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2018

# mHealth Applications: A Tool for Behaviour Change in Weight Management

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## Publication Details

Vlahu-Gjorgievska, E., Mulakaparambil Unnikrishnan, S. & Win, K. Than. (2018). mHealth Applications: A Tool for Behaviour Change in Weight Management. *Studies in Health Technology and Informatics*, 252 158-163. Sydney, Australia Connecting the System to Enhance the Practitioner and Consumer Experience in Healthcare

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# mHealth Applications: A Tool for Behaviour Change in Weight Management

## **Abstract**

Obesity has become a public concern all over the world and weight management is of interest to consumers. Heavy intake of food and lack of exercise are the foremost factors for obese condition. Self-management programs are essential for the prevention and treatment of obesity and weight management. Mobile health (m-Health) applications for weight management can be a useful tool in monitoring behaviour and self-management programs, thus engaging consumers in lifestyle changes to mitigate the risk of obesity. The aim of this review is to identify and compare the features supported in mHealth applications for weight management.

## **Disciplines**

Engineering | Science and Technology Studies

## **Publication Details**

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# mHealth Applications: A Tool for Behaviour Change in Weight Management

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**Abstract.** Obesity has become a public concern all over the world and weight management is of interest to consumers. Heavy intake of food and lack of exercise are the foremost factors for obese condition. Self-management programs are essential for the prevention and treatment of obesity and weight management. Mobile health (m-Health) applications for weight management can be a useful tool in monitoring behaviour and self-management programs, thus engaging consumers in lifestyle changes to mitigate the risk of obesity. The aim of this review is to identify and compare the features supported in mHealth applications for weight management.

**Keywords.** Obesity, weight management, information-motivation-behavioural skills model, persuasive technology

## Introduction

Obesity is the leading cause of morbidity all over the globe [1]. Recent studies have shown that there has been an exponential increase in the number of obese people especially in developed countries like U.S, Australia and U.K, and both adult and children are affected. Lack of physical exercise and high-calorie intake are the main factors leading to obese condition that can result in long-term health conditions and illness including diabetes, stroke, heart diseases, gall bladder diseases and some cancer [2].

Technological advancement and ubiquitous nature of mobile phones with the support of wireless sensor networks introduced a new era for self-management programs. Mobile phone and smart devices like the tablets and smart watches are in use for self-monitoring in various aspects of the health sector [3, 4]. Self-management programs, which include practising diets, healthy food habits and completing daily physical exercises, are essential for the prevention and treatment of obesity. mHealth applications for weight management have supporting features (like diet plans, reminders, messages) and can read information from external devices or sensors regarding anthropometric and physiological parameters. Therefore, these m-Health applications can be a useful tool in monitoring behaviour and self-management programs, thus engaging consumers in lifestyle changes.

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One of the models related to behaviour changes is Information-motivation-behavioural skills (IMB) model [5]. This model distinguishes (1) Information as the basic knowledge about a medical condition, (2) Motivation as personal attitudes towards the adherence behaviour, and (3) Behavioural skills as tools or strategies that the patient has in order to perform the adherence behaviour. The IMB model demonstrates that information is a prerequisite for changing behaviour, and motivation and behavioural skills are critical determinants that are independent of behaviour change. However, the presence of both, information and motivation, increase the likelihood of behavioural change [6]. The aim of this review is to identify and compare the features supported in the mHealth apps for weight management.

## 1. Methodology

A literature search was conducted between December 2016 and May 2017 for mobile-based applications for obesity (weight management). Scopus, IEEE and PubMed databases were searched by the query: “Obesity” AND “Physical activity” AND (“Smart phone” OR “Smart Devices” OR “Mobile application”). The articles published after 2013, in the English language were considered.

The combined searches returned 2017 results. 1630 articles were excluded based on the title. From the selected articles, 33 papers were removed due to repetition. 137 papers were considered eligible based on the abstract and 32 papers were shortlisted for full-text reading. Review articles, studies regarding the initial design and articles that did not give a clear picture about the mobile applications used were excluded.

Six articles that include studies regarding applications related to weight management, self-motivation, physical activity support and nutritional management were taken into consideration for this review.

## 2. Results

Each article uses a different approach in order to estimate the effectiveness, impact, accuracy, qualitative feedback, and desired feature/support of the mobile application. Duration of studies varied and the number and age group of the participants was grounded on different inclusion criteria. Except for two studies, one focused on pregnant women and another on children, all other studies included adults with age between 18 and 50 with BMI >25 kg/m<sup>2</sup>.

Each application (presented in the articles) was supported by specific features like self-monitoring, feedback report, social media support, nutritional management, behavioural change program, physical activity and calorie counting management. Different features supported in the reviewed applications are shown in Table 1.

In order to improve healthy behaviour of children and prevent obesity, Yang et al. developed a mobile application named “Happy ME” [7]. One of the features included in this app was encouraging messages. The intention of these messages is to keep the children motivated throughout the period of weight management program. Results from the study shown that the most attractive feature of this app is child-parent-school participation, which provides an opportunity for parents and teachers to monitor child’s dietary habits and physical activities.

Jung and Chung [8] present the knowledge-based dietary nutrition recommendations incorporated into “Obesity Management Service”. The evaluation study focused on users’ satisfaction and accuracy of developed application, showed the users’ positive feedback regarding receiving a real-time nutritional menu that can help with obesity control.

**Table 1.** Features in reviewed apps.

Features	Yang et al., 2017 [7]	Jung & Chung, 2016 [8]	Kranz et al., 2013 [9]	Laing et al., 2014 [10]	Kennelly et al., 2016 [11]	Lee & Kim, 2016 [12]
User	Child	Child/ Adolescent	Adult	Adult	Pregnant women	Adult
Providing additional info	Yes	Yes	Yes	No	Yes	No
Motivation	self-monitoring	nutrition recommend -ations, self-monitoring	exercise skill assessment	calorie counting, track diet and exercises	diet and physical activity tips	Motivation effect via social relationship and support
Encouraging messages	Yes	N/A	Yes	No	No	No
Social support	No	No	Facebook Twitter	Community forum	Option to contact medical team	Facebook
Reminder	Yes	No	Yes	No	Yes	No

Regular physical activity plays a significant role in maintaining personal health and well-being. However, engaging people in regular exercise requires long-term motivation. Kranz et al. [9] present a smartphone application “GymSkill” that uses an integrated sensor for exercise skill assessment and provides an individualized, self-determining training supported by a coach quality feedback. Based on the evaluation results, the authors conclude that the users were satisfied with the immediate feedback and time and location independent training support generated by the app.

Laing et al. [10] conducted a randomized-controlled trial among 212 participants (whose BMI index was greater than 25kg/m<sup>2</sup>) to access the impact of application for weight control called “MyFitnessPal”. The trial results showed that smartphone apps could be used as tools for weight loss in the primary care setting, but to achieve better results there is need for guidance and feedback from a health care team.

Kennelly et al. [11] conducted a clinical trial to evaluate the effectiveness of a smart phone technology-assisted targeted healthy lifestyle intervention. In their trial, the smart phone app provides ongoing healthy lifestyle advice and support throughout pregnancy.

Innovation in Social service network (SSN) facilitated in self-motivation as well as the behavioural change, in many users acts as a critical role in weight management. Considering this, Lee and Kim [12] developed a mHealth application named “with U”. This competitive game application is using six structural elements (rules, feedback, stories, competition, social support, goals) for engaging user in weight control. The results of the study showed that relationships within social networks are more helpful in weight loss and behavioural change.

The most of the study results [8-10, 12] have shown that the users are satisfied with the applications, and the presented apps mostly contributed towards users' motivation. The application presented in [8] was found to have positive satisfaction level of its users on service quality. Users had greater satisfaction in motivation when using GymSkill [9], and the analysis of WithU [12] shown statistically significant increases in users' motivation. Lee and Kim [12] discuss that this satisfaction can be due to the rewards included in the WithU. These rewards have the power to make the users feel good, thus induce long-term participation. Results presented in [10] showed that there was no significant increase in weight loss for participants that were using MyFitnessPal app compared to usual primary care. However, some of the participants shown high satisfaction with the application.

### 3. Discussion

Most of the applications reviewed in this paper focus on self-motivation/self-monitoring program, behavioural change, physical activity management, education, calorie counting and dietary nutritional recommendation, as well as social media (Facebook and Twitter) support, setting the goal and motivational strategy.

Information is a prerequisite for changing behaviour. The users need information to understand their health condition and the problems that can arise. On the other side, the education will empower the users to successfully cope with their health condition.

Educational materials regarding the risk of obesity, nutritional food, the importance of physical activity are part of the application "Happy Me" [7]. These education materials are very useful not only for the primary users of the app (children) but also for teachers and parents in order to develop a healthier environment. The application presented in [8] suggests the knowledge-based dietary nutritional recommendations. It also provides various types of information related to nutrition and exercise. In order to inform, educate and teach women to overcome barriers to lifestyle changes Kennelly et al. [11] presents 'healthy lifestyle package' with mHealth smart phone technology, that gives users practical tips on how to incorporate more physical activity into daily life.

Solbrig et al. [13] conclude that users are looking for applications that can strengthen their motivation and enable them to follow an accurate daily routine with adequate physical exercise and good eating habit. Although self-motivation is a very effective approach at the initial stage of weight management program, staying motivated is the hardest part. Based on the papers included in this review, every application has its own approach in users' motivation. "Happy Me" [7] offers self-monitoring. Besides the self-monitoring, "Obesity Management Service" [8] provides dietary nutritional recommendations. Combined dietary-physical activity tracking is an advantage for "GymSkill" [9] and "MyFitnessPal" [10] additionally offers exercise skill assessment. However, motivation can be also maintained with social networks, so "WithU" [12] is using the social relationship and support to increase the users' motivation.

To control unhealthy food style and improve physical exercise, proper monitoring is unavoidable. Several behavioural tools and strategy can be used for practising diets, healthy food habits and completing the daily physical exercise. Encouraging messages based on the prior performance, providing optimal feedback or a weekly or monthly progress report can be way out for behavioural change. Setting personal goal enables the user to maintain motivation for long duration time. Moreover, weekly or monthly feedbacks regarding the progress of health status are another way of keeping motivation.

Continuous monitoring and personalized advice related to exercise and health also inspire obese people to follow a regular activity. Different motivational messages are generated for the users in the applications presented in [7] and [9]. The individualized dietary nutritional menu is another approach for controlling food intake and calorie consumption. This “nutritional recommendation” feature in the mobile application helps in analyzing individually required calories, energy sources, and basic information (age, gender, BMI, height, weight.). Generating a personal menu schedule with aid of dietary nutritional database is presented in the application in [8].

Feedback support leads individuals towards better food habit and proper exercise. Regular feedback also provides a provision for the user to interact with the medical expert team or an online forum for sharing the idea, discussing and clarifying doubts that in turn help in developing self-confidence like presented in the app in [10]. At the same time, professional feedback and progress report could relieve anxiety and pressure in obese people, feature supported in the apps in [9] and [11].

The features presented and analyzed in the reviewed applications influence the consumers’ behaviour and contribute towards changes for healthier lifestyles. We strongly believe that advanced features like personalized recommendations and social elements will add a value to the mobile applications for weight management. In this context, personalized recommendations for light meals and physical activities should be based on the consumer’s (monitored) health parameters and habits. Moreover, social elements as social communities, chat rooms or forums can include broader social support promoting social healthcare programs and services. Thus, the mHealth applications can be more utilized in consumers’ everyday life.

#### **4. Conclusion**

Self-management programs are valuable for a better obesity treatment. Therefore, features like self-monitoring, professional feedback, support from social media, nutrition menu generation, goal setting, physical activity and calorie counting, supported in mobile applications play a critical role in obesity control. These features could deliver a noble platform for weight control and management through information, motivation and behavioural tools or strategies.

Most of the application for weight management support motivation and incorporate behavioural skills for pertaining the users’ desired behavioural outcome. However, some of the application do not include any information and education regarding basic knowledge, which is crucial in behaviour change. In addition, it is significant to consider the quality of the application. Lack of clinical guidance, proper testing in laboratory, security, and privacy concern and usability issue are the common weakness associated with the consumer mHealth applications for weight management.

Reviewing the features in the applications presented in this paper, we can conclude that the mobile applications for weight management include educational materials, motivation mechanisms (encouraging messages, self-motivation) and behavioural tools and strategy that can be used for practising diets, healthy food habits and completing daily physical exercises. Thus, these applications can be aligned with the information-motivation-behavioural skills (IMB) model. Applications for weight management present a powerful tool that empowers users in behavioural and lifestyle changes.

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