

Gamified Smartphone-App Interventions on Behaviour and Metabolic Profile in Patients at Risk of Cardiovascular Disease

Sayan MITRA^{a,b,1}, Cynthia M KROEGER^{a,b}, Tian WANG^{a,b}, Andrius MASEDUNSKAS^{a,b}, Sophie A CASSIDY^{a,b}, Robin HUANG^c, Luigi FONTANA^{a,b,d,e} and Na LIU^f

^a Charles Perkins Centre, The University of Sydney, Camperdown, NSW, Australia

^b Faculty of Medicine and Health, The University of Sydney, Camperdown, NSW, Australia

^c School of Computer Science, The University of Sydney, Darlington, NSW, Australia

^d Department of Endocrinology, Royal Prince Alfred Hospital, Sydney, NSW, Australia

^e Department of Clinical and Experimental Sciences, Brescia University, Brescia, Italy

^f The University of Sydney Business School, Darlington, NSW, Australia

ORCID ID: Sayan Mitra <https://orcid.org/0000-0002-4883-4966>, Cynthia M Kroeger <https://orcid.org/0000-0002-5828-4283>, Tian Wang <https://orcid.org/0000-0001-7217-4200>, Andrius Masedunskas <https://orcid.org/0000-0002-4533-5467>, Sophie A Cassidy <https://orcid.org/0000-0002-0228-7274>, Robin Huang <https://orcid.org/0000-0002-1529-9231>, Luigi Fontana <https://orcid.org/0000-0001-8500-5537>, Na Liu <https://orcid.org/0000-0003-1046-0775>

Abstract. This study assesses how effective gamification in smartphone apps is at enhancing lifestyle and cardiometabolic health in adults at risk of cardiovascular disease. Using a systematic review of six databases, it looked at trials that compared gamified and traditional interventions. Although apps scored highly for functionality, averaging a 4.07 rating, they lacked focus on user engagement. The study reveals that gamification can aid in achievable lifestyle changes and improve cardiometabolic factors, providing insights for future digital health approaches targeting CVD risk reduction.

Keywords. Gamification, app-based education, behaviour change, cardiovascular health, smartphone, mhealth

1. Introduction

Cardiovascular disease (CVD) represents a significant global health burden, contributing to a considerable annual mortality rate. Empirical evidence has substantiated the efficacy of lifestyle alterations in attenuating the risk associated with CVD.[1] However, traditional approaches to risk mitigation frequently exhibit diminished effectiveness over prolonged periods, necessitating the development of novel intervention methodologies to sustain motivation among individuals predisposed to CVD.[2] One emerging approach

¹ Corresponding author: Sayan Mitra, sayan.mitra@sydney.edu.au

is gamification, a technique that incorporates elements of game design into non-gaming environments, with the objective of amplifying intrinsic motivation and user engagement in smartphone application-based interventions.[3] Despite the escalating attention towards the application of gamification, comprehensive literature reviews evaluating its impact on CVD risk reduction are notably scarce.

2. Methods

Our study adhered to the PRISMA guidelines and AMSTAR-2 checklist, and the protocol was pre-registered in PROSPERO (CRD42021239220). Multiple databases were queried for relevant literature. The inclusion criteria were (a) RCTs, (b) interventions via mobile apps with/without gamification, (c) targeting those at CVD risk, (d) assessing lifestyle and cardiometabolic outcomes, and (e) in English. The Mobile Apps Rating Scale (MARS) was used to evaluate app quality. Risk of bias was assessed using the Cochrane Risk of Bias Tool 2.0.

3. Results

Of the 4050 records screened, 33 articles (21 for meta-analysis; 1878 total participants) were included in the review. Utilising the MARS App Quality Rating Subscale (Sections A-D), the functionality of the apps was the most salient factor for higher ratings, with a mean score of 4.07 (SD 0.38). 'Rules/goals' and 'Assessment' are the most frequently occurring game attributes. 'Feedback' and 'Progress (task-related)' were the most studied elements. Despite utilising gamification, the apps demonstrated limited focus on user engagement, particularly in terms of entertainment and interactivity. Overall, seven studies had low risk, 12 had some, and 10 had high risk of bias.

4. Conclusions

This systematic review evaluates the impact of gamification in smartphone apps for individuals at risk of cardiovascular disease. It provides insights into gamification's effectiveness in promoting achievable lifestyle changes and improving cardiometabolic profiles. These findings will have implications for future interventions targeting CVD risk reduction via digital health interventions.

References

- [1] Rippe JM. Lifestyle Strategies for Risk Factor Reduction, Prevention, and Treatment of Cardiovascular Disease. *American Journal of Lifestyle Medicine*. 2018;13(2):204-12. doi: 10.1177/1559827618812395.
- [2] Berkel LA, Carlos Poston WS, Reeves RS, Foreyt JP. Behavioral Interventions for Obesity. *Journal of the American Dietetic Association*. 2005;105(5, Supplement):35-43. doi: 10.1016/j.jada.2005.02.031.
- [3] Lewey J, Murphy S, Zhang D, Putt ME, Elovitz MA, Riis V, et al. Effectiveness of a Text-Based Gamification Intervention to Improve Physical Activity Among Postpartum Individuals With Hypertensive Disorders of Pregnancy: A Randomized Clinical Trial. *JAMA Cardiology*. 2022;7(6):591-9. doi: 10.1001/jamacardio.2022.0553.