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FINAL REPORT

Project / Program Title		Text Messages for Cardiovascular Disease Prevention and Analysis of Engagement using Machine Learning
Name		Dr Harry Klimis
Award Received		2019 RACP Fellows Research Entry Scholarship
Report Date		June 2021
Chief Investigator / Supervisor		Dr Clara Chow
Administering Institution		The University of Sydney
Funding Period	Start Date:	February 2019
	Finish Date:	February 2020

PROJECT SUMMARY

We examined the role of text message-based programs to prevent heart disease in patients who have uncontrolled risk factors (e.g. smoking). There were 2 main parts. The first part centred around assessing previous trials we have run targeting people with established heart disease and determining what influences participant engagement with text messages using machine learning techniques to categorise text messages. We found that participants with higher baseline risk are more motivated towards beneficial lifestyle change. This key learning was used to inform Part 2, which tested (using a randomised clinical trial) and delivered a text message-based program to patients without established heart disease but who are at high risk. The results found that text messages for primary prevention can engender behaviour change and is highly acceptable by patients.

PROJECT AIMS / OBJECTIVES

1. To examine the role of mHealth in bridging gaps in cardiovascular disease (CVD) prevention

2. To identify factors that are associated with effective text message-based CVD prevention programs in order to optimise future program development by:

2.1 Examining participant engagement with text message-based prevention

programs by assessing responses to texts

2.2 Identifying predictors of smoking cessation in a text message-based intervention delivered to people with CVD, and the effect of interactions with

clinical variables selected a priori

3. To develop and test the effect of a text message-based primary prevention program

delivered to patients, with moderate-high absolute cardiovascular risk presenting to RAC services, on cardiovascular risk factors (TextMe2)

SIGNIFICANCE AND OUTCOMES

Program message intent (e.g. informative) was found to be an important influencer of engagement, including the likelihood of prematurely stopping the intervention, but is affected by program type (i.e. either unidirectional or bidirectional).

Analysis of TEXT ME assessing smoking cessation, as an example of beneficial lifestyle change, suggested that participants with higher baseline risk may be more likely to change behaviour in response to mHealth programs. Specifically, mean number of cigarettes smoked per day (OR 1.02; 95% CI 1.00-1.04) and receiving text messages (OR 2.34; 95% CI 1.43-3.86) were independent predictors for smoking cessation. High low-density lipoprotein cholesterol (LDL-C) showed a significant interaction effect with the intervention to result in quitting smoking (High LDL*Intervention OR 3.77; 95% CI 2.05-6.94).

In a RCT comparing text message support for primary prevention in moderate-high cardiovascular risk patients (the TextMe2 RCT), there was no significant between-group difference in the proportion of patients who had ≥3 uncontrolled risk factors (raised LDL-C, elevated blood pressure, high body mass index, physical inactivity, and smoking) at 6 months. However, there was a greater reduction in the proportion of participants with ≥3 uncontrolled risk factors at 6-months compared to baseline in intervention versus control groups (21.9% versus 8.4% absolute decrease from baseline; P=0.008). Significantly more intervention participants decreased the number of uncontrolled risk factors at 6 months from baseline compared to controls (RR 1.15; 95% CI 1.00-1.32), and were almost 30% less likely to be physically inactive (RR 0.72; 95% CI 0.57- 0.92).

Significance: This research describes a novel method of characterising text message-based health interventions, identifies program features associated with engagement, and has found that participants with higher baseline risk may be more motivated towards beneficial lifestyle change. Our ML models would allow the ability to monitor and to describe the way participants interact with different text message-based prevention programs, which potentially could be used to optimise future programs by minimising participant withdrawal and maximising the likelihood of behaviour change. TextMe2 has shown that text messages for primary prevention can engender behaviour change and is highly acceptable by patients. The results are generalisable to similar primary prevention populations with elevated risk, and the intervention is scalable.

Future studies should be directed at examining how to maximise the effectiveness of text message-based programs for primary prevention embedded within healthcare systems and how best to scale this novel approach to other healthcare settings.

PUBLICATIONS / PRESENTATIONS

1. Klimis H, Khan ME, Kok C, Chow CK. The Role of Text Messaging in Cardiovascular Risk Factor Optimization. Curr Cardiol Rep.

2017;19(1):4.

2. Klimis H, Thakkar J, Chow CK. Breaking Barriers: Mobile Health Interventions for Cardiovascular Disease. Can J Cardiol.

2018;34(7):905-913.

3. Klimis H, Marschner S, Von Huben A, Thiagalingam A, Chow CK. Predictors of Smoking Cessation in a Lifestyle-Focused Text-Message Support Programme Delivered to People with Coronary Heart Disease: An Analysis From the Tobacco Exercise and Diet Messages (TEXTME)

Randomised Clinical Trial. Tob Use Insights. 2020;13:1179173X20901486

4. Klimis H, Thiagalingam A, Chow CK. Text messages for primary prevention of cardiovascular disease: the TextMe2 randomised controlled trial protocol. BMJ Open. 2020;10(4):e036767.

5. Klimis H, Nothman J, Lu D, Sun C, Cheung NW, Redfern J, Thiagalingam A, Chow CK. Text message analysis for chronic disease prevention: analysing message characteristics that predict engagement with mobile health using machine learning. JMIR mHealth and uHealth. 2021, Under review.

6. Klimis H, Thiagalingam A, McIntyre D, Marschner S, Von Huben A, Chow CK. Text messages for primary prevention of cardiovascular disease: The TextMe2 Randomised Clinical Trial. AHJ. 2021, Under review.

ACKNOWLEDGEMENTS

1. Klimis H, Marschner S, Von Huben A, Thiagalingam A, Chow CK. Predictors of Smoking Cessation in a Lifestyle-Focused Text-Message Support Programme Delivered to People with Coronary Heart Disease: An Analysis From the Tobacco Exercise and Diet Messages (TEXTME) Randomised Clinical Trial. Tob Use Insights. 2020;13:1179173X20901486

2. Klimis H, Thiagalingam A, Chow CK. Text messages for primary prevention of cardiovascular disease: the TextMe2 randomised controlled trial protocol. BMJ Open. 2020;10(4):e036767.

3. Klimis H, Nothman J, Lu D, Sun C, Cheung NW, Redfern J, Thiagalingam A, Chow CK. Text message analysis for chronic disease prevention: analysing message characteristics that predict engagement with mobile health using machine learning. JMIR mHealth and uHealth. 2021, Under review.

4. Klimis H, Thiagalingam A, McIntyre D, Marschner S, Von Huben A, Chow CK. Text messages for primary prevention of cardiovascular disease: The TextMe2 Randomised Clinical Trial. AHJ. 2021, Under review.

5. Klimis H, Von Huben A, Turnbull S, Han J, Chen H, Nalliah CJ, Thiagalingam A, Chow CK, Kumar S. Rapid Access Arrhythmia Clinics (RAACs) Versus Usual Care: Improving Efficiency and Safety of Arrhythmia Management. Heart, lung & circulation. 2021.

30(5):665-673. doi: 10.1016/j.hlc.2020.10.023