Journal of Telemedicine and Telecare
2014, Vol. 20(6) 339–349

DOI: 10.1177/1357633X14537777
jtt.sagepub.com

Use of mobile phones as a tool for weight loss: a systematic review

Alicia Aguilar-Martínez[1], Josep M Solé-Sedeño[2], Gemma Mancebo-Moreno[2,3], F Xavier Medina[1], Ramon Carreras-Collado[2,3] and Francesc Saigí-Rubió[1]

Summary

We conducted a systematic review of the literature on the use of mobile phones for weight loss. A total of 43 studies were identified on obese or overweight adults, aged 18 years or over. After review, ten articles met the inclusion criteria. There were 19–534 participants per study. Participants were from European, Asian and North American regions. The mean body mass index (BMI) of the subjects varied from 22 to 36 kg/m^2. Two studies used text messaging or multimedia messaging. All the other studies used mobile-phone apps or web-based programmes that could be accessed from mobile phones as a part of a weight-loss intervention or for evaluating their potential for use and their acceptance. Most studies lasted 2–4 months and the maximum duration was 1 year. All but two studies showed reductions in the participants' bodyweight, BMI, waist circumference and body fat in the various interventions. There appeared to be a proportional relationship between weight loss and programme use. The programmes most benefited those who took a pro-active approach to everyday problems. Frequent self-recording of weight seemed to be important, as was the personalisation of the intervention (counselling and individualized feedback). Finally, a social support system acted as a motivational tool.

Accepted: 28 April 2014

Introduction

Obesity is the cause of death of 2.8 million people a year. It is also one of the main risk factors for other chronic diseases, such as diabetes, cardiovascular disease and some types of cancer.[1] Unhealthy diets and physical inactivity, together with a variety of social factors, are the main causes of obesity developing.

Nutritional, dietary, physical, pharmacological and surgical treatments can lead to controlled weight loss and provide health benefits for individuals.[2] However, weight regain after initial weight loss is a major problem.[3] Clinical practice and research have highlighted major limitations regarding access to, compliance with, and the cost and long-term effectiveness of conventional weight-loss treatments. The difficulty in changing weight-control behaviours seems to be the main cause behind the weight regain. Current approaches to behavioural weight control have inherent limitations and are not feasible in the long-term. They are costly and require significant time and effort on the part of the participant.[3]

It is therefore necessary to seek new approaches that are effective in the long term, economically viable and capable of reaching a broad population of individuals in order to engage and involve them over extended periods of time. Information and communication technologies (ICTs) may be useful tools in weight loss and weight maintenance, as they offer advantages in terms of cost, ease of use, accessibility and visit times, while improving compliance with prescribed treatments through extensive patient monitoring and continuous support.[4,5] Communication via ICTs could improve conventional health communication through improved customization, contextuality, interactivity and mixed media. Theoretically, e-health communication could combine these features, unlike the current 'segmented' approaches.[6] To promote dietary and behavioural changes, research suggests that intervention programmes must be participatory, empathetic, empowering, interactive, contextually situated and convenient. In this sense, communication via ICTs seems to have a greater effect on psychological control factors, self-efficacy and motivation among patients than conventional means of communication.[6] Some studies have shown

[1]Department of Health Sciences, Universitat Oberta de Catalunya, Barcelona, Spain
[2]Department of Obstetrics and Gynecology, Hospital Universitari del Mar, Barcelona, Spain
[3]School of Medicine, Hospital Universitari del Mar, Universitat Autònoma de Barcelona, Barcelona, Spain

Corresponding author:
Francesc Saigí-Rubió, Telemedicine Programme Director, Department of Health Sciences, Universitat Oberta de Catalunya, Roc Boronat 117, 08018 Barcelona, Spain.
Email: fsaigi@uoc.edu

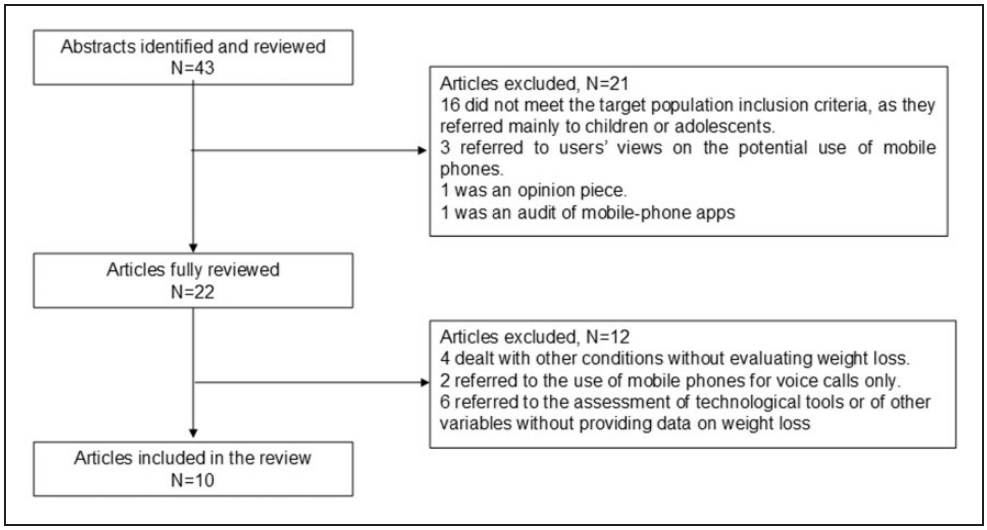

Figure 1. Search results.

that self-monitoring of food intake, physical activity and weight, together with greater responsibility being taken by patients for their own health, help with weight loss and maintenance.[7,8]

Of the many ICTs available (e.g. web sites, instant messaging, chats, video calls), mobile-phone applications (apps) are the ones most likely to gain in importance. The number of patients with mobile phones, of health-related apps and of scientific publications on the potential of using mobile phones and apps for self-care is growing considerably.[9] Their ease of use and availability are important factors. Communicating via mobile phones also enables interaction, which is one of the most important features of communication in health promotion.[10]

The objective of the present study was to review the use of mobile phones and associated apps as weight-loss tools.

Methods

A literature search was performed to find articles published up to December 2012 in the databases: PubMed, IME – Biomedicina (Spanish National Research Council), Cochrane Library Plus, Informa Healthcare, SpringerLink and PsycARTICLES (American Psychological Association). The search was performed with no language restrictions, using combinations of the following keywords and MESH terms: ''cellular phone'', ''cell phone'', ''smartphone'', ''weight loss'' and ''obesity''. Studies were included if they had been conducted on obese or overweight human adults, aged 18 years or over; there was no body mass index restriction. The search included any type of study using tools or apps for mobile phones, whose primary aim was to achieve weight loss or weight loss maintenance, and which reported data about weight change. The concomitant use of any other type of ICT communication – such as websites, email messages, chats – or face-to-face interaction was not an exclusion criterion.

A total of 43 studies were identified, the abstracts of which were reviewed to determine whether or not they matched the inclusion and exclusion criteria. After assessing the 43 abstracts, 21 studies were excluded and 22 required a more detailed review. After reading the full texts of those studies, 10 were considered to meet the selection criteria of the search. The reasons for exclusion were that the studies dealt with other conditions without evaluating weight loss; did not meet the target population inclusion criteria, as they referred mainly to children or adolescents; referred to the assessment of technological tools without providing data on weight loss; referred only to users' views on the potential use of mobile phones for the delivery of weight loss interventions; opinion pieces; audit of mobile-phone apps; or referred to the use of mobile phones for voice calls only. The search and selection process is summarised in Figure 1.

Results

The data and information on the ten studies reviewed are summarised in Table 1. There were 19–534 participants per study. Participants were from European (Central European and Nordic[11,12,16], Mediterranean,[17]), Asian[13,14,18,19] and North American[15,20] regions. Only two studies[15,20] made a distinction between Whites, African Americans and Hispanics. Men and women were included in all studies, except one.[19] In most studies, women were more highly represented and accounted for 60–89% of the participants. The age range of the participants was 18–65 years, with mean ages mostly between 45 and 55 years. The mean body mass index (BMI) of the subjects varied considerably from 22 to 36 kg/m^2.

Several studies stated that the participants had to have a little knowledge of technology, such as Internet access, data entry or basic computer skills.[17,18,19] None of the other articles either included or specified criteria of this type.

Table 1. Articles reviewed.

Study	Study population and sample	Objective	Study type	Length	Intervention	Measurements used	Results
Mattila (2010)	N: 29 69% male + 31% female. Mean age: 29 years Mean BMI: 28.8 kg/m^2	To examine the validity of self-recording of weight and the patterns of behaviour in individuals that manage to lose weight and in those who do not.	Study on the use, usability and acceptance of an app for self-recording of weight, steps, exercise and food intake.	12 weeks	Weight and waist circumference measurement, questionnaire and WD (program) installation. Weight and waist circumference check at the end of the intervention. Daily self-recording, in the app, of weight, steps, exercise done (chosen from a list) and the food and drink consumed after meals (list). Sending data each week. Reminder if the data has not been sent, but no feedback on the data sent.	Researcher-recorded weight difference. Self-recorded weight difference. Comparison of steps, exercise and food reported in the first and last months. Interest in weight fluctuations too.	Weight difference: −2.6 kg Self-recorded weight difference: −1.4 kg Validity of self-recording because of a good correlation with the measurements. Positive correlations between weight loss and records of more physical activity, lower high-calorie food consumption and higher low-calorie snack consumption. Weekly weight-loss rhythm (greater loss at the end of the week, back on at the weekend).
Morak (2008)	N: 25 40% male + 60% female. Mean age: 48 years Mean BMI: 35.6 kg/m^2	To assess the technical viability, ease of use and acceptance of a therapy for obese patients based on a web-based programme with access from mobile phones.	Pilot study	70 days	Development of a therapy management system (TMS) as a support for obesity therapy. Patients provided with mobile phones to interact with the web-based service.	Researcher-recorded before and after weight difference.	Variation in: Weight: −2.67 kg BMI: −0.78 kg/m^2 WC: −2.37 cm Reliability of self-entering of data.

(continued)

Table 1. Continued.

Study	Study population and sample	Objective	Study type	Length	Intervention	Measurements used	Results
					Self-recording of variables to be monitored. Reminder messages sent to those not interacting. Final questionnaires. Controls to check the patients' weight.		
Lee (2010)	N: 26 Mean age: 28.8 years Mean weight: 58.4 kg Mean BMI: 22.2 kg/m^2	To evaluate the effectiveness of a mobile-phone app to collect data on diet, weight control and patient satisfaction.	Case-control design	6 weeks	Development of SmartDiet (daily food intake control + "learn weight control" games). Download + dietary data entry. Results: 3 avatars (slim, normal and fat). Database containing 600 types of food and types of exercise. Recommendations and dietary rules from Han[39]	Body fat, weight and BMI at the start and end.	C: No variation I: Weight: −2 kg BMI: −0.75 kg/m^2 Body fat: −1.2 kg
Joo (2007)	N: 534 89% female. Age range: 30–60 years Mean BMI: 25.7 kg/m^2	To test changes in behaviour using text messaging for weight loss.	Uncontrolled clinical trial	12 weeks	Text messaging 1 message per week containing advice on diet, exercise and habit change.	Weight Waist circumference BMI	Measurement variations: Weight: −1.5 kg BMI: −0.6 kg/m2 WC: −4.3 cm
Patrick (2009)	N: 65 80% female, 75% White, 17% African-American. Mean age: 44.9 years Mean weight: 89 kg Mean BMI: 33.2 kg/m^2	To develop and assess a weight-loss or weight-maintenance intervention based on the use of text messaging.	RCT	4 months	I: Daily text messages and multimedia messages containing dietary and behavioural strategies to improve weight control. +	Weight Compliance Satisfaction	Mean weight after 2 months: C: No loss I: 86 kg Mean weight after 4 months: C: No loss I: 85 kg I: −2.88 kg (mean)

(continued)

Table 1. Continued.

Study	Study population and sample	Objective	Study type	Length	Intervention	Measurements used	Results
					Paper-based materials containing general information. 5-10-min telephone calls with an expert each month. C: Paper-based materials containing similar information each month. No calls or text messages.		All messages requiring a response answered in the first week. 2–3 in the last (16). 92% of the participants would recommend the experience.
Haapala (2009)	N: 125 77% female + 23% male. Mean age: 38.1 years Mean weight: 87.5 kg Mean BMI: 30.6 kg/m^2 WC: 98.5 cm	To evaluate the effectiveness of a weight-loss programme via mobile phone.	RCT	12 months	C: No intervention. I: WeightBalance weight-loss programme via mobile phone. Text messages, no calls. Option to access a website too (with a password). Contact initiated by participant. Text message containing weight objectives, levels of attainment, % achieved by others, etc. Objective: A loss of 2 kg per month.	Weight Height Waist circumference Patient opinions Quantity, frequency and type of programme use.	Mean body weight variations after 12 months: C: −1.3 kg I: −4.5 kg Mean WC variations after 12 months: C: 2.4 + −5.4 cm I: 6.3 + −2.4 cm Patient satisfaction: 7.8 (on a scale from 4 to 10) Frequency of use: 8 times per week at the start 3–4 in month 12.
Castelnuovo (2011)	N: 128 With obesity and diabetes. Mean age: 53.3 years Mean weight: 120.5 kg BMI >30 kg/m^2	To examine the effectiveness of a 12-month weight-loss intervention in obese patients with DM type 2	RCT	12 months	C: Dietary treatment, physical training and psychological counselling 1 month. I: Access to weight-loss website, video call, mobile app, electronic step counter bracelet.	Weight Behaviours and attitudes towards food intake alterations (Eating Disorder Inventory-2, EDI-2).	Initial weight: C: 110 kg I: 124 kg Weight after 3 months: C: 105 kg I: 116 kg Weight after 6 months: C: 104.4 kg I: 113 kg Weight after

(continued)

Table 1. Continued.

Study	Study population and sample	Objective	Study type	Length	Intervention	Measurements used	Results
							12 months: C: 103.3 kg I: 131 kg
Park (2009)	N: 49 53% male + 47% female with obesity and HTN. Mean age: 53.8 years Mean weight: 68.8 kg Mean BMI: 26.1 kg/m^2	To assess whether text messaging and the Internet improve cardio-vascular risk markers: Blood pressure, weight and lipids in hypertensive obese patients.	RCT	8 weeks	Text messages and the Internet Training on how to enter data on the website. Weekly self-recording of measurements via the Internet or mobile phone. Sending individual recommendations in accordance with the data sent by text message and via the Internet.	Blood pressure Weight Blood lipids: Total CHOL, HDL-chol, LDL-chol and TG.	Measurement variations: Weight: C: +1 kg I: −1.6 kg WC: C: +2.1 cm I: −2.8 cm Increase of 3.7 mg/dl They also reported improvements in blood pressure and HDL-chol.
Park (2012)	N: 79 100% post-menopausal women with abdominal obesity. Mean age: 56.2 years Mean weight: 62.2 kg WC: 89.7 cm	To assess whether text messaging and the Internet improve cardio-vascular risk factors.	RCT	12 weeks	Text messages and the Internet. Weekly self-recording of measurements via the Internet or mobile phone. Sending individual recommendations in accordance with the data sent. In total, there were ∼3 text messages per week and 1–2 visits with the specialist in month 12.	WC Weight Blood pressure CHOL LDL-chol	WC at the start: C: 89.6 cm I: 89.9 cm WC at the end: C: 90.5 cm I: 86.9 cm Weight at the start: C: 62.5 kg I: 62.1 kg Final weight: C: 63.2 kg I: 60.1 kg Blood pressure, CHOL and LDL-chol fell in the intervention group. There were differences in HDL-chol or TG.
Turner (2011)	N: 96 Americans 75% female, 76% White, 19% Black, non-Hispanic. Mean age: 42.9 years Mean BMI: 32.5 kg/m^2	To examine whether the combination of communication, diet monitoring and sending podcasts via	RCT	6 months	I: Podcast + smartp-hone. App (FatSecret's Calorie Counter) + Twitter, with coordinator.	Weight after 3 and 6 months. Questionnaires about the number of pod-casts listened to, self-recording of	Weight variations after 3 months: I: −2.4 kg C: −2.3 kg Weight variations after 6 months: I: −0.2 kg

(continued)

Table 1. Continued.

Study	Study population and sample	Objective	Study type	Length	Intervention	Measurements used	Results
		mobile phone help with weight loss.			3 months of initial contacts. + 3 months of 2 daily messages from the coordinator to back up the podcast information and encourage participation and discussion. No intervention between patient tweets. C: 3 months: 2 15-minute podcasts per week. + 3 months: 2 5-minute mini podcasts per week. Listening by telephone or computer.	physical activity and diet, messages on Twitter.	C: −0.3 kg % loss I: 5.1% C: 5.6% No significant weight differences between groups. Nor any significant differences in calorie expenditure/intake, fat or behavioural aspects.

RCT Randomised controlled trial; C: Control group; I: Intervention group; DM: Diabetes mellitus; HTN: Hypertension; WC: Waist circumference; CHOL: Cholesterol; TG: Triglycerides.

Interventions

Two studies[14,15] focused on the use of text messaging or multimedia messaging. In the first study, one message per week was sent giving advice on diet, exercise and a change in habits. In the second study, the control group had paper-based materials containing nutritional information and the intervention group had additional daily text and multimedia messages containing dietary and behavioural strategies to improve weight control and a monthly phone call with an expert.

All the other studies used mobile-phone apps or web-based programmes that could be accessed from mobile phones as a part of their weight-loss interventions[13,16,17,18,19,20] or to evaluate their potential for use and their acceptance.[11,12] The interventions were based on a combination of nutritional information and general dietary recommendations, together with self-recording of weight or other variables of interest to the study. Lee *et al.*[13] developed a phone-based diet game including daily food intake control and learning weight control. Haapala *et al.*[16] used a weight loss programme via mobile phone with feedback text messages containing weight objectives, levels of attainment and percentage achieved by other users. In the study by Castelnuovo *et al.*[17] the intervention group accessed a weight-loss website, received video calls, a mobile application and electronic step counter bracelet. In both studies by Park *et al.*[18,19] there was weekly self-recording of measurements via the Internet or mobile phone, plus text messages with individual recommendations. Turner-McGrievy *et al.*[20] used two weekly podcasts for all the participants, plus one smartphone application including the use of 2.0 social tools (Twitter) in the intervention group.

Other studies[11,12,20] also included the option of sending general motivational or participation reminder messages. In both studies by Park *et al.*[18,19] they permitted individualised responses to data entered by the participants by way of feedback.

Most of the studies lasted 2–4 months, and the maximum duration was 1 year.[16,17] None of the studies mentioned any post-intervention follow-up, so there was no evidence of the observed effect being sustained over time. In other words, follow-up only lasted for the length of the intervention.

Measures and outcomes

All studies included bodyweight change before and after the intervention. This measurement was complemented by other anthropometric data (waist circumference,[14,16] BMI,[13,14] body fat[13]) information about patient satisfaction and compliance,[12,15,16] behavioural changes,[17] level of physical exercise[11] or programme use.[16] In addition, the studies by Park *et al.*[18,19] added bodyweight, blood pressure and other data about blood lipid and cholesterol levels in order to evaluate cardiovascular risk levels.

Analysis

Two groups of studies could be distinguished by their objectives. In the first group (n = 2), the studies by Mattila *et al.*[11] and Morak *et al.*[12] sought to validate a tool as a step prior to its implementation as a weight-loss method. In the first study, self-recording of weight, dietary habits and physical activity had a good correlation with observer-recorded measurements. Mattila *et al.* concluded that mobile-phone apps could be useful for enabling follow-up in a weight-loss programme. They also observed that patients with higher self-recording activity were those who managed to achieve greater weight loss. The pilot study by Morak *et al.*[12] aimed to assess whether the proposed intervention in a group of obese patients would be accepted by them. Their intervention was generally welcomed and well accepted, and was linked to a significant and almost immediate weight loss and waist circumference reduction. They highlighted the reliability of the data entered by the patients, even though they found that some participants had had problems accessing the website and needed technical assistance.

In the second group (n = 7), despite differences in duration, design and variables studied, all but two of those that assessed the effectiveness of a specific intervention on the reduction of biophysical variables (bodyweight, BMI, waist circumference and body fat) found that the values in intervention groups decreased by 4.5 kg [16] to 1.6 kg.[18] Two studies did not do this.[17,20] One study[17] found that the percentage of weight loss did not differ between the groups. In the other[20], there was no significant difference in weight change between groups, although a within-group analysis revealed significant reductions of initial weight at 3 and 6 months, but not at 12 months.

Studies showing data about BMI changes[12,13,14] found that the values in the intervention groups decreased by 0.6 kg/m^2 [14] and 0.78 kg/m^2.[12] Articles showing data about waist circumference[12,14,16,18,19] found that the values in the intervention groups decreased by 6.3 cm[16] and 2.3 cm.[12] Most studies lasted 2–4 months and the maximum duration was 1 year.[16,17]

Discussion

Despite the diversity and limitations of the studies reviewed, there appeared to be certain elements that were important to the successful use of apps in obesity. First, there was a proportional relationship between weight loss and programme use. Second, the programmes most benefited those who took a pro-active approach to everyday problems. Third, frequent self-recording of weight seemed to be important, as was the personalisation of the intervention (counselling and individualized feedback). Finally, a social support system acted as a motivational tool.

The studies reviewed showed that the mobile phone interventions were generally welcomed and well-accepted, and were linked to an almost immediate weight loss.

All but two studies[17,20] showed reductions in the participants' bodyweight, BMI, waist circumference and body fat. They also showed that the patients' self-recorded data coincided with the researchers' observed data. In the study of Turner-McGrievy *et al.*, although there was weight loss within groups (control and intervention) the percentage weight loss did not differ between the groups. In the study of Castelnuovo *et al.*, there were no significant differences between groups in weight change at any time point. However, within-group analysis revealed significant reductions of initial weight at 3 and 6 months, but not at 12 months.[17]

However, the generalisability of the results is hindered by certain limitations. First, most of the studies were conducted on women aged about 50 years with a BMI of 29-30 kg/m^2. A greater predisposition of women towards participating in weight-loss trials could explain some of the results.[21,22,23,24] In future studies, samples should be gender-balanced to avoid such bias.

Second, it would be interesting to check if there is a more suitable population type for interventions of this kind. In the studies reviewed, population selections were diverse and supposedly in accordance with the specific local characteristics of the countries in which they had been conducted; these considered that the BMIs of the different populations varied by ethnic origin.[25,26,27] It should be noted that the studies conducted in the US were the only ones that reflected ethnically complex societies, making a distinction between Whites, African Americans and Hispanics (in the case of the latter, they were excluded from one study and not mentioned in the other).

Third, in most of the reviewed studies, the sample size was small and the study duration was short. In general, the intervention lasted for 2–4 months and there was no post-intervention follow-up to evaluate whether the effect had been sustained. The success of an intervention might be a consequence of what could be called the novelty factor. However, with the passing of time, interest in it could wane, meaning that data collection would be inaccurate or incomplete. If that effect were to persist in an intervention extended by several months, then the positive weight-loss effect could gradually weaken. This might also lead to a degree of fatigue among the participating subjects, thus making it harder for them to comply with the weight-loss steps proposed via the various ICTs, as shown in the study by Haapala *et al.*[16]

Nonetheless, we consider that studies with short intervention periods can serve as a preliminary approach to the implementation of mobile weight-loss tools. Without this interpretation, the short length of the studies would otherwise be hard to understand.

The wide variety of methodologies used in the reviewed studies did not allow us to work out what the best type of intervention would be for the central objective: weight loss. Even so, the motivation to try and lose weight and a predisposition towards using technologies among the participants in studies of this type were aspects that should be taken into account when it comes to developing apps.[28] In the study by Haapala *et al.*,[16] there was a proportional relationship between weight loss and programme use. Subjects who used the available tools more frequently achieved better results. This implies that a positive attitude towards technology may be an indicator for predicting healthier dietary behaviours. These results are in keeping with those obtained by others,[29] who have pointed out that the people who benefit most are those who take a more pro-active approach to the problems, as they not only feel that that they have the ability to overcome them, but also like taking the initiative to resolve them. They also suggest that ICTs could provide the necessary levels of responsibility and positive feedback to weight loss and weight maintenance if they were accessed regularly.[30,31,32,33]

Identifying the most suitable patients for this type of intervention, or implementing actions with different levels of intensity and at different times might significantly contribute to the success of the treatments.[34]

Of particular note is the potential importance of frequent self-recording of bodyweight, an aspect that, as observed by Wing *et al.*, was strongly associated with the maintenance of weight loss.[35] In this respect, several recent studies[32,33,34] have demonstrated the importance of frequent weight recording as a contributing factor in weight-gain prevention. In addition, it is worth recalling that the recommendations of the US National Institute of Health state that self-control of weight is crucial to long-term weight maintenance.[36] That is why a predisposition towards using tools of this type is so important, because they also require regular effort to self-record weight variations. The study by Morak *et al.* related the benefits of the weight-loss programme to the patients' acceptance of having to enter data regularly.[12] The use of mobile-phone apps was found to be greater than that of web-based programmes, owing to the flexibility and accessibility that the use of the former offers.

Social and personal circumstances (mainly work-related) had the greatest effect on participant drop-out. At the same time, the use of mobile-phone apps might be a motivational tool for further weight loss. Intervention personalisation could be another important aspect of the success of an intervention.[34] However, further research is required to understand the extent to which the technology used in the intervention, the intervention modality and the use of tools that foster motivational support, peer communication and professional feedback contribute to the attainment of the desired results. The inclusion of telephone calls with an expert in the study by Patrick *et al.* makes it difficult to assess the extent to which the success was due to the text-messaging intervention.[15] Weight loss interventions with enhanced behavioural features such as counselling and individualized feedback are more effective at achieving weight loss than programmes with education alone.[28,37]

Regarding the support that social networks might provide, only the study by Turner-McGrievy *et al.*[20] referred

to it, with unexpected results: the participants did not find the Twitter option useful for achieving greater weight loss. Even so, we consider that, by creating support groups, Twitter, Facebook and other social networks could be a motivational tool to be taken into account as a social support system.[22,38]

Finally, it is important to consider the clinical significance of the results obtained from most of the studies. Absolute weight loss before and after the 2–4 months of intervention was less than 3 kg in the intervention groups. The question is, therefore, whether a weight loss of less than 3 kg in 3 months is clinically significant. Perhaps the type of subjects included in the studies, with mean BMI of 29–30, is one of the explanations for such a modest weight loss. Does this justify the implementation of new technologies in this field? Is the final difference so limited because an intensive weight-loss programme is unviable without strict healthcare follow-up? These questions require further research.

Despite the encouraging results for the use of mobile tools to treat obesity, a number of questions still need to be answered. Some of the challenges are: identifying the most suitable patients for this type of intervention; using specific tools with different levels of intensity and at different times, and determining the extent to which the incorporation of peer motivational support and communication contributes to success.

Incorporating web 2.0 tools enables interaction, which is one of the most important features of communication in health promotion.[22] The use of ICTs seems to have a greater effect on self-efficacy and motivation than the use of usual, conventional means of healthcare communication.[5] We believe that further research is necessary, with larger samples in diverse populations and longer-term interventions in order to confirm the effectiveness of the use of mobile phones and apps as weight-loss tools.

References

1. World Health Organization. Obesity and overweight. Fact sheet No 311. See http://www.who.int/mediacentre/factsheets/fs311/en/index.html (last checked 4 April 2014).
2. Bray GA. Medical consequences of obesity. *J Clin Endocrinol Metab* 2004;**89**:2583–9.
3. Hill JO, Thompson H, Wyatt H. Weight maintenance: what's missing? *J Am Diet Assoc* 2005;**105**(5 Suppl. 1): 63–6.
4. Pagliari C, Sloan D, Gregor P, et al. What is eHealth (4): a scoping exercise to map the field. *J Med Internet Res* 2005;**7**:e9.
5. Tate DF, Wing RR, Winett RA. Using Internet technology to deliver a behavioral weight loss program. *JAMA* 2001;**285**:1172–7.
6. Neuhauser L, Kreps GL. Rethinking communication in the e-health era. *J Health Psychol* 2003;**8**:7–23.
7. Wadden TA, Butryn ML, Wilson C. Lifestyle modification for the management of obesity. *Gastroenterology* 2007;**132**:2226–38.
8. Hill JO, Wyatt H, Phelan S, Wing R. The National Weight Control Registry: is it useful in helping deal with our obesity epidemic? *J Nutr Educ Behav* 2005;**37**:206–10.
9. Tatara N, Arsand E, Nielsen H, Hartivgesen G. A review of mobile terminal-based applications for self-management of patients with diabetes. *Proceedings of the International Conference on eHealth, Telemedicine, and Social Medicine*. 1–7 Feb 2009, Cancun, Mexico.
10. Rice RE. The Internet and health communication: a framework of experiences. pp 5–46 in Rice RE, Katz JE (eds). *The Internet and Health Communication*. Thousand Oaks, CA: Sage, 2001.
11. Mattila E, Lappalainen R, Pärkkä J, Salminen J, Korhonen I. Use of a mobile phone diary for observing weight management and related behaviours. *J Telemed Telecare* 2010;**16**:260–4.
12. Morak J, Schindler K, Goerzer E, et al. A pilot study of mobile phone-based therapy for obese patients. *J Telemed Telecare* 2008;**14**:147–9.
13. Lee W, Chae YM, Kim S, Ho SH, Choi I. Evaluation of a mobile phone-based diet game for weight control. *J Telemed Telecare* 2010;**16**:270–5.
14. Joo NS, Kim BT. Mobile phone short message service messaging for behaviour modification in a community-based weight control programme in Korea. *J Telemed Telecare* 2007;**13**:416–20.
15. Patrick K, Raab F, Adams MA, et al. A text message-based intervention for weight loss: randomized controlled trial. *J Med Internet Res* 2009;**11**:e1.
16. Haapala I, Barengo NC, Biggs S, Surakka L, Manninen P. Weight loss by mobile phone: a 1-year effectiveness study. *Public Health Nutr* 2009;**12**:2382–91.
17. Castelnuovo G, Manzoni GM, Cuzziol P, et al. TECNOB study: ad interim results of a randomized controlled trial of a multidisciplinary telecare intervention for obese patients with type-2 diabetes. *Clin Pract Epidemiol Ment Health* 2011;**7**:44–50.
18. Park MJ, Kim HS, Kim KS. Cellular phone and Internet-based individual intervention on blood pressure and obesity in obese patients with hypertension. *Int J Med Inform* 2009;**78**:704–10.
19. Park MJ, Kim HS. Evaluation of mobile phone and Internet intervention on waist circumference and blood pressure in post-menopausal women with abdominal obesity. *Int J Med Inform* 2012;**81**:388–94.
20. Turner-McGrievy G, Tate D. Tweets, Apps, and Pods: results of the 6-month Mobile Pounds Off Digitally (Mobile POD) randomized weight-loss intervention among adults. *J Med Internet Res* 2011;**13**:e120.
21. Rodríguez-Rodríguez E, Aparicio A, López-Sobaler AM, Ortega RM. Body weight perception and dieting behaviour in Spanish population. *Nutr Hosp* 2009;**24**:580–7. (Spanish).
22. French Agency for Food, Environmental and Occupational Health and Safety. *Assessment of the risks related to dietary weight loss practices*. See http://www.anses.fr/Documents/NUT2009sa0099RaEN.pdf (last checked 25 April 2014).
23. Hubert, A. Introduction. pp5-11 in Hubert A. *Corps de femmes sous influence*. París: Cahiers de l'OCHA, 2004.
24. Boëtsch, G. Les femmes ne vieillissent jamais. Etudes et mesures sur 2000 femmes de 50 à 70 ans à Marseille. pp 63-74 in Hubert A. *Corps de femmes sous influence*. París: Cahiers de l'OCHA, 2004.
25. World Health Organization. The Asia-Pacific perspective: Redefining obesity and its treatment. See http://www.wpro.who.int/nutrition/documents/docs/Redefiningobesity.pdf (last checked 17 April 2014).

26. Swinburn BA, Craig PL, Daniel R, Dent DP, Strauss BJ. Body composition differences between Polynesians and Caucasians assessed by bioelectrical impedance. *Int J Obes Relat Metab Disord* 1996;**20**:889–94.
27. Poulain J.-P. *Sociologie de l'obesité*. Paris: PUF, 2009.
28. Neve M, Morgan PJ, Jones PR, Collins CE. Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis. *Obes Rev* 2010;**11**:306–21.
29. Armayones M, Hernández E. Las características psicológicas de los usuarios en la eSalud: nuevas oportunidades a través de la Web 3.0. *Revista de Salud* 2007;**3**:11.
30. Funk KL, Stevens VJ, Appel LJ, et al. Associations of internet website use with weight change in a long-term weight loss maintenance program. *J Med Internet Res* 2010;**12**:e29.
31. Gokee-Larose J, Gorin AA, Wing RR. Behavioral self-regulation for weight loss in young adults: a randomized controlled trial. *Int J Behav Nutr Phys Act* 2009;**6**:10.
32. Steinberg DM, Tate DF, Bennett GG, Ennett S, Samuel-Hodge C, Ward DS. The efficacy of a daily self-weighing weight loss intervention using smart scales and e-mail. *Obesity (Silver Spring)* 2013;**21**:1789–97.
33. Linde JA, Jeffery RW, French SA, Pronk NP, Boyle RG. Self-weighing in weight gain prevention and weight loss trials. *Ann Behav Med* 2005;**30**:210–6.
34. Svetkey LP, Stevens VJ, Brantley PJ, et al. Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *JAMA* 2008;**299**:1139–48.
35. Wing RR, Tate DF, Gorin AA, Raynor HA, Fava JL. A self-regulation program for maintenance of weight loss. *N Engl J Med* 2006;**355**:1563–71.
36. [No authors listed]. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults – The Evidence Report. *National Institutes of Health*. Obes Res 1998;**6**(Suppl. 2): 51S–209S.
37. Saperstein SL, Atkinson NL, Gold RS. The impact of Internet use for weight loss. *Obes Rev* 2007;**8**:459–65.
38. Scapuzzi S, Aguilar A. Eficacia de las intervenciones a nivel de Internet para el mantenimiento de peso a largo plazo. [Spanish] See http://revista.nutricion.org/PDF/EFICACIA-INTERVENCIONES.pdf (last checked 17 April 2014).
39. Han YS. *Easy Calorie Book, vol 1*. Seoul: Hyunam Publishing, 2007.