



Personal Health Promotion Interventions Using Telephone and Web-based Technologies

Mobile Health

CSIRO Submission to the Qld
Parliamentary Committee

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1 Introduction

The prevalence of health risks factors for chronic diseases is rapidly increasing with modern lifestyle and industrialisation. Cardiovascular disease is the leading chronic disease contributed by a wide range of risk factors from age, family history to poor diet and physical activity, overweight and obesity. Most of these risk factors are avoidable through lifestyle changes.

CSIRO undertakes research in many areas of health to measure the effectiveness of various interventions to improve health outcomes through the use of technology, including telephone and web based technologies.

CSIRO undertakes this research through the e-Health Research Program in the Digital Productivity Flagship and the Personalised Nutrition program in the Food, Nutrition and Bioproducts Flagship. The Australian e-Health Research Centre (AEHRC), an unincorporated joint venture between CSIRO and Queensland Health, is a key component of the e-Health Research Program and collaborates across CSIRO on related projects.

This submission described the research undertaken by the Australian e-Health Research Centre in the use of a mobile phone and web based service model for chronic disease management. This includes the first randomised controlled trial of a technology enabled cardiac rehabilitation program on patients following a heart attack. This technology is now being implemented as business as usual in hospitals in several hospitals in Queensland for cardiac rehabilitation. CSIRO is continuing to partner with Queensland Health to develop other mobile phone based programs for other chronic diseases such COPD, diabetes and heart failure as well as to develop Indigenous specific programs.

This submission also describes some of the work occurring in the CSIRO Food and Nutrition Flagship in developing mobile phone and web based diet programs, including an online version of the popular CSIRO Total Wellbeing Diet.

2 MoTER: Mobile Health Platform

The Mobile Technology Enabled Rehabilitation (MoTER) platform is a care model with the capacity to provide patients with support to change their lifestyles and provide efficiencies in the delivery of clinical based services. MoTER provides rehabilitation and chronic disease management over distance through mobile phone applications and web based portals. The MoTER platform has been proven to be effective in cardiac rehabilitation and is being extended to other diseases.

2.1 Metro North RCT for Cardiac rehabilitation

Clinical guidelines recommend patients complete a cardiac rehabilitation program following a heart attack. Studies have shown that those who complete rehabilitation program are likely to adopt lifestyle changes and have much better long-term health outcomes, reducing the risk of a second heart attack or death.

Despite the benefits, uptake of traditional delivery of cardiac rehabilitation from an outpatient clinic or centre-based setting is poor. Many patients find travelling to a health care facility on a weekly basis to be onerous – particularly those who work or care for others, or live in regional or remote Australia where these services are inaccessible.

To address this, CSIRO and Queensland Health together designed and developed a home-based, smartphone- and Internet delivered cardiac rehabilitation program, called the Care Assessment Platform. This program comprises of a smartphone app to provide health and exercise monitoring tools, support weekly mentoring consultations, and deliver motivational and educational and videos (Figure 1).

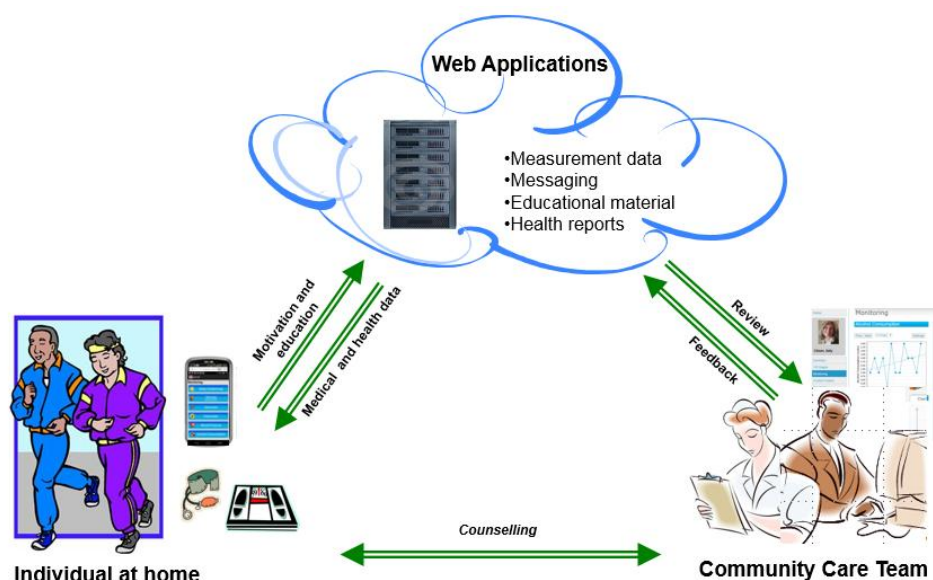


Figure 1: The Care Assessment Platform includes medical devices and a smartphone wellness diary for the individual. Data is uploaded to web applications which are accessed by the community care team.

A clinical trial was performed and the results have now been published in the journal Heart¹. The trial, conducted by CSIRO and Queensland Health through the Australian e-Health Research Centre, showed a significant increase in uptake and adherence to the program. The trial also showed that the home care delivery model achieved equal or better clinical outcomes as a traditional rehab program.

Patients recovering from heart attacks were almost 30 per cent more likely to take part in rehab at home using the smartphone app enabled service, compared to those who had to travel to an outpatient clinic or centre.

What's more, those who used the home-based, smartphone-delivered model were 40 per cent more likely to adhere to the program guidelines and almost 70 per cent more likely to see it through to completion.

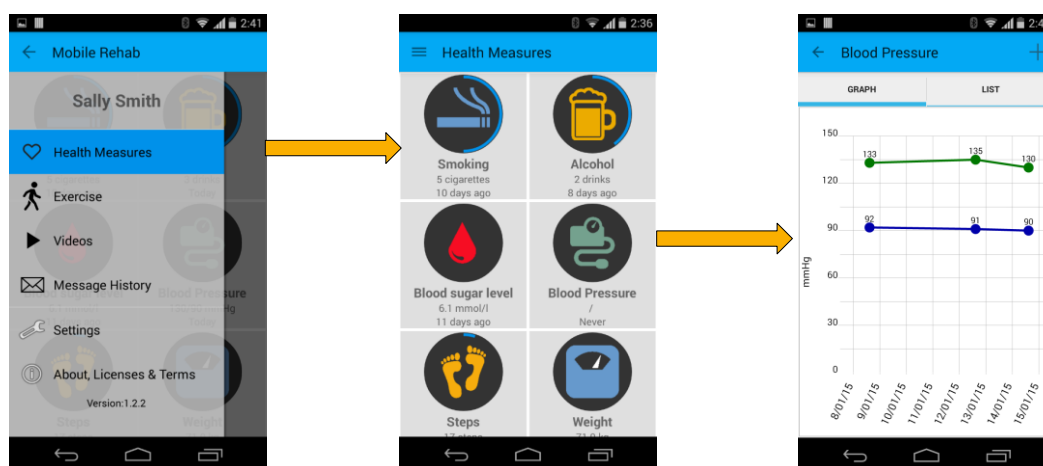
Most importantly, it gives patients a more flexible option to attend a rehabilitation program. By integrating rehab treatment with a patient's daily life, they are more likely to complete the program and make their new healthy lifestyle permanent. This overcomes one of the key barriers to patient participation and recovery.

The platform will soon be offered in a number of Queensland hospitals. The research team is also looking to adapt the technology for other chronic conditions such as pulmonary disease and diabetes.

2.2 Cardiac Rehabilitation Implementation

Based on positive outcomes of the clinical trial, CSIRO re-engineered the mobile health platform (MoTER) to accommodate the management of wider chronic diseases. It provides a simple way for patients to undertake their rehabilitation from their own home or work setting, while getting proper support from clinicians.

Patients use health measurement devices and the MoTER App to monitor their health by entering specified measurement data into the App on their smartphones once a day.



Patients may view graphs on their own data by using the MoTER App, which may give motivational feedback on their progress during the rehabilitation program. They also receive health information and exercise advice via multi-media resources on their smartphone.

¹ Varnfield M, Karunanithi M, Lee CK, et al. Smartphone based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: results from a randomised controlled trial. Heart. 2014. 10.1136/heartjnl-2014-305783

All the data collected in the MoTER App are automatically transferred to a MoTER web portal (Figure 2). The data uploaded to the portal can be viewed by a rehab clinician who phones the patient/s every week to guide and motivate them during the 6-week program.

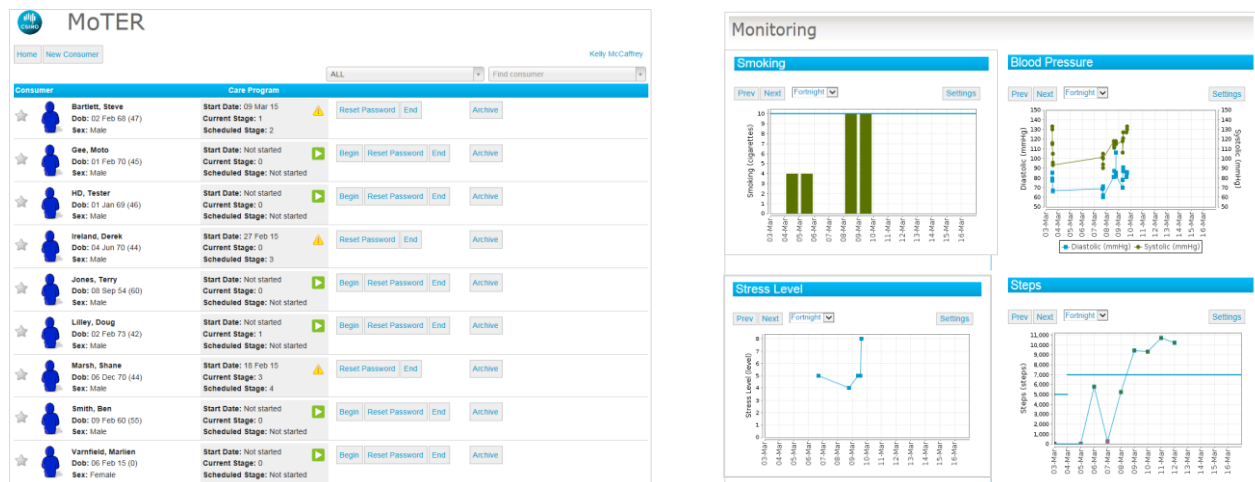


Figure 2: The web portal contains information about the patient, as well as data uploaded from the MoTER app.

The MoTER platform for cardiac rehabilitation has already been implemented at the Ipswich in the West Moreton Hospital and Health Service as part of their day-to-day service provision for Cardiac Rehabilitation. MoTER is currently being implemented in another Qld metropolitan health service district, the Metro North Hospital and Health Service. Furthermore, Metro South Health is currently developing a business case to do the same.

2.3 Further Research and Development

The advantage of mobile and web technology is that it is personalised, easy to access, and is widely used by people from all ages and stages of life. Because MoTER is an evidence-based platform, it is envisaged that the MoTER platform has the potential to provide an effective approach to preventive care and self-management of other chronic diseases. CSIRO is currently working with clinicians in Queensland Health to extend the MoTER platform and design and develop mobile phone based service models for diseases such as diabetes, heart failure and COPD are currently.

2.3.1 DIABETES

Diabetes is a good example of a chronic disease that requires ongoing self-management but can require support from a specialised in-hospital clinic, such as the insulin stabilizing service at the PA hospital. Currently the service provides support to diabetes patients through regular phone calls and in-patient appointments with the aim of achieving more effective glycaemic control.

To reduce the manual workload of the clinic, CSIRO has worked with clinicians to add functionality to the MoTER platform for automated capture of blood glucose levels. The platform uses modern glucose meters with wireless Bluetooth connectivity, enabling the patients' glucose entries in the glucose meter to be wirelessly transferred to their mobile phones.

Through the mobile phones, the glucose are automatically uploaded to a remote computer at the diabetes clinic for monitoring and clinical interventions. The application of MoTER is expected to improve the data quality, and increase the capacity of the current insulin stabilizing service by 20%. To evaluate the proposed care model, a clinical trial has been designed, and is currently running at the Princess Alexandra Hospital

2.3.2 INDIGENOUS CARDIAC HEALTH

Cardiovascular disease is the leading cause of death in Aboriginal and Torres Strait Islanders². Barriers to the use of cardiac rehabilitation programs for Indigenous people are exacerbated, including accessibility, cultural differences and financial difficulties. A study conducted in 2003 found that only 3% of remote Indigenous patients were fully engaged in cardiac rehab³. Perhaps as a consequence, Indigenous people are 2.3 times more likely to die within four years of a cardiac event.

In July 2014, the Department of Science, Information Technology, Innovation and the Arts (DSITIA) launched the Queensland Government Innovation Hub Pilot Project as a new way to solve complex issues. CSIRO was tasked with one of Queensland Health's most difficult problems: "Indigenous Health – it is hard for Indigenous Australians living in remote communities to recognise their cardiovascular risks and to identify accessible and relevant options to improve their health". CSIRO drew on expertise in the development and validation of the mobile health delivery of the cardiac rehabilitation program with Metro North HHS (Section 2.1) to provide a solution for this problem. If the results from the Metro North HHS trial can be replicated in Indigenous populations, the program has the potential to significantly improve life expectancy and help close the gap in health outcomes.

The existing program was not suitable for Indigenous Australians as it was heavily text based, Caucasian-centric and designed for the individual rather than community. To meet the challenge faced by Queensland Health, CSIRO undertook to customise the platform through engagement with an Aboriginal community, Indigenous health providers and an Aboriginal production company. Modifications were made to all components of the program including service delivery (home care program, clinical portal and mentoring); education (videos and messages); and the smartphone app (health diary and program delivery) to develop a culturally relevant health management tool suitable for Indigenous Australians living in urban and remote communities (Figure 3).

This novel program is now ready for further community consultation and trial in an Indigenous community. CSIRO and Queensland Health are currently finalising the arrangements for a metropolitan pilot.

² AIHW 2011. The Health and Welfare of Australia's Aboriginal and Torres Strait Islander People, An Overview 2011. AIHW 42. Canberra.

³ Shepherd, F., Battye, K., & Chalmers, E. 2003. Improving access to cardiac rehabilitation for remote Indigenous clients. *Aust N Z J Public Health*, 27(6), 632-636.

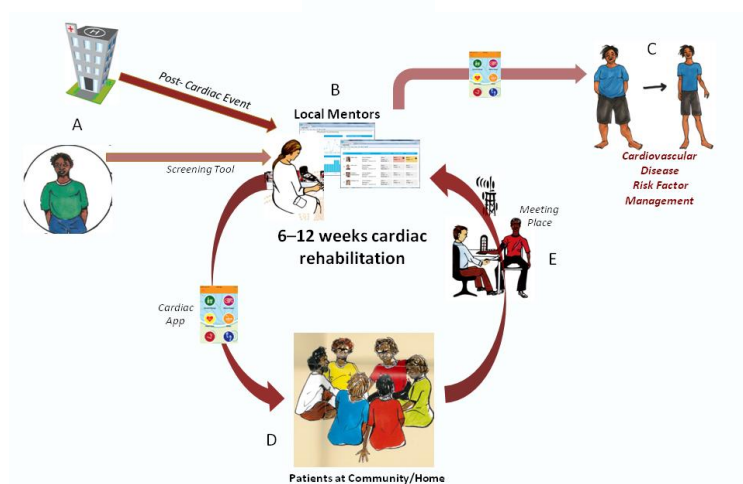
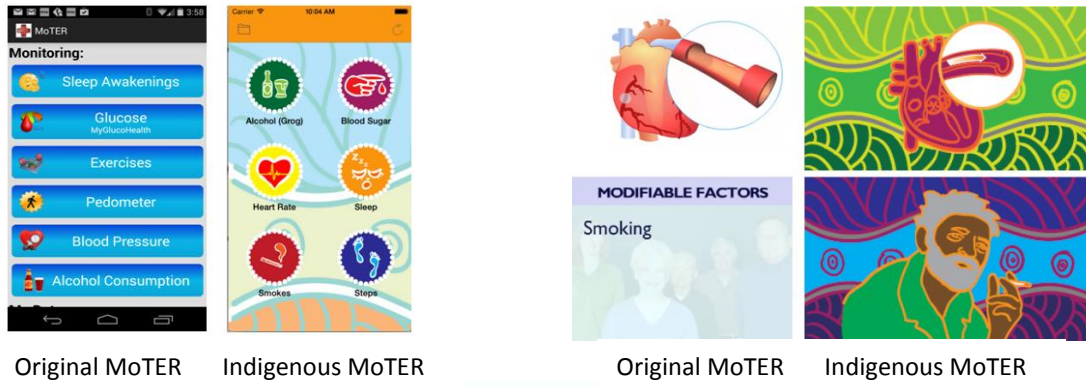


Figure 3: In the Indigenous MoTER Cardiac platform, Aboriginal artwork replaces the original text based app (top left) and educational videos (top right). An integrated service delivery model was developed (bottom).

3 Food and Nutrition

CSIRO's Food, Nutrition and Bioproducts Flagship undertakes research into food and nutrition related to personalised health. Increasingly these interventions are being delivered through online platforms.

3.1 The CSIRO Total Wellbeing Diet Online

The CSIRO Total Wellbeing Diet online is a 12-week program that allows better personalisation of one of Australia's most popular diets. The [CSIRO Total Wellbeing Diet online](#) is a digital version of the program that was originally published as a series of books⁴.

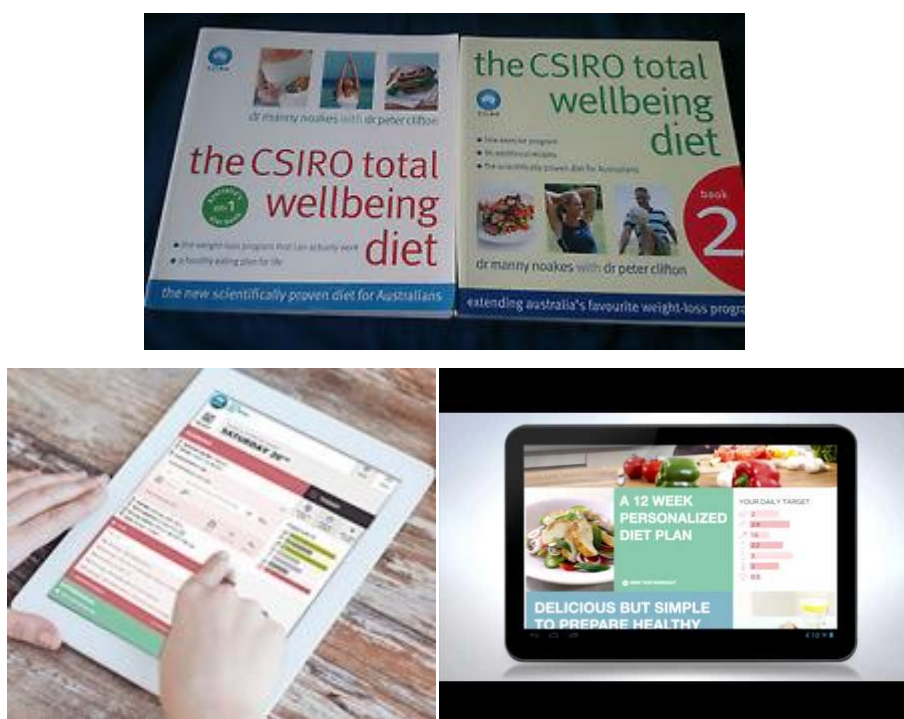


Figure 4: The CSIRO Total Wellbeing Diet books are now available online.

CSIRO has licensed the CSIRO Total Wellbeing Diet to SP Health for the development of an online next generation Total Wellbeing Diet program, in collaboration with the Glycemic Index Foundation. The online program was launched in January 2015.

⁴ Wyld B, Harrison A, Noakes M. The CSIRO Total Wellbeing Diet Book 1: sociodemographic differences and impact on weight loss and well-being in Australia. Public Health Nutr. 2010 Dec;13(12):2105-10.

The eating plan is based on scientific research and is higher protein and low GI. It is also nutritionally balanced and meets Dietary Guidelines for red meat consumption.

Food diaries are essential for successful weight management, but most diaries only count calories. The new Total Wellbeing Diet online diary instantly tallies food groups and shows where users are going right and wrong with their eating plan.

What you eat is just part of the story, and the online system includes practical, realistic exercise programs to help maximise the weight loss and wellness benefits of the Total Wellbeing Diet. Perfect for beginners, you can choose from a gym program or walking and running programs that can be done from home.

The essential features⁵ of your Total Wellbeing Diet program are available on tablet and mobile phone. Clients can check their meal plans, track their intake and remain motivated with the online Forum and weekly emails.

3.2 Impromy™ Health and Weight Management Program

Impromy™ is a unique health and weight management program developed by CSIRO in collaboration with Probiotec PTY LTD.

Meal replacements have been used extensively in weight loss research that has demonstrated long term effectiveness. The key element of translating this research is to develop a service delivery model that can replicate these findings.

CSIRO has tested the efficacy of combining higher protein main meals with breakfast and lunch meal replacements in the form of shakes in the early stages of weight loss and incorporated a mobile app and point of care testing for use in the pharmacy setting. Impromy™ brings together key elements:

- A focus on high protein meals and meal replacements (nutritionally enhanced shakes and bars).
- A mobile phone app which provides ongoing support and personalised feedback (available for smart phones)
- A trained consultant who provides support, measures cholesterol, blood pressure and blood sugar levels, and guides you through the stages of the program.
- Expert telephone and online program information is also available for consumers, pharmacists and doctors

Prior, and ongoing, clinical trials have provided the building blocks for the Impromy™ program^{6,7}. It expands CSIRO research on higher protein diets and mobile phone technology, and how these can be used effectively in a community pharmacy setting (Figure 5).

⁵ Brindal E, Freyne J, Saunders I, Berkovsky S, Smith G, Noakes M. Features predicting weight loss in overweight or obese participants in a web-based intervention: randomized trial. J Med Internet Res. 2012 Dec 12;14(6):e173.

⁶ Brindal E, Hendrie G, Freyne J, Coombe M, Berkovsky S, Noakes M. Design and pilot results of a mobile phone weight-loss application for women starting a meal replacement programme.

⁷ Evaluation of Impromy in Pharmacy. Griffiths University Report: <http://impromy.com/effect-pharmacy-online-support-griffith-university-study/>

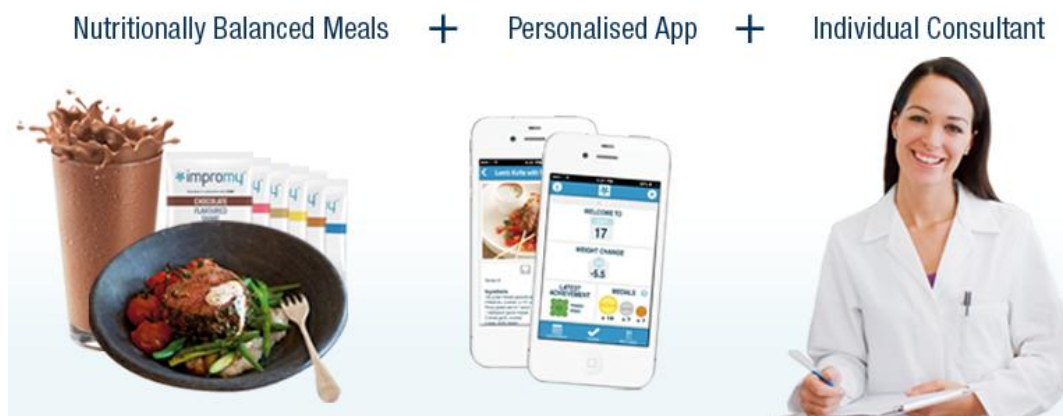


Figure 5: The Impromy™ program combines nutritious meals with an app-based health management program and expert advice.

3.3 CSIRO Healthy Heart Program

The CSIRO Healthy Heart Program is the culmination of research, which has come together as a comprehensive program, designed to look after the health of the whole cardiovascular system. Although available as a commercial publication, a pilot of a service model delivered in a General Practice setting via telephone support from the Heart Foundation Information Service Call Centre has been completed in collaboration with the University of Adelaide.

Key features of the Healthy Heart Program include

- A Quantitative structured eating program
- Kilojoule controlled
- Low in saturated fat (<8% energy) and sodium
- Contain 2g plant sterols
- High in Omega 3 fatty acids from fish or enriched foods or supplements (>500mg/day)
- Includes cardio-protective foods - whole grains, nuts, fruit/vegetables

In general practice patients, delivering the Healthy Heart Program through an existing telephone health service is effective in achieving reductions in LDL-C and total cholesterol^{8,9}. This program has potential for wider implementation to support primary prevention of cardiovascular disease.

⁸ Stuart KL, Wyld B, Bastiaans K, Stocks N, Brinkworth G, Mohr P, Noakes M. A telephone-supported cardiovascular lifestyle programme (CLIP) for lipid reduction and weight loss in general practice patients: a randomised controlled pilot trial. *Public Health Nutr.* 2014 Mar;17(3):640-7.

⁹ Cleanthous X, Noakes M, Brinkworth GD, Keogh JB, Williams G, Clifton PM. A pilot comprehensive lifestyle intervention program (CLIP)--comparison with qualitative lifestyle advice and simvastatin on cardiovascular risk factors in overweight hypercholesterolaemic individuals. *Nutr Metab Cardiovasc Dis.* 2011 Mar;21(3):165-72.

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