

Prevention of Obesity and Cardiovascular Disease in Young People Using Technology

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Conflict-of-interest statement: The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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Received: December 11, 2017

Revised: February 2, 2018

Accepted: February 6, 2018

Published online: March 19, 2018

ABSTRACT

Cardiovascular disease (CVD) is the leading cause of death worldwide. Excess weight gain during adolescence (14-18 years) and young adulthood (18-24 years) is associated with CVD in later life. Despite the significant investment into treatment for obesity, efforts have had limited success. Aiming to prevent obesity by halting weight gains at critical life stages where weight gain occurs, such as adolescence and young adulthood, could be a solution towards combating the obesity epidemic and thus reducing CVD

prevalence in later life. Technology-based interventions can improve lifestyle behaviours in adults. Currently, over 80% of young people in developed countries own a Smartphone. Smartphones may offer an opportunity for intervention. However, there is limited long-term evidence for the role of mhealth in primary prevention of CVD in young people. In this manuscript, we discuss and review the potential use of mhealth for the primary prevention of CVD in young people, and we provide recommendations for further research.

Key words: Adolescents; Young adults; Obesity; Cardiovascular disease; Prevention; Technology

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Partridge SR, Redfern J. Prevention of Obesity and Cardiovascular Disease in Young People Using Technology. *Journal of Cardiology and Therapy* 2018; 5(1): 718-722 Available from: URL: <http://www.ghrnet.org/index.php/jct/article/view/2222>

INTRODUCTION

Two-fifths of the world's population is less than 24 years of age^[1]. Society perceives adolescence (13-18 years) and young adulthood (18-24 years) as healthy life stages with high physical and cognitive abilities^[2]. However, many young people are facing worse health prospects than their parents, due to increasing rates of overweight and obesity and the subsequent earlier onset of chronic diseases, including cardiovascular disease (CVD)^[3]. CVD remains the leading cause of death worldwide. In 2015, CVD accounted for 31% of all global deaths^[4]. Considering the current obesogenic environment, CVD risk factors^[5], including overweight and obesity, unhealthy diet and physical inactivity, are often established and ingrained in youth, particularly during transitional periods such as adolescence^[6] and young adulthood^[7,8].

Age-related weight gain during adolescence and young adulthood have been positively associated with both unhealthy diet and physical inactivity^[9,10]. Uncontrolled annual weight gains of 0.7-1.0 kilogram (kg) per year may lead to overweight and obesity^[11], which is an independent risk factor for CVD^[5]. Young people who gain

weight and maintain a high body mass index (BMI) into adulthood, have higher odds of developing hypertension and systemic inflammation^[3,12,13]. Intervention to prevent obesity by addressing unhealthy diet and physical inactivity is an advisable goal in the primary prevention of CVD in young people.

Given today's adolescents and young adults ('Generation Z') are digital natives, mobile health ('mhealth') is a promising modality for CVD prevention in this population^[14]. Globally, young people are using the same technological devices. Indeed, smartphones are deeply embedded in their everyday lives, with ownership and usage highest among young adults aged 18-34 years from Australia and United States of America (USA) at 95% and 92%, respectively^[15]. Approximately, 86% and 73% of adolescents from Australia and USA own a Smartphone, respectively^[16,17]. Over 80% of adolescents and young adults are going online three or more times per day, with 24% of adolescents going online 'almost constantly',^[16] and undertaking range of activities online^[15]. Communication via social networking sites is an increasingly popular online activity for young people^[15,16]. This proliferation in use and availability of technology offers an opportunity to explore the potential role of technology in healthcare delivery and support for all populations but in particular young people.

Use of inexpensive and scalable mhealth interventions could have a major role in the primary prevention of CVD by improving risk factors in young people. In this short communication paper we discuss key risk factors for CVD established during youth, current evidence for mhealth interventions to improve risk factors, and provide recommendations for further research.

OBESITY AS AN INDEPENDENT RISK FACTORS FOR CARDIOVASCULAR DISEASE

The global prevalence of child and adolescent (5-19 years) obesity has increased from < 1% in 1975 to nearly 6% in girls and 8% in boys in 2016^[18]. An additional 213 million children and adolescents were overweight in 2016^[18]. Despite 2016 data showing children's and adolescent's BMI plateauing in many high-income countries^[18] the prevalence is higher compared to low-income countries with 23.8% of boys and 22.6% of girls overweight or obese^[19]. In 2014-15, 28.1% and 32.6% of Australian adolescents aged 12-15 years and 16-17 years were overweight or obese, respectively^[20]. In the USA, 20.6% of adolescents aged 12-19 years were obese in 2013-14^[21]. Similarly to adolescents, the prevalence of overweight and obesity in young adults is higher in high-income countries such as Australia and the USA^[20,22]. In Australia, national data from 2014-2015 showed that 38.9% of young adults aged 18-24 years were overweight or obese^[20]. In the USA, 34% of 20-39-year-olds were obese in 2013-14^[22]. In developed countries, socioeconomically disadvantaged adolescents and young people have higher rates of overweight and obesity^[23].

To prevent obesity in young people, there is a need for coordinated prevention approaches to improve key lifestyle behaviours, namely unhealthy diet and physical inactivity. Currently, young people are not achieving dietary intake recommendations and do not meet physical activity targets. The World Health Organisation (WHO) recommends a healthy diet for adults consisting of 400 g or more per day of fruits and vegetables, less than 30% of total energy intake from fats, less than 5 g of salt and less than 10% of total energy intake from free sugars^[24]. Further attention to diet is required during adolescent growth where requirements for certain nutrients, such as calcium and iron, are higher than that of young adulthood^[25].

Moreover, adolescents should accumulate at least 60 minutes or more of moderate to vigorous intensity physical activity every day^[26], and activities that strengthen muscle and bone. In addition, adolescents should minimise their sedentary time by limiting the use of electronic media for entertainment to no more than two hours a day^[26]. It is recommended young adults engage in 150 to 300 minutes of moderate to vigorous intensity physical activity each week^[26].

Energy intake, diet quality and physical activity levels often reach their peak in adolescence and carry forward into young adulthood^[27]. Adolescents and young adults are exposed to an overabundance of highly palatable convenient food choices and as such frequently consume energy-dense, nutrient-poor foods^[28]. For example in Australia, < 1% of adolescents eat enough vegetables, < 27% eat enough fruit, or < 2% eat adequate amounts of high-calcium foods^[29]. They are also the highest consumers of discretionary foods and sugar-sweetened beverages^[29]. In the USA, 6 in 10 young people (63%) drink a sugar-sweetened beverage daily, adding an additional 143 kilocalories [kcal; 598 kilojoules (kJ)] per day^[30]. This may result in excessive energy intake. This is often in combination with a decline in physical activity during the transition from adolescence to young adulthood^[31] and an increase in sedentary behaviour^[32], thereby reducing total energy expenditure. Recent Australian data indicates only 1 in 8 met the adolescent physical activity guidelines^[29] and 47% of young adults are physically inactive^[33]. This results in positive energy balance and subsequent weight gain. It has been suggested that a weight gain of 1-5 kg per year results from consuming as little as 20-100 kcal (84-418 kJ) per day more than expended^[34]. National bodies have identified that achieving a negative energy balance is the most important factor affecting weight management^[35,36].

A challenge of prevention efforts for obesity is that many young people recognise a growing societal concern with many health-related implications of weight gain, but do not feel that it affects them personally^[37]. This may be because many young people, particularly, young men, feel healthy, and have no medical indications warranting medical attention^[38,39]. An additional challenge with adolescents and young adults is that they are in a transitional life stages where independence develops, and many young people are resistant to interventions they feel inhibits their independence^[38,39].

Recent endeavours to prevent obesity have focused on adolescents and young adults^[40,41]. However, the rising prevalence of obesity in adolescents and young adults, as well as the excess weight gain during these life stages, and the increased CVD risk associated with excessive weight gain indicate that scalable efforts to prevent and manage obesity in young people should be given a high priority^[42]. Many weight management interventions for young people have focused on diet or physical activity education by in-person individual or group based sessions^[41]. While implementing such interventions results in short-term effectiveness for weight management and lifestyle behaviour change, it is unclear if these changes are sustained long-term and if the interventions are feasible at scale^[41].

Key behaviour change techniques for weight management programs in young people include goal setting, self-monitoring and stimulus control, via personal contact, such as individual counselling and reinforced by resources^[35,43]. Mobile technology has the ability to deliver such behaviour change techniques^[44] and young adults are known to access health information using technology^[45]. Given the ubiquity of mobile phone ownership in young people, particularly smartphones, and their transient lifestyle and need for independence, more efficient delivery of obesity prevention programs might be enabled by electronic means^[46,47].

MHEALTH INTERVENTIONS FOR IMPROVING CARDIOVASCULAR RISK FACTORS IN YOUNG PEOPLE

Smartphones have the electronic functions and capabilities to support delivery of lifestyle interventions through core functions such as the call feature, text messaging, internet access and smartphone applications ('apps'). Using these capabilities of Smartphones, mhealth programs can be designed to deliver individualised health coaching, send personalised text messages, provide access to mobile websites, send emails and provide smartphone apps containing resources for behavioural reinforcement^[48]. These functionalities can be used in a number of ways and in combination for obesity prevention, including to enhance program flexibility and affordability; allowing health education or counselling to be delivered remotely; or by incorporating automated features to replace program personnel.

Two of the main strategies for delivering mhealth delivery are via text messages and the use of apps^[49]. In brief, text messages [or Short Message Service (SMS)] are traditionally 160 characters sent from an internet server or from a mobile phone to one or several mobile phones^[50]. Text messages provide a global, low cost medium of communication, particularly among young people. Apps are purposive designed software programs developed to be downloaded and run on smartphone devices^[51]. Additionally, smartphone devices enable internet access via apps or web browsers for online activities such as social networking sites. Despite the limited evidence based, there is promising trends showing mhealth interventions, can produce significant improvements in the dietary and physical activity behaviours of adolescents and young adults^[46,47]. Specifically, web site and electronic health interventions can effect diet and physical activity behaviour change among adolescents and young adults^[45,47]. However, these changes are often not sustained long term. Robust evidence is lacking for text messages, apps, and social media interventions^[46,52].

There is an emerging body of evidence for text message based interventions for short-term weight management in adolescents and young adults^[53-56]. A mhealth trial with text messages in at-risk or overweight young adults (18-35 years) with baseline BMIs between 23.0-31.9 kg m² that ran for 3-months with a 6-month maintenance phase found intervention participants weighed 3.7 kg [95% confidence interval (CI) -6.1, -1.3] less at 3-months, and 4.7 kg (95% CI -6.9, -1.8) less at 9-months compared to control participants^[53]. Further, a study in USA college students found a combined social media (Facebook) and text message based program resulted in significantly greater weight loss at 8 weeks (-2.4 ± 2.5 kg) compared to a social media only group (-0.63 ± 2.4 kg) and a wait list control (-0.24 ± 2.6 kg) (Ps < 0.05)^[55].

There is less evidence for the use of text messages in obesity management for adolescents^[52]. Text messages have shown promise in the maintenance of diet and physical activity behaviours after participation in an 8-week a family-centred behavioural intervention^[56]. However, process evaluation data indicated that what adolescents said they wanted in text messages often conflicted with their actual experiences in the program^[57]. Other research has indicated when text messages are constructed carefully in collaboration with adolescents, they are acceptable to support weight loss^[58]. Previous research in adults with heart disease used a multistep, iterative, mixed methods process to develop text messages that provide information, motivation, and support to meet national guidelines for heart disease^[59]. This collaborative formative research

with the target population increased engagement and acceptability of the intervention and significantly reduced BMI by -1.3 kg m⁻² (95% CI -1.6, -0.9, *p* < 0.001)^[60]. There is potential to apply the formative research methodology for primary prevention of CVD in adolescent overweight populations.

RECOMMENDATIONS FOR FUTURE RESEARCH

mhealth for CVD primary prevention in young people, through obesity prevention remains an emerging area of research. Considering how embedded technology is in the everyday lives of young people, formative research is essential to ensure interventions are engaging and motivating. The needs and values of young people is particularly important when developing and implementing mhealth solutions, therefore consumer engagement throughout intervention development is vital. Lessons from effective and acceptable text message based interventions in adult populations have the potential to be applied to young people. Testing of such interventions will require large, high-quality RCTs with hard outcomes to provide more robust evidence of effectiveness of mhealth interventions, particularly in the long term. Further, mhealth obesity prevention research should have a focus on translation to inform implementation and integration into existing health services.

CONCLUSIONS

In this short communication paper we have discussed the potential use of mhealth for the prevention of obesity in young people and we highlighted need for further research. Stemming the rapid rise in CVD – through prevention and management of obesity in youth – should be given a high priority. Obesity prevention and management in young people, faces additional challenges due to the transient nature of young adulthood and the unwillingness to engage in preventive health behaviours in the absence of ill-health. Some barriers to engagement and adherence may be overcome via the use of smartphone technologies. Despite the limited evidence based, there is promising trends showing mHealth interventions, particularly text message-based, can produce significant improvements in the dietary and physical activity behaviours of young people. Considering technology is embedded in the lives of Generation Z, we require mhealth focused research efforts to provide solutions to improve the health prospects of the largest generation in history.

FUNDING

No specific funding was received to support the preparation of this manuscript. JR is funded by a Career Development and Future Leader Fellowship co-funded by the National Health and Medical Research Council and the National Heart Foundation.

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