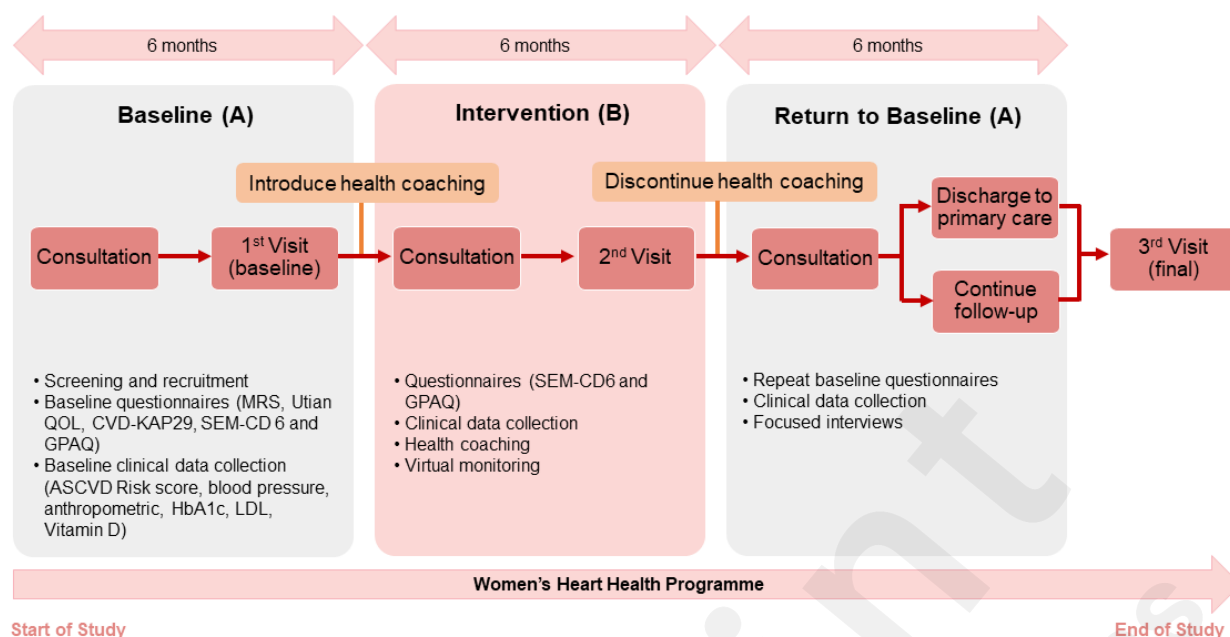
Multi-strategy intervention and procedures

The women's preventive heart health programme is a multidisciplinary programme that aims to prevent the onset of CVD by empowering women with the knowledge and skills to achieve optimal cardiovascular health even after they have exited the programme.

The integrated behavioural determinant intervention logic model for midlife women CVD screening and prevention used to devise the programme is elaborated in Additional File 2. Key features of the intervention include individualised risk assessment and sex-specific tailored care for women undergoing menopause transition. Women will have access to trained onsite personalised health

coaching according to their CVD risk levels, health goals, and lifestyle. Health coaching sessions will be conducted by certified health coaches within the hospital sites on a one-to-one basis in the Women's Heart Health clinic. Collaborative consultations between the physician and health coach will include motivational interviewing to identify any barriers causing the knowledge and execution gap, to target change in both internal and external factors of behavioural determinants, ultimately attaining health goals. Information provided to the participants by the physicians and health coaches are aligned to the national clinical practice, dietary and physical activity guidelines, personalised where appropriate. Follow ups with the physician and health coach will be aligned to the A-B-A reversal design of 6-month intervals, lastly concluding with the post-intervention time-point. Clinical data collection and questionnaires will be administered during those visits. Relevant outcomes will be collected during the follow-ups. Women are encouraged to track their health parameters using the existing hospital e-health platform between the follow-ups. Timely encouragements and reminders that are relevant to individuals' target that was set together with the health coach will also be sent via the electronic health platform. Once individualised health goals are achieved, symptoms relieved, and programme participation is completed, low-risk women are discharged to the family physician with detailed handovers and health targets. Moderate to higher risk women may continue in the programme. Semi-structured interview sessions with participants and healthcare providers that last approximately 30 to 45 minutes each will be conducted at the end of the study. The interview will be conducted during the last visit or at a place and time of convenience for the participant. The TIDieR Checklist (31) A summary of the programme is shown in Figure 2.

Figure 2. Summary of the preventive heart health programme study design



Outcome Measures

Primary outcomes

We used the RE-AIM model (Reach, Effectiveness, Adoption, Implementation, Maintenance) (30) to conceptualise the primary outcomes as it is well-suited to the practical approach of this study and provides a comprehensive way to assess the complex interventions in real-world settings beyond clinical efficacy rather than in controlled trials. It also allows for translation of the intervention between individual and institutional levels to promote uptake, transferability and public health impact of the programme eventually.

Reach indicators involve assessing the number, proportion, and representativeness of the women participating in the programme. **Effectiveness** is defined as the degree to which participants engage in healthy heart behaviours and the degree of change in clinical CVD indicators and QOL measures. Both behavioural change and patient-related outcome indicators are measured. **Adoption** of programme strategies by the healthcare providers in the Women's Heart Health Clinic will be reviewed, from the perspective of physicians, allied health professionals, and the clinical operations

team. The following **implementation** strategies will be used and assessed: evaluation and feedback, training and supporting stakeholders, adaptation and tailoring, infrastructure change, and financial strategies. To assess the continuation and **maintenance** of the programmes strategies and practices even after the study has been completed, the following aspects will be considered: feasibility, sustainability, service outcomes, and participant satisfaction in forms of observations, audits and feedbacks (refer to Additional File 3 for further details of the 5 stages).

Secondary outcomes

There will be a total of three visits: baseline (month 0), intervention (month 6), return to baseline (month 12). Sociodemographics, anthropometric measurements (height, body weight, body mass index), blood pressure measurements, laboratory blood test results (HbA1C, lipid panel, vitamin D), CVD risk assessment and documentation will be collected from the clinic records at all three visits. Questionnaire responses relating to lifestyle (GPAQ; SEMCD-6) will be self-administered by participants at all three time points. Questionnaires pertaining to patient's knowledge of CVD (CVD-KAP29), menopausal symptoms (MRS), and QOL (Utian Scale) will be self-administered at both baseline and final visits. Routine clinic business and operations data obtained from the clinic operations team, and physical or cardiovascular lab results available during the duration of the entire study that are not additionally done as part of the research procedures will also be reviewed. Recordings of the relevant health parameters will also be collected from an online health monitoring platform. All data will be de-identified and kept confidential.

Semi-structured interview guides have been developed for patients and healthcare providers, respectively. Questions are organised under predetermined concepts based on the literature (detailed in Additional File 4 and 5). For participants, we will investigate feasibility, fidelity, acceptability, uptake, sustainability and patient-centeredness. For healthcare providers, we will look at knowledge,

skills, role, beliefs, perceptions, barriers and facilitators.

Statistical analysis

Quantitative data

Data from the structured surveys will be analysed quantitatively using appropriate statistical software. Exploratory analyses will be performed, including testing of assumptions of linearity, homoscedasticity, multicollinearity and normality of errors and, if necessary, transformation of data. Baseline characteristics, pre and post-implementation survey findings, and CVD indicators will be reported descriptively using univariate methods such as chi-square and t-test. Comparisons between pre and post programme will be made using paired T-test and Wilcoxon sum rank test. Complete case analysis will be used as the primary analysis. As the main focus of this pilot research is to establish the implementation of a new intervention, it is not powered to detect between-group differences. Variables will thus be provided descriptively as well as using paired T-test where appropriate. With this being a programme evaluation of a pilot programme and numbers are small, statistical manipulation such as multiple imputations will not be done.

A segmented regression analysis of ITS will be used to evaluate the impact of the behavioural change strategy intervention. Data collected over a 1-year period will be plotted. The clearly defined intervention period and the availability of at least 10 data points before, and 10 data points after the intervention enabled this quasi-experimental design. The analysis can estimate the intervention effect whilst taking account of time trend and autocorrelation among the observations. The ITS design allowed the estimation of any sudden change in level immediately after the intervention, which is defined as the difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend, the estimation of the difference between pre- and post-intervention slopes, and the estimation of the level effect 6 months post-intervention. The level effect

at 6 months' post-implementation is the difference between the predicted value 6 months' post-intervention calculated with the pre-slope and the observed value 6 months post-implementation. After testing the absence of first-order autocorrelations with the Durbin–Watson statistic, a time series regression model, ARIMA (autoregressive integrated moving average), without adjustment for autocorrelation will be fitted to the data. Analyses will be performed using SPSS statistical software.

Qualitative data

Data from the qualitative interviews will be managed using NVivo. Data analysis will follow Clarke and Braun's reflexive thematic analysis approach (32), which is theoretically independent and it can be used for a wide range of research questions, data collection and sampling methods. Themes are conceptualised as patterns of shared meaning across the data set, based on an underlying central concept or idea, that provides an answer to the research: 'Evaluating a preventive heart health programme for women at midlife'. Themes will be generated predominantly inductively from the data. However, some predetermined concepts will guide the first level of analysis. These are based on the literature, the study objectives and input from lived experience. The predetermined concepts are reflected in the interview questions. Data analysis will follow a rigorous process including several steps: 1) data familiarisation; 2) coding; 3) generating initial themes; 4) reviewing themes; 5) defining and naming themes; and 6) writing up. Coding will occur at two levels — semantic and latent with the objective of identifying themes across the whole data set.

Discussion

Due to the nature and context of the preventive heart health programme, the use of an ITS approach is the most appropriate to estimate effects of behavioural change strategy as randomisation is not feasible. It can provide valuable insights into the effectiveness of the programme by assessing the changes over time and is more sensitive to differences in the effects of intervention as it involves

self-comparison of the participants themselves, which controls confounding variables to the greatest possibility. It can also be conducted with a small sample size which is ideal for our pilot study.

Despite the benefits of an ITS approach, the lack of randomisation is a limitation in which drawing definitive answers about the effects of programme is limited. Another limitation of the study protocol relies on self-administration of the questionnaire for subjective measurements, which may induce response bias and limit depth of responses. Appropriate validation from the study team and healthcare providers can help mitigate this limitation to some extent.

Declarations

Authors' contributions: GSHC, LYTW, LWXE and CMLT contributed to the design of the study. GSHC, PTCT, and WYTL drafted the manuscript and all authors read and approved the final manuscript.

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Institutional Review Board Statement: This study has been approved by the National Healthcare Group Domain Specific Review Board (2022/00350). Any modification to the study protocol would require pre-approval from the committee.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the

study.

Data Availability Statement: Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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Conflicts of Interest: The authors declare no conflicts of interests.

Abbreviations

The following abbreviations are used in this manuscript:

BMI: Body mass index

COM-B: Capability (C), Opportunity (O), and Motivation (M) model of Behaviour (B)

CHD: Coronary heart disease

CVD: Cardiovascular disease

GPAQ: Global Physical Activity Questionnaire

ITS: Interrupted time series

KAP: Knowledge, attitudes, practices

MRS: Menopause rating scale

QOL: Quality of life

RE-AIM: Reach, Effectiveness, Adoption, Implementation, Maintenance

SEMCD-6: Self efficacy for chronic disease scale

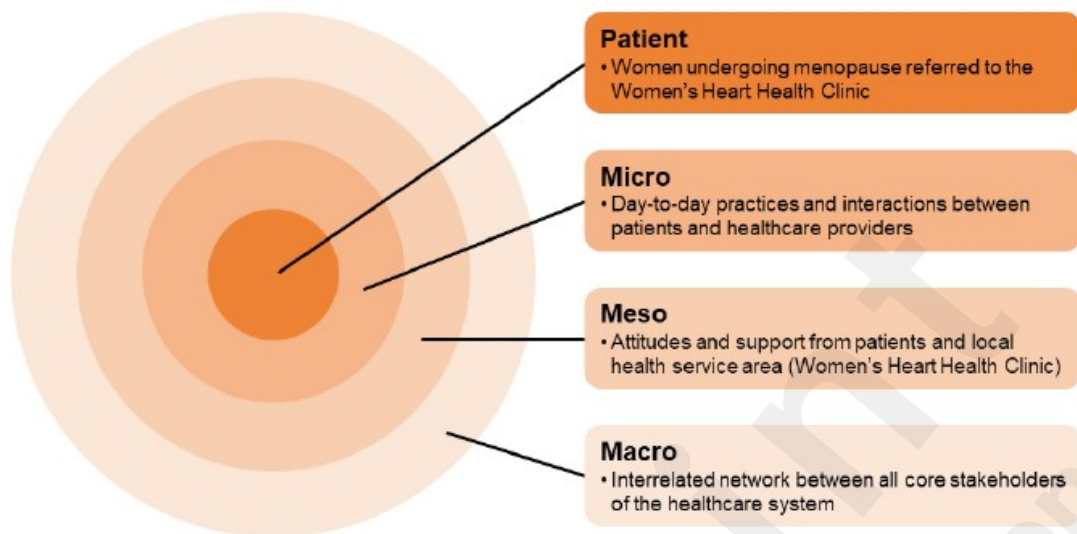
TDF: Theoretical Domains Framework



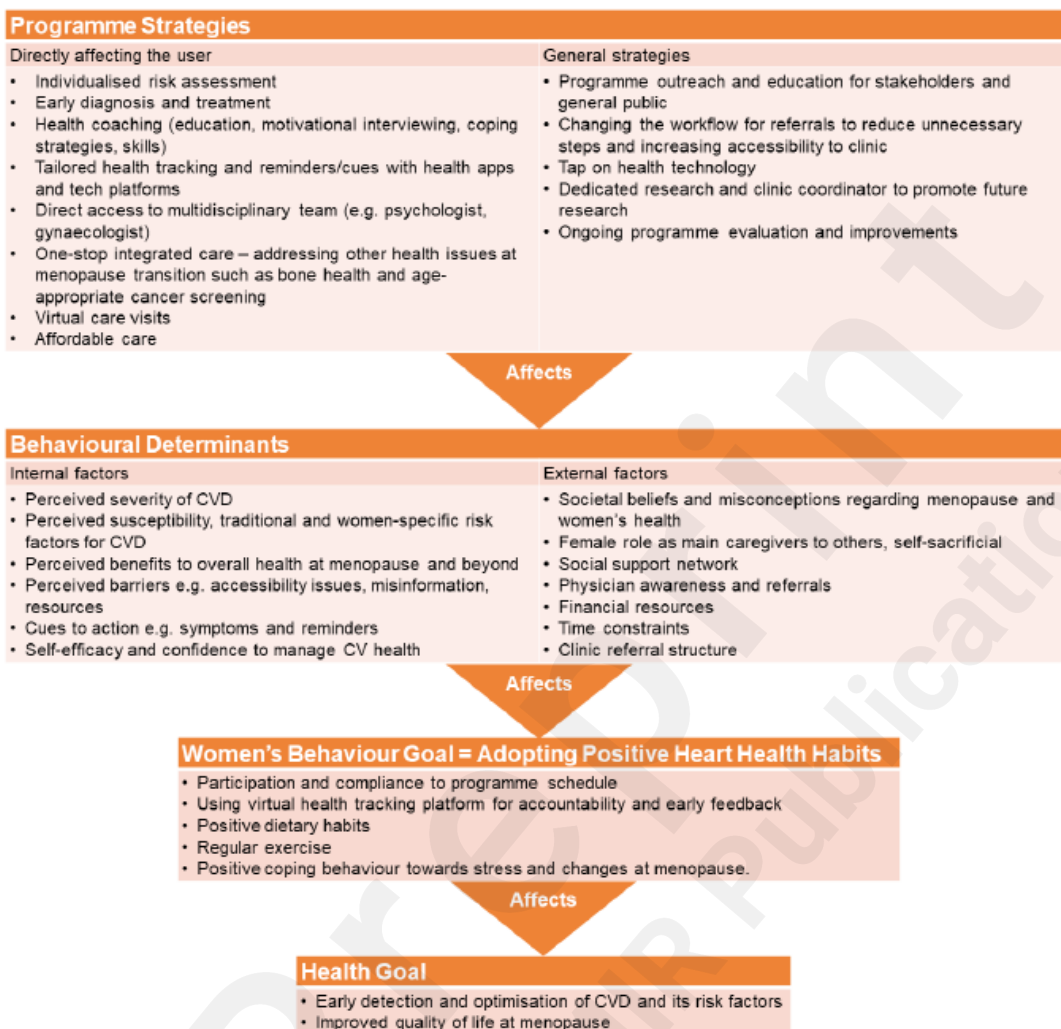
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Additional File 1. Levels of the Healthcare System

Additional File 2. An Integrated Behavioural Determinant Intervention Logic Model for Midlife Women CVD Screening and Prevention



Additional File 3. Outcome Measurements Based on Proctor's and RE-AIM Framework

Implementation Outcomes		
Programme Evaluation Questions	Measurements	Method
Feasibility - Are the resources (manpower, funds, equipment, knowledge) to carry out the intervention sufficient? - Is the intervention suitable for the intended population?	- The proportion of women who complete the programme - Feedback survey - Qualitative interviews with programme providers and stakeholders	- Surveys, interviews, observation/direct counts
Fidelity - How is it determined if the intervention was successfully delivered?	- Healthcare provider: Use of menopause transition health screening tool checklist by physicians - Participants: Compliance to health logs of blood pressure and glucose	- Observations, checklists, self-reporting
Acceptability - What are providers' & participants knowledge, attitudes and experience regarding the intervention?	- Feedback forms (Appendix) - Qualitative interviews	- Surveys, interviews
Uptake - How can we know if employees utilised the intervention? - Who is the target audience, and where are they being targeted?	- Referral numbers and participation rate	- Direct counts, administrative data
Sustainability - Can the hospital maintain the initiative for the long-term? - How likely is it that this program will have lasting effects on individuals? - How can information regarding the programmes progress and evaluations be disseminated?	- Biannual audits post study - Sharing sessions at clinical board meetings	- Audit of records, interviews

Service Outcomes		
Programme Evaluation Questions	Measurements	Method

Efficiency and timeliness - What is the rate of improvement?	- Time to completion of programme	- Direct counts, data analysis
- Are the processes meeting the timeline targets?	- Rate of improvement in various health score aspects in patients clinical and behavioural outcomes	
Safety - Are there any safety issues?	- Audits and feedback	- Observations, audits, surveys
Effectiveness - What is the efficacy of this programme?	- Improvement in clinical and behavioural measures	- Biomarkers, questionnaires
Equity - Is there equality in the outreach and delivery of the service?	- Referral numbers and participation rate	- Direct counts and observations
Patient centeredness - Do individuals feels that the programme is participant-centric?	- Feedback and qualitative interviews	- Surveys and interviews

Client/Patient-related Outcomes		
Programme Evaluation Questions	Measurements	Method
Physical activity - How do we tell that the participants have behaviour change regarding physical activity?	- Global Physical Activity Questionnaire (GPAQ) (17)	- Questionnaire
Specific to women at midlife QOL scale - How is it determined if quality of life and symptoms relating to peri-menopause have improved?	- Utian Scale (encompasses occupational, emotional, sexual, health QOL aspects)(18)	- Questionnaire
Menopause symptoms - How is it determined if quality of life and symptoms relating to peri-menopause have improved?	- Menopause rating scale(19)	- Questionnaire
Self-efficacy - How do we know participants are able to continue on measures on their own?	- Self-efficacy for managing chronic diseases 6-item scale (SEMCD-6)(20)	- Questionnaire

Knowledge, attitudes, practices (KAP) score - Does the programme result in changes of KAP in participants?	- Modified CVD-KAP29 (21)	- Questionnaire
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Future risk of CVD - Does the programme help to lower CVD risk?	- Score calculated by healthcare professional - Pooled cohort equation to predict 10-year risk for CVD(22)	- Calculation of validated risk score
Clinical measurements - Does the programme result in improvements in clinical indicators?	- BP, Weight and BMI - Blood biomarkers: - o Lipids - o HbA1c - o Vitamin D	- Anthropometric measures - Laboratory tests
Participant satisfaction - Are participants satisfied with programme?	- Feedback forms	- Questionnaire

Additional File 4. Feedback Form for Programme Participants

Rating No.	1	2	3	4	5
1. How satisfied are you with the programme?	Extremely satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Extremely dissatisfied
2. How satisfied are you with your interactions with your doctor?	Extremely satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Extremely dissatisfied
3. How satisfied are you with your interactions with your health coach?	Extremely satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Extremely dissatisfied
4. How easy was it for you to follow the recommendations for monitoring your health?	Extremely easy	Easy	Neither easy nor difficult	Difficult	Extremely difficult
5. Were the goals and recommendations for diet and exercise convenient and achievable?	Extremely convenient	Convenient	Neither convenient nor inconvenient	Inconvenient	Extremely inconvenient
6. How likely will you continue to adhere to the health monitoring after the programme?	Extremely likely	Likely	Neither likely nor unlikely	Unlikely	Extremely unlikely
7. How likely will you continue to adhere to diet and lifestyle recommendations after the programme?	Extremely likely	Likely	Neither likely nor unlikely	Unlikely	Extremely unlikely

8. Do you think the programme interventions will help improve your health/help you to age well?	Extremely useful	Useful	Neither useful nor useless	Useless	Extremely useless
9. How confident are you in achieving your health goals after menopause?	Extremely confident	Confident	Neither confident nor not confident	Not confident	Extremely not confident

Additional File 5. Semi-structured Interview Guide for Healthcare Team (Based on COM- B & Data Framework Analysis)

Involvement	1. What is your job title and role?
Knowledge	2. Why do you think women visit the doctor? Is it mainly for acute illnesses, insurance claim or employment health screening?
	3. What is your understanding of the women's heart health clinic service? - Probe: What kind of conditions does this clinic treat? What benefits does this clinic provide?
	4. In your opinion, what are the best ways to influence behaviour change in women who came forth for CV health checks or have been diagnosed with CV condition(s)? - Probe: Are there any particular approaches that you think are helpful or useful?
Skills	5. How easy/hard is it for you in your role to deliver the program? - Probe: For physicians, do you find it hard to give recommendations about women-specific factors related to CVD or menopause, as some may find it a sensitive topic?
	6. How easy/hard is it for you in your role to deliver the program? - Probe: For physicians, do you find it hard to give recommendations about women-specific factors related to CVD or menopause, as some may find it a sensitive topic?
	7. How easy/hard is it for you in your role to deliver the program? - Probe: For physicians, do you find it hard to give recommendations about women-specific factors related to CVD or menopause, as some may find it a sensitive topic?
	8. Do you think our health coaching and education is adequate?
	9. How many patients did you interact with? Could you describe your interaction with the patients? How long did each session last? What was satisfactory and what was not?
Role	10. To what extent do you think providing holistic care for these women is part of your job? - Probe: What is the role of other members in the team? Is it your job to do this?
Beliefs and perceptions	11. What do you think are the benefits of doing this for you/patients/hospital? What do you think are the costs of doing this for you/patients/hospital? - Probe: In your opinion, do the benefits of following these recommendations outweigh the costs?
	12. Do you think women prefer alternative/traditional medicine over western medicine for the prevention of heart disease and managing menopause? Why?
	13. Do you think the concept of preventive care is understood locally?

Barriers and facilitators	14. What do you feel about participant adherence to the programme recommendations and follow-ups?
	15. What do you think are possible barriers to implement this program from the stakeholders' and patients' points of view? - Probe: What are some of the reasons you think will prevent women from seeing a doctor (e.g. too busy, housework, costs)? Based on the COM-B model (e.g. Knowledge, geography, resources).
	16. What do you think are possible facilitators to this programme from the stakeholders' and patients' points of view? - Probe: Based on the COM-B model (e.g. Knowledge, geography, resources).
	17. Were there any parts you disliked? What was difficult about implementing the programme? What could have been better? - Probe: Could you share an experience that did not go as planned?
	18. How do you feel about the workflow in this study? - Probe: Logistically (e.g., schedule, monitoring, touchpoints)? Experience? Is this workflow better? In what way? Why? Why not?
Environmental context and resources	19. Did you have enough support to implement the programme? - Probe: Are the necessary resources available to the physician/nurses/health coach/case manager? Are there competing tasks or time constraints that affect whether patients get optimal care from the clinic?
Acceptance, motivation, reinforcement and goals	20. What are your thoughts about implementing this intervention in regular care practice?
	21. What do you think about the long-term sustainability of this intervention?
	22. Do you think preventive heart health care should be provided for all women (similar to mammogram/cervical cancer screening)? Why?
	23. Do you think there are any incentives/motivating factors to continue/upscale the programme?
Memory and decision-making processes	24. Are the programme strategies [<i>choose relevant</i>] something you would be willing to adhere to in the long run?
	25. Will you remember to do these [<i>choose relevant</i>] in the future?
Social influence	26. What do you think (A) other physicians and (B) women would think of this dedicated service?
Emotions and acceptance	27. What are your hopes/changes/additions for the future of this programme in clinical practice?
	28. What are your fears regarding the future use of this intervention in clinical practice?

	29. Overall, do you feel this programme will improve women's health and experience during menopause? - Probe: Would you recommend your mother/sister/etc. to come?
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Behaviour regulation	30. Do you think this programme will, in the long-term, result in positive health behavior changes and reduce CVD burden in Singapore? - Probe: Healthcare providers to be more open to individualization and holistic care/women to embrace menopause transition as an opportunity to improve their health and overall wellbeing?
	31. Are there particular patients for whom this programme may not be suitable for promoting behaviour change?

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