



Emerging Technologies and Virtual Medicine in Obesity Management

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KEY MESSAGES FOR HEALTHCARE POLICY MAKERS



- **The management of obesity through technological means has shown benefits in recent years.** These include treatment and follow-up strategies delivered through portable devices (e.g., mobile phones), web-based platforms (e.g., websites) and wearable tracking devices (e.g., accelerometers).
- **Technology-based interventions provide time-efficient, flexible, and potentially cost-effective options for the management of patients with obesity, either on their own or as an adjunct to conventional (face-to-face) care.**
- **The weight-loss benefits of technology-based interventions in the management of obesity have been shown in the literature.** However, there is insufficient data as yet comparing these interventions to conventional (face-to-face) treatment in populations with obesity. This prohibits us from forming firm conclusions about their comparative benefits. Also, while weight loss and weight-loss maintenance may be important outcomes in obesity-management interventions, they are not the only outcomes. Future research is needed to assess the impact of technology-based obesity interventions on outcomes such as quality of life and prevention or management of obesity-related complications

RECOMMENDATIONS



1. Implementation of management strategies can be delivered through web-based platforms (e.g., online education on medical-nutrition therapy and physical activity) or mobile devices (e.g., daily weight reporting through a smartphone application) in the management of obesity (Level 2a, Grade B)^{1,2}.
2. We suggest that healthcare professionals incorporate, or use technology which incorporates, individualised feedback and

follow-up (e.g., personalised coaching or feedback via phone or email) into technology-based management strategies to improve weight-loss outcomes (Level 4, Grade D)³.

3. The use of wearable activity-tracking technology should be used as part of a comprehensive strategy for weight loss (Level 1a, Grade A)⁴.

KEY MESSAGES FOR PEOPLE LIVING WITH OBESITY



- **Technology-based strategies can help you manage your health, both when used alone or when combined with conventional (face-to-face) obesity-management approaches.**
- **There are multiple options for incorporating technology into your obesity-management programme, including through your portable device (e.g., mobile phone), a web-based platform (e.g., website) and/or a wearable tracking device (e.g., pedometer).**
- **In many cases, you may find technology-based strategies more convenient and time efficient than face-to-face encounters with your healthcare professional, though you should consider the impacts related to data privacy when using available technologies.** We suggest you discuss with your HCP which options might work best for you.

Introduction

Throughout this chapter will use a number of terms that are specific to virtual medicine and emerging technologies including:

- Emerging technologies for healthcare: broadly referred to as “digital health” or “telemedicine” and is defined as the use of digital information and communication technologies, including telephones, computers and smart devices, to facilitate delivery of remote healthcare. It is used “for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare professionals (HCPs), all in the interests of advancing the health of individuals and their communities” according to the World Health Organisation (the WHO)⁵.
- Conventional obesity management: refers to face-to-face weight-management programmes that includes education regarding nutrition, exercise and/or a behavioural-change component.
- Usual obesity care: refers to healthcare interactions for people living with obesity where there is no active or intentional weight-management intervention for patients living with obesity i.e. there are no dedicated visits, education or obesity treatment plan.

Conventional obesity-management programmes have been shown to be effective in achieving short-term weight reductions in patients living with obesity^{6,7}. However, many of the conventional obesity-management programmes have also been shown to be cost-, labour- and time-intensive^{6,8}. Attempts to reduce the frequency of encounters or interactions have shown negative results in terms of obesity management and other secondary parameters, such as cardiometabolic risk factors other than weight⁹. The challenge in obesity management is to maintain or improve upon proven programmes by maintaining the supportive aspects of conventional programming, that include social and clinical support, accountability and personal feedback on a long-term basis, and to ensure these are accessible to all who need it.

The Covid-19 pandemic has accelerated the uptake of digital health, creating an opportunity to strengthen our approach to the prevention and management of obesity. The WHO has called for prioritisation of the development and integration of digital interventions to health systems¹⁰, and more locally, the Health Service Executive (HSE) eHealth Strategy for Ireland¹¹, laid out ambitious plans to digitalise healthcare across services, including the implementation of telehealthcare systems for chronic-disease management. The development of an eHealth programme for Ireland has been identified as a critical enabler for the Sláintecare

reform programme. The new model of care for obesity management provides an opportunity to integrate digital and virtual options for aspects of care to services¹². Advances in technology, as well as use of technologies that have long been employed in medical care, present an opportunity to maintain the key components of conventional obesity-management programmes or expand its reach, while potentially reducing costs and HCP time inputs, and improving convenience for patients, potentially resulting in improved adherence to treatment^{3,4,7}. Technology-based strategies may also overcome the barrier of inadequate training in effective psychological and behavioural counselling commonly cited by HCPs¹³. Additionally, it may present an opportunity to address concerns related to weight-loss maintenance, as several studies have shown high rates of weight regain after initial successful short-term weight loss¹⁴⁻¹⁶.

The ubiquitous nature of technologies, specifically the widespread use of mobile phones, presents new opportunities for obesity-management programmes that can be used in an increasing subset of the patient population. Mobile phone use in Ireland is now estimated to include 90% of the population¹⁷. Access to the Internet for the use of web-based platforms is increasingly prevalent as well; however, wide disparities in the availability and quality of Internet access exists across regions¹⁸. New technologies are increasingly being presented for application in healthcare, although it is unclear how best to use these technologies in obesity management, or whether they are widely accepted among the target population. Because the widespread application of technology for the purpose of remote patient care is relatively new in healthcare, more work needs to be done to determine the application of specific technologies for specific clinical purposes and within specific groups of patients, and for whom it is appropriate and accessible. It is vital that such technologies are used to enhance care and accessibility to care, but do not limit access options for populations who experience barriers.

The role of HCPs is to determine which aspects of proven conventional programmes may potentially be substituted or augmented by technologies that could offer convenience and cost effectiveness, for appropriate patients, as well as to determine the ways in which technology could be used to bridge care gaps due to a lack of availability of conventional programmes. This should be done in the context of shared decision-making and in accordance with patient preferences, whereby management plans which integrate technology are co-designed with patients. Finally, conventional programmes could be supplemented by the use of technologies to increase access, improve convenience, provide cost-containment benefits or to improve outcomes in both initial weight loss and maintenance.

Efficacy of technology in the management of obesity

Technology-based strategies include those delivered through web-based platforms, mobile devices or wearable tracking devices. Web-based platforms that have been studied include those that provide education about nutrition and physical activity, self-monitoring

of goal behaviours and goal setting, among others. Strategies delivered through mobile devices include text message advice and smartphone applications to monitor food in-take and weight. Wearable tracking devices, on the other hand, include pedometers and accelerometers.

Current evidence has shown that interventions for the management of obesity that incorporate technology, may lead to significant reductions in weight for patients with obesity, providing superior outcomes to usual care^{1,19}. The majority of studies on this topic involve follow-up ranging between six weeks to six months^{1,4}. It is important to note that, while the combination of technology-based management with conventional care augments weight-management benefits, evidence regarding employing technological strategies as a substitute to conventional (face-to-face) programmes remains inconclusive^{4,19,20}. A meta-analysis of 23 randomised control trials examining web-based experimental versus non-web-based controls found that the utilisation of technology led to improved weight-loss outcomes (-0.68 kg, $p = 0.03$) over a period of three to 30 months²⁰. Secondary analyses revealed that the combination of web-based technology to conventional (face-to-face) care led to superior weight-loss outcomes (-1.93 kg, 95% CI -2.71 to -1.15, $p < 0.001$) compared with web-based strategies without face-to-face care (-0.19 kg, 95% CI -0.87 to 0.49, $p = 0.59$), and that this difference was statistically significant ($p = 0.003$)²⁰. Similarly, a second systematic review found that the incorporation of human contact or individualised feedback, through email or online discussion, into a web-based weight-loss programme led to improved outcomes³. These findings suggest that incorporating individualised care, whether through face-to-face encounters or technological means, may provide improved weight loss and possibly improved obesity management.

A major downfall to many conventional programmes is the high prevalence of weight regain over the long term following treatment¹⁶. Due to the limited evidence and short-term follow-up of available studies, it remains to be seen whether technology-based strategies are effective in preventing weight regain and aiding with weight-loss maintenance, or indeed effective at managing other obesity-related outcomes^{3,21,22}.

Limitations and future directions

It is important to note that conventional programming, while having its limitations, has generally performed very well as a medical intervention. It is backed by strong evidence supporting its efficacy. Interventions that seek to replace this modality will need to be studied intensely and applied broadly in order to achieve results that could suggest replacing a widely accepted and rigorously proven intervention such as conventional obesity-management programmes^{6,7}.

Recommendations for the use of technology in obesity management are limited by a number of factors:

- A large proportion of studies on the topic do not implement any intervention for the control group or use wait-list controls^{1,19}.

This may falsely accentuate the positive effects of technology. Future studies should compare technological interventions to conventional (face-to-face) care to be able to form true conclusions about the potential benefits of technological interventions in obesity management.

- Technology studies often implement multiple interventions in the intervention group (e.g., mobile app in tandem with a web-based programme) making it difficult to decipher which intervention in particular the effects of technology may be attributed to in the study^{1,19}. Future studies should investigate each intervention in isolation in order to be able to draw strong conclusions about the various modes of delivery and their efficacy or effectiveness.
- The majority of studies on the topic have relatively short follow-up times ranging between six weeks to six months^{1,4}. It is important that future studies allow for longer follow-up to be able to make conclusions surrounding weight regain and weight-loss maintenance.
- Future studies should also be aligned with the new definition of obesity as described in this clinical practice guideline. Although weight loss and weight-loss maintenance components are important outcomes in obesity management interventions, they are not the only outcomes. For example, studies should assess the impact of technology-based obesity interventions on outcomes such as quality of life and prevention or management of obesity related complications.
- Studies evaluating the use of technology-based management in obesity suffer from methodological flaws that limit their external validity. For one, a large proportion of studies on the topic include only patients living with obesity but exclude those with other comorbidities and chronic conditions, including diabetes and hypertension. This is detrimental to the generalisability of the findings, as obesity is strongly associated with such conditions. Additionally, many of the

trials evaluating the efficacy of technology-based management for obesity have recruited disproportionately more women than men³. More studies evaluating outcomes in men are needed to draw firm conclusions.

- A large proportion of studies investigating technology-based strategies for the management of obesity exclude patients that have recently engaged in obesity-management programmes or strength and endurance training²³⁻²⁵. This inevitably pre-selects for patients who may be less informed about obesity as a chronic disease and in whom adherence to treatment and possible benefits may be undermined.
- Many of the studies underpinning these recommendations included populations who do not live with obesity, and the results may therefore not be generalisable to such populations^{1,4,26}.
- As the literature review underpinning this chapter was conducted prior to the Covid-19 pandemic, it does not take account of the contemporary evidence arising from the rapid adaption of face-to-face programmes to digital models of care, and the safety considerations for remote care. Therefore, a more up-to-date review is recommended to help understand what digital health tools were used and in what context so that lessons learned can be shared and best practices upscaled.
- Further evidence is needed to describe the acceptability and level of input from people living with obesity and HCPs for the various technology-based interventions²⁷.
- As digital health is a rapidly developing field, a core set of parameters should be used to allow for a more robust, standardised approach to evaluating these technologies, such as those provided by the WHO²⁸, to enhance comparability between studies. Available appropriate reporting guidelines should also be utilised²⁹.

Additional considerations

- Appropriate methods for evaluating digital technologies for obesity management should be considered. These methods should include service outcomes (efficiency, safety, effectiveness, equity), patient outcomes (clinical and psychosocial) and implementation outcomes (acceptability to both patients and HCPs, adoption, training and support requirements, cost effectiveness and sustainability).
- Gaps and deficits in the availability of resources, funding, equipment and/or proficiency of information and communication technologies may be critical factors to the successful local implementation of technology-based interventions or adjuncts to treatment.
- A framework for the governance of digital technologies is vital. General data protection regulations and additional relevant local and institutional processes and legislation relating to

cyber security and the protection of patient data should be central to any inclusion of technology in healthcare.

- HCPs should consider the appropriateness of incorporating technology-based obesity management, where available, with sub-populations of the target user group. Low digital literacy and/or the potential additional burden of costs associated with Internet connection may hinder successful engagement with technology-based approaches. Decisions on incorporating such approaches should be made with the patient, and alternatives made available for those for whom technology-based approaches are not accessible, feasible, comfortable or acceptable.
- To maximise the potential benefit of digital technologies, engaging key stakeholders such as HCPs and patients in the co-design and implementation of digital interventions is recommended.

Conclusion

While there is some evidence to support the use of technology for obesity management, it does not support the replacement of conventional treatment approaches^{1,19}. There is insufficient evidence comparing technology-based treatments for obesity management to conventional (face-to-face) programmes, as discussed above^{4,19,20}. Therefore, technology-based programming may be offered in addition to conventional (face-to-face) programming or in instances where conventional care is unavailable, not feasible or less preferred by the patient.

It is clear that technologies that employ a more personalised approach are superior to those that operate independent of user characteristics or feedback^{3,20}. Simply put, technology-based interventions still have to account for the personal nature that is inherent in the delivery of medical care in general.

More work will need to be done to determine which technologies are appropriate for application to obesity management and in which patient groups they will be most beneficial²⁷.

The Emerging Technologies and Virtual Medicine in Obesity Management chapter is adapted from the Canadian Adult Obesity Clinical Practice Guidelines (the "Guidelines"), which Obesity Canada owns and from whom we have a license. ASOI adapted the Guidelines having regard for any relevant context affecting the Island of Ireland using the ADAPTE Tool.

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