

Cognitive behavioral therapy to aid weight loss in obese patients: current perspectives

Gianluca Castelnuovo^{1,2}
 Giada Pietrabissa^{1,2}
 Gian Mauro Manzoni^{1,3}
 Roberto Cattivelli^{1,2}
 Alessandro Rossi¹
 Margherita Novelli¹
 Giorgia Varallo¹
 Enrico Molinari^{1,2}

¹Psychology Research Laboratory, Istituto Auxologico Italiano IRCCS, San Giuseppe Hospital, Verbania, ²Department of Psychology, Catholic University of Milan, Milan, ³Faculty of Psychology, eCampus University, Novedrate, Italy

Abstract: Obesity is a chronic condition associated with risk factors for many medical complications and comorbidities such as cardiovascular diseases, some types of cancer, osteoarthritis, hypertension, dyslipidemia, hypercholesterolemia, type-2 diabetes, obstructive sleep apnea syndrome, and different psychosocial issues and psychopathological disorders. Obesity is a highly complex, multifactorial disease: genetic, biological, psychological, behavioral, familial, social, cultural, and environmental factors can influence in different ways. Evidence-based strategies to improve weight loss, maintain a healthy weight, and reduce related comorbidities typically integrate different interventions: dietetic, nutritional, physical, behavioral, psychological, and if necessary, pharmacological and surgical ones. Such treatments are implemented in a multidisciplinary context with a clinical team composed of endocrinologists, nutritionists, dietitians, physiotherapists, psychiatrists, psychologists, and sometimes surgeons. Cognitive behavioral therapy (CBT) is traditionally recognized as the best established treatment for binge eating disorder and the most preferred intervention for obesity, and could be considered as the first-line treatment among psychological approaches, especially in a long-term perspective; however, it does not necessarily produce a successful weight loss. Traditional CBT for weight loss and other protocols, such as enhanced CBT, enhanced focused CBT, behavioral weight loss treatment, therapeutic education, acceptance and commitment therapy, and sequential binge, are discussed in this review. The issue of long-term weight management of obesity, the real challenge in outpatient settings and in lifestyle modification, is discussed taking into account the possible contribution of mHealth and the stepped-care approach in health care.

Keywords: overweight, BED, ACT, BWL, BWLT, mHealth, virtual reality, chronic care management, stepped care

The obesity pandemic

Obesity, defined as a body mass index of $>30 \text{ kg/m}^2$, is a growing, expensive, and chronic public health problem today, and could be considered an epidemic (globesity).^{1,2} In 2006, the World Health Organization (WHO) estimated that globally >700 million adults will develop the condition of obesity by 2015.^{3,4} The latest data (not estimations) available in the WHO website⁵ are very alarming:

Worldwide obesity has more than doubled since 1980. In 2014, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 600 million were obese. 39% of adults aged 18 years and over were overweight in 2014, and 13% were obese.⁵

Therefore, obesity can be considered one of the most important current health problems affecting millions of people around the world,⁶⁻⁸ including elderly population.^{9,10}

Correspondence: Gianluca Castelnuovo
 Clinical Psychology Lab, Istituto Auxologico Italiano IRCCS, San Giuseppe Hospital, Strada Cadorna 90 – 28824 Piancavallo di Oggebbio (VB), Italy
 Email gianluca.castelnuovo@auxologico.it

Moreover, obesity is associated with early death^{11,12} and is typically considered as a risk factor for many medical complications and comorbidities such as cardiovascular diseases, some types of cancer, osteoarthritis, hypertension, dyslipidemia, hypercholesterolemia, type-2 diabetes, obstructive sleep apnea syndrome, and different psychosocial issues and psychopathological disorders.^{8,11-24}

Obesity is a complex disease with a multifactorial etiology: a genetic component (inheritance)²⁵ interacts with individual, familial, behavioral, cultural, and environmental factors that lead to the expression of heterogeneous conditions and results.²⁶⁻²⁸

Treating obesity needs a biopsychosocial approach including medical and lifestyle interventions, psychosocial support, self-management programs, and pharmacological strategies and bariatric procedure if necessary,²⁴ considering a stepped-care framework.²⁹

The importance of psychological variables in managing obese patients

Because obesity is related to psychological variables, clinical psychological interventions and psychotherapies are key elements to engage patients in lifestyle modification and motivate them to achieve weight loss with the help of multidisciplinary teams. Old and new cognitive behavioral techniques are successful strategies among other medical protocols and rehabilitation procedures. Clinical and health psychology can help patients achieve a long-term involvement in sustainable and successful weight loss programs.

Dombrowski noted that

Behavioral factors, ie, poor diet and physical inactivity are among the main proximal causes linked to obesity³⁰, obesity-related morbidity³¹ and mortality^{32,33}

The importance of working on the modifiable factors, especially the psychological ones, to reduce or prevent obesity, is well expressed by Davin and Taylor:

Given the failures of weight loss methods, even surgical methods, an understanding of the psychological variables that impact success of surgical and nonsurgical weight loss is imperative, as the field continues to strive to reduce the public health impact of obesity.⁴

The literature on the psychosocial aspects of obesity has a long history: G. Stanley Hall, the first person to earn a Ph.D. in psychology in the US, started studying eating behaviors and obesity in the nineteenth century, and he could be considered a real pioneer in this field.^{28,34}

The investigation on the psychological aspects of obesity evolved significantly in the following and recent years. Fabricatore and Wadden³⁵ noted that the earliest literature was more focused on psychopathological variables related to a condition of overweight:

The first empirical studies of the matter attempted to find commonalities in the psychological profiles of obese persons. No ‘obese personality’ was ever identified, however. Comparisons of overweight and average weight individuals yielded inconsistent results that depended on the characteristics of the samples.³⁵

Afterward, the identification of risk factors behind psychopathological conditions in obese patients became the focus of research (for example, the gender issue, particularly being a female, was detected as a relevant risk factor). In the last years were largely dedicated to the investigation of the connection between obesity and psychosocial features (for example, in discovering the temporal–causal relationship between psychological distress, depression, and the condition of obesity).³⁵

The etiology of obesity is multifactorial, due to a complex interaction between genetic, behavioral–psychosocial, and environmental factors.²⁶ Behavioral factors, such as dysfunctional eating habits and low levels of physical activity, are typically key variables and are among the main modifiable and proximal causes closely related to obesity-related complications and to simple obesity too.³³

Taking into account the multifactorial etiology of obesity, evidence-based strategies to improve weight loss, maintain a healthy weight, and reduce related comorbidities typically integrate different interventions: dietetic, nutritional, physical, behavioral, psychological, and if necessary, pharmacological and surgical ones. Such treatments are implemented in a multidisciplinary context with a clinical team composed of endocrinologists, nutritionists, dietitians, physiotherapists, psychiatrists, psychologists, and sometimes surgeons.

For the successful long-term treatment of obesity, according to Castelnuovo et al,² psychosocial and psychopathological variables are important elements to consider due to the relevant correlations between obesity and psychological factors such as self-esteem, quality of life, stressful life events, eating disorders, mood problems, anxiety, and personality traits.^{4,36-40} Moreover for the in-patient management of obesity, many psychological treatments with different approaches (psychoeducational, cognitive behavioral, interpersonal, systemic–strategic, psychodynamic, etc) are available.⁴¹

Psychotherapies for obesity typically could help patients achieve weight loss outcome reducing dysfunctional behav-

iors, focusing on cognitive processes, modifying unrealistic weight goals and negative perceptions of body image,^{28,42} and improving psychological skills such as the client's ability to self-monitor (eg, using diaries), stimulus control through restricting quantities of food, and behavioral modification strategies such as chewing slowly, taking time to enjoy food, and increasing awareness of the pleasure associated with taste and food.^{2,28,42,43} Moreover, psychotherapies work on helping patients in maintaining goals that have initially been achieved, preventing possible relapses, and managing critical situations with coping strategies.^{19,33,40,44–46}

Is cognitive behavioral therapy (CBT) the gold standard treatment to aid weight loss in obese patients? A unsolved question complicated by the binge eating disorder (BED)

CBT is traditionally recognized as the best established treatment for BED and the most preferred intervention for obesity,⁴⁷ and could be considered as the first-line treatment among psychological approaches.⁴⁸ Although the comprehensiveness and the practical nature of CBT approach are positive, this psychotherapy does not necessarily produce a successful weight loss.⁴⁹ Traditional medication protocols and psychological treatments have short-term efficacy in comparison with placebo.^{50,51}

Dalle Grave et al described the typical CBT protocol reporting the set of procedures necessary to address weight loss and weight maintenance obstacles.⁵²

In 2004, the National Institute of Clinical Excellence recommended that CBT is the treatment of choice with important empirical evidence of a significant grade (grade A).⁴⁹ According to Grilo et al,⁴⁹

Controlled trials have provided further support for the efficacy of CBT⁵³; however, studies have reported little difference between interpersonal psychotherapy (IPT) and CBT delivered via group⁵⁴ or CBT guided-self-help⁴⁸ [...] CBT generally [...] fails to produce weight loss⁵¹.⁴⁹

So, is CBT clinically effective only in obesity with BED? Does CBT work only on the psychopathology of related eating disorder without reducing specifically and directly the condition of obesity?

First, it is important to take into account that epidemiological studies have indicated BED to be the most common eating disorder^{36,55} and there is a strong association between obesity and BED even if obesity is not a criterion of BED.^{56,57}

There are important differences between obese binge eaters and obese non-binge eaters which are well reported in the study by Vanderlinden et al:

Obese binge eaters often show more severe obesity and greater eating disorder psychopathology (more weight and shape concerns, greater ineffectiveness and body dissatisfaction, more emotional eating, and so on), more negative self-evaluations, and lower self-esteem compared with obese nonbinge eaters^{58–60}.⁵⁷

Vocks et al, in a comprehensive meta-analysis, noted that in a short period with large effect sizes, CBT can significantly reduce binge eating episodes, promote days without bingeing, manage eating, and reduce shape and weight concerns, without directly affecting body weight.⁶¹ Follow-up studies in order to monitor long-term results are strongly requested.^{57,61–64}

Recently, Cuzzolaro, in a book edited by the Italian Society of Obesity (SIO), summarized the main recommendations and evidences about the relationship between obesity and BED. To identify binge episodes and other disordered eating behaviors is a necessary issue for both medical and surgical treatments of obesity. Moreover, patients with BED–obesity have more psychopathological comorbidity than those without BED–obesity, and hence, more psychological support is requested. Particularly, CBT, interpersonal therapy, dialectical behavior therapy, and with lower evidence, Internet-based guided self-help CBT have been demonstrated to be useful in managing BED and obesity.⁶⁵

Strategies for weight loss in addition to CBT: CBT-E, CBT-Ef, behavioral weight loss treatment, therapeutic education, acceptance and commitment therapy, and sequential binge

According to Fairburn et al, CBT has strongly developed in the management of obesity and eating disorders:

There are two forms of this 'enhanced' treatment (CBT-E): a focused form (CBT-Ef) that targets eating disorder psychopathology exclusively, and a more complex broad form (CBT-Eb) that also addresses certain additional problems – mood intolerance, clinical perfectionism, low self-esteem, and interpersonal difficulties [...].⁶⁶

Behavioral weight loss treatment (BWL) or behavioral weight loss (BWL) typically considers diet, exercise, and behavior therapy, where behavioral modification strategies

usually include self-monitoring, goal-setting, shaping, reinforcement, and stimulus control.^{67,68} BWL interventions are not so efficacious in reducing binge eating episodes in comparison with traditional CBT, but only in a short-term perspective. However, the efficacy of BWLT in obese patients with BED is not so clear. Therefore, more research is needed in order to demonstrate if CBT or BWLT should be considered as the first-line treatment for obesity, taking into account that it is necessary to evaluate the cost-effectiveness too.⁶⁷

Some authors have recently proposed a new interesting weight management protocol in the CBT framework, the Healthy Approach to weight management and Food in Eating Disorders (HAPIFED), which was developed and studied by Palavras et al starting from the CBT-E.⁶⁹

Although therapeutic education is not a form of psychotherapy but a particular multidisciplinary approach, it shares a part of cognitive behavioral background. According to Valerio Miselli in Rotella et al,

Therapeutic education means the therapeutic act continuously characterized by ‘accompanying’ the patient, ‘joining together’ in the path of chronic disease, tending to negotiate [...] for the implementation of measures aimed at achieving the highest possible clinical outcome and the best perceived quality of life [...].⁷⁰

Another important development of the traditional CBT approach for obesity is the “third-wave” CBT protocols, such as the acceptance and commitment therapy (ACT).^{71–73} ACT can enhance weight loss behaviors through the integration of

[...] self-regulation skills that are reflected in acceptance-based treatment, ie, tolerating discomfort and reduction in pleasure, enacting commitment to valued behavior, and being mindfully aware during moments of decision-making.⁷³

It is relevant to distinguish the mindfulness-based part of the ACT protocol from the more CBT-based component, because they impact differently on the weight loss issue. According to a recent meta-analysis about mindfulness-based interventions for adults who are overweight or obese, ACT produced significant effect only in reducing weight, while mindfulness approaches produced important effects on different psychological health variables and eating-related factors, so the conclusion of this meta-analysis is that

Mindfulness-based interventions may be both physically and psychologically beneficial for adults who are overweight or obese, but further high-quality research examining the mechanisms of action are encouraged.⁷⁴

A last promising proposal in the behavioral framework, specific for the reduction of binge eating episodes, is the sequential binge (SB) approach proposed by Neveu et al:

We present the sequential binge (SB), a new behavioral intervention that complements CBT. The SB intervention consists in replacing patients’ usual pattern of food ingestion during a binge by a repeated monotonous food ingestion sequence, interspersed with short incremental pauses.⁷⁵

This approach includes some strategic prescriptions and techniques typical of a systemic–strategic background more than a cognitive behavioral framework.^{76–78}

CBT in the long-term weight management of obesity: the real challenge in outpatient settings and in lifestyle modification

As underlined before, most evidence-based psychological treatments, and in particular CBT, are not so successful in aiding weight loss.⁶¹ BWLT can produce weight loss in the presence of BED, but the weight regain is common.^{69,79}

The long-term weight management of obesity is a very complicated task with a high possibility of failure and risk of weight regain. Montesi et al reported the most important factors that allow a successful management of weight loss in the long term too, considering observational and randomized studies as the source of information:

A few (factors) pertain to the behavioral area (eg, high levels of physical activity [...]), a few to the cognitive component (eg, reduced disinhibition, satisfaction with results achieved [...]), and a few to personality traits (eg, low novelty seeking) and patient-therapist interaction.⁸⁰

For these authors, it is necessary to consider a lifestyle modification-based approach for the management of obesity, including a nonphysician healthy lifestyle counselor-trainer as the point of reference in the multidisciplinary team.⁸⁰ The importance of multicomponent programs in outpatient settings and primary care contexts is also underlined by Kelley et al: in order to motivate and support patients, it is recommended

[...] a combination of nutritional, physical activity, and cognitive behavioral approaches to target overweight/obesity. The focus is on behavioral approaches and practical applications, such as motivational interviewing techniques.⁸¹

A complete description of the three main components of lifestyle modification for weight loss in a CBT framework

is given in the study by Dalle Grave et al⁸² that described the evolution of behavioral therapy for weight loss, from a behavior-centered approach, to a more cognitive attitude and then to a multicomponent treatment:

Modern lifestyle modification programs have three main components: dietary recommendations; physical activity recommendations; and cognitive-behavioral therapy to address weight loss and weight maintenance obstacles [...]. These components interact with each other, each contributing to the final success of treatment.⁵²

The diet is typically designed to produce a calorie deficit in order to achieve the first step of weight loss (for example, 1 kg per week) and then to maintain a functional weight in a flexible range as the second step. The physical activity consists in period exercises such as walking (for example, with goals to gradually achieve 10,000 steps per day) that can achieve a calorie deficit particularly useful for producing weight loss and enhancing muscle mass. The cognitive behavioral component of the lifestyle modification can motivate patients in their adherence to diet and exercise and can provide a set of procedures and strategies such as self-monitoring during eating, realistic and achievable goal setting, control of dangerous stimuli and triggers and promotion of alternative behaviors during critical emotional situations or negative mood states.

As previously underlined, important limitations in the multidisciplinary chronic care management of obesity concern the difficulty associated with maintaining long-term compliance and adherence, which are the variables necessary to ensure clinical efficacy.²

In fact, most overweight and obese individuals regain about one third of the weight lost with treatment within one year and they will typically come back to baseline in three to five years.⁸³

Assessment and enhancement of patients' motivation, compliance, and engagement is a strategic issue for a successful treatment of obesity and its comorbidities.^{84–86} The transtheoretical model of change^{87,88} that describes five motivational stages through which patients necessarily evolve trying to change their dysfunctional behaviors could be useful in weight loss too. Motivational interviewing (MI) and motivational enhancement therapy are other potential steps forward in comparison with the transtheoretical model.^{89,90}

Particularly, MI has been demonstrated to be effective in promoting behavioral change through a nonjudgmental approach and a style of communication that enhances patient's competence, autonomy, and intrinsic motivation.⁷⁸

In order to achieve a long-lasting behavioral change engaging people in a healthy attitude, the ambivalence regarding change is considered and discussed in MI, avoiding too much rigidity in directive prescriptions.^{91–93} The functional use of MI requires clinicians with enhanced skills who can go beyond a traditional style of consultation. The approach is not educational but aims at moving patients toward self-motivational strategies improving readiness to change.⁹⁴

CBT and mHealth: the integration of Internet-based technologies into psychological and multidisciplinary protocols according to a stepped-care approach

mHealth is a new technological opportunity in the health care scenario and could be briefly defined as the delivery of preventive, monitoring, or clinical procedures and protocols through the mobile communication devices, such as mobile phones, tablets, personal computers, personal digital assistants, biosensors, and other up-to-date technological devices.^{15,95–102}

Clinical procedures that include mHealth-based components could overcome some limitations typically connected to the traditional chronic care management of obesity through the enhancement of weight reduction in remote settings with better long-term efficacy and effectiveness across clinical, organizational, and economic perspectives.^{68,103–105} Many articles have been published showing the utility of mHealth devices in promoting healthy habits, weight loss reduction, and functional management of comorbidities.^{16,97,103–119} One interesting telephone-based CBT intervention, planned to improve eating and psychosocial functioning, has been tested in a preliminary study by Sockalingam et al.¹²⁰ Another interesting project was the positive online weight reduction, a web-based weight management intervention focused on supplementing a telephone-based support in web-based obesity treatment protocols.¹²¹ Many of these interventions include cognitive, behavioral, or cognitive behavioral techniques compatible with a CBT approach. Moreover, the mHealth applications have achieved positive results in adult obesity^{118,122} and in childhood obesity too.^{116,123} Even if evidence is growing in mHealth for obesity, organizational, technological, economical, and philosophical barriers for its development are still present as underlined by Mohammadzadeh and Safdari.¹²⁴

CBT and other psychological approaches have to improve and test monitoring and treatment protocols for obesity

and overweight with or without new technology-based devices,^{125,126} not forgetting the basic principles of communication with each patient even in an mHealth scenario.^{127–130}

One of the up-to-date approaches in the management of obesity is delivering CBT or cognitive behavioral techniques in traditional and innovative settings for each step of the cost-effective stepped-care approach,^{29,101,131} as proposed by Castelnuovo et al:

[...] the lower level of treatment could be simply a mhealth or traditional based lifestyle psychoeducational and nutritional approach [...] the following step [...] could be [...] health professionals-driven multidisciplinary protocols [...] then the inpatient approach with the inclusion of drug therapies [...] finally the solution of bariatric surgery [...].²

Another current and future scenario where CBT could be improved in the management of obesity is represented by virtual reality (VR) applications, such as the VR-enhanced CBT that is a sort of enhanced CBT of obesity with a VR module focused on unlocking the negative memory of the body, changing its dysfunctional behavioral correlates, and managing negative emotional states.¹³² Riva et al have strongly demonstrated the utility of VR in weight reduction protocols.^{133–142}

Disclosure

The authors report no conflicts of interest in this work.

References

- Gutierrez-Fisac JL, Angel Royo-Bordonada M, Rodriguez-Artalejo F. [Health-risks associated with Western diet and sedentariness: the obesity epidemic]. *Gac Sanit*. 2006;20 Suppl 1:48–54. Spanish.
- Castelnuovo G, Pietrabissa G, Manzoni GM, et al. Chronic care management of globesity: promoting healthier lifestyles in traditional and mHealth based settings. *Front Psychol*. 2015;6:1557.
- WHO. *Definition and Diagnosis of Diabetes Mellitus and Intermediate Hyperglycemia*. Geneva: WHO;2006.
- Davin SA, Taylor NM. Comprehensive review of obesity and psychological considerations for treatment. *Psychol Health Med*. 2009;14(6):716–725.
- WHO. Obesity and overweight. Fact sheet. 2017 [updated June 2016]. Available from: <http://www.who.int/mediacentre/factsheets/fs311/en/>. Accessed February 3, 2017.
- Ayensa JI, Calderon MJ. [Psychopathological comorbidity of obesity]. *An Sist Sanit Navar*. 2011;34(2):253–261. Spanish.
- DerSarkissian M, Bhak RH, Huang J, et al. Maintenance of weight loss or stability in subjects with obesity: a retrospective longitudinal analysis of a real-world population. *Curr Med Res Opin*. 2017;33(6):1105–1110.
- Curry SA. Obesity epidemic: pharmaceutical weight loss. *R I Med J (2013)*. 2017;100(2):18–20.
- Bowman K, Delgado J, Henley WE, et al. Obesity in older people with and without conditions associated with weight loss: follow-up of 955,000 primary care patients. *J Gerontol A Biol Sci Med Sci*. 2017;72(2):203–209.
- Batsis JA, Gill LE, Masutani RK, et al. Weight loss interventions in older adults with obesity: a systematic review of randomized controlled trials since 2005. *J Am Geriatr Soc*. 2017;65(2):257–268.
- Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet*. 2009;373(9669):1083–1096.
- Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. *JAMA*. 2005;293(15):1861–1867.
- Wadden TA, Brownell KD, Foster GD. Obesity: responding to the global epidemic. *J Consult Clin Psychol*. 2002;70(3):510–525.
- Byrne SM, Cooper Z, Fairburn CG. Psychological predictors of weight regain in obesity. *Behav Res Ther*. 2004;42(11):1341–1356.
- Castelnuovo G, Manzoni GM, Pietrabissa G, et al. Obesity and outpatient rehabilitation using mobile technologies: the potential mHealth approach. *Front Psychol*. 2014;5:559.
- Castelnuovo G, Manzoni GM, Cuzzio P, et al. TECNOB: study design of a randomized controlled trial of a multidisciplinary telecare intervention for obese patients with type-2 diabetes. *BMC Public Health*. 2010;10:204.
- Klein S, Sheard NF, Pi-Sunyer X, et al. Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies: a statement of the American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition. *Diabetes Care*. 2004;27(8):2067–2073.
- Klein S, Sheard NF, Pi-Sunyer X, et al. Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies. A statement of the American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition. *Am J Clin Nutr*. 2004;80(2):257–263.
- Capodaglio P, Lafortuna C, Petroni ML, et al. Rationale for hospital-based rehabilitation in obesity with comorbidities. *Eur J Phys Rehabil Med*. 2013;49(3):399–417.
- Capodaglio P, Castelnuovo G, Brunani A, Vismara L, Villa V, Capodaglio EM. Functional limitations and occupational issues in obesity: a review. *Int J Occup Saf Ergon*. 2010;16(4):507–523.
- Lemstra ME, Rogers MR. The Healthy Weights Initiative: a community-based obesity reduction program with positive impact on depressed mood scores. *Psychol Res Behav Manag*. 2016;9:115–124.
- Murray TE, Williams D, Lee MJ. Osteoporosis, obesity, and sarcopenia on abdominal CT: a review of epidemiology, diagnostic criteria, and management strategies for the reporting radiologist. *Abdom Radiol (NY)*. Epub 2017 Apr 6.
- Pohl D. Medical, surgical, behavioral, preventive approaches to address the obesity epidemic. *R I Med J (2013)*. 2017;100(2):14.
- Boles A, Kandimalla R, Reddy PH. Dynamics of diabetes and obesity: epidemiological perspective. *Biochim Biophys Acta*. Epub 2017 Jan 24.
- Price R. Genetics and common obesities: background, current status, strategies, and future prospects. In: Wadden T, Stunkard A, editors. *Handbook of Obesity Treatment*. New York: The Guilford Press; 2002.
- Marcus MD, Wildes JE. Obesity: is it a mental disorder? *Int J Eat Disord*. 2009;42(8):739–753.
- Horgen K, Brownell K. Confronting the toxic environment: environmental and public health actions in a world crisis. In: Wadden T, Stunkard A, editors. *Handbook of Obesity Treatment*. New York: The Guilford Press; 2002.
- Swencionis C, Rendell SL. The psychology of obesity. *Abdom Imaging*. 2012;37(5):733–737.
- Castelnuovo G, Zoppis I, Santoro E, et al. Managing chronic pathologies with a stepped mHealth-based approach in clinical psychology and medicine. *Front Psychol*. 2015;6:407.
- Haslam DW, James WP. Obesity. *Lancet*. 2005;366(9492):1197–1209.
- Alley DE, Chang VW. The changing relationship of obesity and disability, 1988-2004. *JAMA*. 2007;298(17):2020–2027.

32. Flegal KM, Graubard BI, Williamson DF, Gail MH. Weight-associated deaths in the United States. *J Womens Health (Larchmt)*. 2007;16(9):1368–1370.
33. Dombrowski SU, Sniehotta FF, Avenell A, Johnston M, MacLennan G, Araújo-Soares V. Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related co-morbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychol Rev*. 2012;6(1):7–32.
34. Lepore J. American chronicles: twilight. *The New Yorker*. 2011 Mar 14.
35. Fabricatore AN, Wadden TA. Psychological aspects of obesity. *Clin Dermatol*. 2004;22(4):332–337.
36. Hudson JI, Hiripi E, Pope HG Jr, Kessler RC. The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. *Biol Psychiatry*. 2007;61(3):348–358.
37. Petry NM, Barry D, Pietrzak RH, Wagner JA. Overweight and obesity are associated with psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosom Med*. 2008;70(3):288–297.
38. Scott KM, Bruffaerts R, Simon GE, et al. Obesity and mental disorders in the general population: results from the world mental health surveys. *Int J Obes (Lond)*. 2008;32(1):192–200.
39. Pickering RP, Grant BF, Chou SP, Compton WM. Are overweight, obesity, and extreme obesity associated with psychopathology? Results from the national epidemiologic survey on alcohol and related conditions. *J Clin Psychiatry*. 2007;68(7):998–1009.
40. Manzoni GM, Cribbie RA, Villa V, Arpin-Cribbie CA, Gondoni L, Castelnuovo G. Psychological well-being in obese inpatients with ischemic heart disease at entry and at discharge from a four-week cardiac rehabilitation program. *Front Psychol*. 2010;1:38.
41. Shaw K, O'Rourke P, Del Mar C, Kenardy J. Psychological interventions for overweight or obesity. *Cochrane Database Syst Rev*. 2005;(2):CD003818.
42. Wing RR. Behavioral weight control. In: Wadden TA, Stunkard AJ, editors. *Handbook of Obesity Treatment*. New York: The Guilford Press; 2002:301–316.
43. Foster GD, Makris AP, Bailer BA. Behavioral treatment of obesity. *Am J Clin Nutr*. 2005;82(1 Suppl):230S–235S.
44. Dombrowski SU, Avenell A, Sniehot FF. Behavioural interventions for obese adults with additional risk factors for morbidity: systematic review of effects on behaviour, weight and disease risk factors. *Obes Facts*. 2011;3(6):377–396.
45. Manzoni GM, Villa V, Compare A, et al. Short-term effects of a multi-disciplinary cardiac rehabilitation programme on psychological well-being, exercise capacity and weight in a sample of obese in-patients with coronary heart disease: a practice-level study. *Psychol Health Med*. 2011;16(2):178–189.
46. Villa V, Manzoni GM, Pagnini F, Castelnuovo G, Cesa GL, Molinari E. Do coping strategies discriminate eating disordered individuals better than eating disorder features? An explorative study on female inpatients with anorexia and bulimia nervosa. *J Clin Psychol Med Settings*. 2009;16(4):297–303.
47. Moffitt R, Haynes A, Mohr P. Treatment beliefs and preferences for psychological therapies for weight management. *J Clin Psychol*. 2015;71(6):584–596.
48. Wilson GT, Wilfley DE, Agras WS, Bryson SW. Psychological treatments of binge eating disorder. *Arch Gen Psychiatry*. 2010;67(1):94–101.
49. Grilo CM, Masheb RM, Wilson GT, Gueorguieva R, White MA. Cognitive-behavioral therapy, behavioral weight loss, and sequential treatment for obese patients with binge-eating disorder: a randomized controlled trial. *J Consult Clin Psychol*. 2011;79(5):675–685.
50. Reas DL, Grilo CM. Review and meta-analysis of pharmacotherapy for binge-eating disorder. *Obesity (Silver Spring)*. 2008;16(9):2024–2038.
51. Wilson GT, Grilo CM, Vitousek KM. Psychological treatment of eating disorders. *Am Psychol*. 2007;62(3):199–216.
52. Dalle Grave R, Centis E, Marzocchi R, El Ghoch M, Marchesini G. Major factors for facilitating change in behavioral strategies to reduce obesity. *Psychol Res Behav Manag*. 2013;6:101–110.
53. Grilo CM, Masheb RM, Wilson GT. Efficacy of cognitive behavioral therapy and fluoxetine for the treatment of binge eating disorder: a randomized double-blind placebo-controlled comparison. *Biol Psychiatry*. 2005;57(3):301–309.
54. Wilfley DE, Welch RR, Stein RI, et al. A randomized comparison of group cognitive-behavioral therapy and group interpersonal psychotherapy for the treatment of overweight individuals with binge-eating disorder. *Arch Gen Psychiatry*. 2002;59(8):713–721.
55. Jacobi C, Hayward C, de Zwaan M, Kraemer HC, Agras WS. Coming to terms with risk factors for eating disorders: application of risk terminology and suggestions for a general taxonomy. *Psychol Bull*. 2004;130(1):19–65.
56. Bulik CM, Reichborn-Kjennerud T. Medical morbidity in binge eating disorder. *Int J Eat Disord*. 2003;34 Suppl:S39–S46.
57. Vanderlinden J, Adriaensens A, Vancampfort D, Pieters G, Probst M, Vansteelandt K. A cognitive-behavioral therapeutic program for patients with obesity and binge eating disorder: short- and long-term follow-up data of a prospective study. *Behav Modif*. 2012;36(5):670–686.
58. Fandino J, Moreira RO, Preissler C, et al. Impact of binge eating disorder in the psychopathological profile of obese women. *Compr Psychiatry*. 2010;51(2):110–114.
59. Mitchell JE, Mussell MP. Comorbidity and binge eating disorder. *Addict Behav*. 1995;20(6):725–732.
60. Wilfley DE, Wilson GT, Agras WS. The clinical significance of binge eating disorder. *Int J Eat Disord*. 2003;34 Suppl:S96–S106.
61. Vocks S, Tuschen-Caffier B, Pietrowsky R, Rustenbach SJ, Kersting A, Herpertz S. Meta-analysis of the effectiveness of psychological and pharmacological treatments for binge eating disorder. *Int J Eat Disord*. 2010;43(3):205–217.
62. Treasure J, Claudino AM, Zucker N. Eating disorders. *Lancet*. 2010;375(9714):583–593.
63. Brownley KA, Berkman ND, Sedway JA, Lohr KN, Bulik CM. Binge eating disorder treatment: a systematic review of randomized controlled trials. *Int J Eat Disord*. 2007;40(4):337–348.
64. Dingemans AE, Bruna MJ, van Furth EF. Binge eating disorder: a review. *Int J Obes Relat Metab Disord*. 2002;26(3):299–307.
65. Cuzzolaro M. Eating disorders and obesity. In: Sbraccia P, Nisoli E, Vettor R, editors. *Clinical Management of Overweight and Obesity: Recommendations of the Italian Society of Obesity (SIO)*. London: Springer; 2016:103–124.
66. Fairburn CG, Cooper Z, Doll HA, et al. Transdiagnostic cognitive-behavioral therapy for patients with eating disorders: a two-site trial with 60-week follow-up. *Am J Psychiatry*. 2009;166(3):311–319.
67. Munsch S, Biedert E, Meyer A, et al. A randomized comparison of cognitive behavioral therapy and behavioral weight loss treatment for overweight individuals with binge eating disorder. *Int J Eat Disord*. 2007;40(2):102–113.
68. Khaylis A, Yiaslas T, Bergstrom J, Gore-Felton C. A review of efficacious technology-based weight-loss interventions: five key components. *Telemed J E Health*. 2010;16(9):931–938.
69. Palavras MA, Hay P, Touyz S, et al. Comparing cognitive behavioural therapy for eating disorders integrated with behavioural weight loss therapy to cognitive behavioural therapy-enhanced alone in overweight or obese people with bulimia nervosa or binge eating disorder: study protocol for a randomised controlled trial. *Trials*. 2015;16:578.
70. Rotella C, Cresci B, Pala L, Dicembrini I. Therapeutic education. In: Sbraccia P, Nisoli E, Vettor R, editors. *Clinical Management of Overweight and Obesity: Recommendations of the Italian Society of Obesity (SIO)*. London: Springer; 2016:37–44.
71. Cattivelli R, Pietrabissa G, Ceccarini M, et al. ACTonFOOD: opportunities of ACT to address food addiction. *Front Psychol*. 2015;6:396.

72. Lillis J, Niemeier HM, Thomas JG, et al. A randomized trial of an acceptance-based behavioral intervention for weight loss in people with high internal disinhibition. *Obesity (Silver Spring)*. 2016;24(12):2509–2514.
73. Forman EM, Butryn ML, Manasse SM, et al. Acceptance-based versus standard behavioral treatment for obesity: results from the mind your health randomized controlled trial. *Obesity (Silver Spring)*. 2016;24(10):2050–2056.
74. Rogers JM, Ferrari M, Mosely K, Lang CP, Brennan L. Mindfulness-based interventions for adults who are overweight or obese: a meta-analysis of physical and psychological health outcomes. *Obes Rev*. 2017;18(1):51–67.
75. Neveu R, Neveu D, Barbalat G, Schmidt U, Coricelli G, Nicolas A. The sequential binge, a new therapeutic approach for binge eating: a pilot study. *PLoS One*. 2016;11(11):e0165696.
76. Castelnuovo G, Manzoni GM, Villa V, Cesa GL, Molinari E. Brief strategic therapy vs cognitive behavioral therapy for the inpatient and telephone-based outpatient treatment of binge eating disorder: the STRATOB randomized controlled clinical trial. *Clin Pract Epidemiol Ment Health*. 2011;7:29–37.
77. Castelnuovo G, Manzoni GM, Villa V, Cesa GL, Pietrabissa G, Molinari E. The STRATOB study: design of a randomized controlled clinical trial of Cognitive Behavioral Therapy and Brief Strategic Therapy with telecare in patients with obesity and binge-eating disorder referred to residential nutritional rehabilitation. *Trials*. 2011;12:114.
78. Pietrabissa G, Manzoni GM, Rossi A, Castelnuovo G. The MOTIV-HEART study: a prospective, randomized, single-blind pilot study of brief strategic therapy and motivational interviewing among cardiac rehabilitation patients. *Front Psychol*. 2017;8:83.
79. Bulik CM, Marcus MD, Zerwas S, Levine MD, La Via M. The changing “weightscape” of bulimia nervosa. *Am J Psychiatry*. 2012;169(10):1031–1036.
80. Montesi L, El Ghoch M, Brodosi L, Calugi S, Marchesini G, Dalle Grave R. Long-term weight loss maintenance for obesity: a multidisciplinary approach. *Diabetes Metab Syndr Obes*. 2016;9:37–46.
81. Kelley CP, Sbrocco G, Sbrocco T. Behavioral modification for the management of obesity. *Prim Care*. 2016;43(1):159–175, x.
82. Dalle Grave R, Calugi S, El Ghoch M. Lifestyle modification in the management of obesity: achievements and challenges. *Eat Weight Disord*. 2013;18(4):339–349.
83. Pietrabissa G, Manzoni GM, Corti S, Vegliante N, Molinari E, Castelnuovo G. Addressing motivation in globesity treatment: a new challenge for clinical psychology. *Front Psychol*. 2012;3:317.
84. Waller G, Stringer H, Meyer C. What cognitive behavioral techniques do therapists report using when delivering cognitive behavioral therapy for the eating disorders? *J Consult Clin Psychol*. 2011;80(1):171–175.
85. Barello S, Graffigna G, Vegni E. Patient engagement as an emerging challenge for healthcare services: mapping the literature. *Nurs Res Pract*. 2012;2012:905934.
86. Ceccarini M, Borrello M, Pietrabissa G, Manzoni GM, Castelnuovo G. Assessing motivation and readiness to change for weight management and control: an in-depth evaluation of three sets of instruments. *Front Psychol*. 2015;6:511.
87. Astroth DB, Cross-Poline GN, Stach DJ, Tilliss TS, Annan SD. The transtheoretical model: an approach to behavioral change. *J Dent Hyg*. 2002;76(4):286–295.
88. Prochaska JO, DiClemente CC. *The Transtheoretical Approach: Crossing Traditional Boundaries of Change*. Homewood: Dorsey Press; 1984.
89. Wilson GT, Schlam TR. The transtheoretical model and motivational interviewing in the treatment of eating and weight disorders. *Clin Psychol Rev*. 2004;24(3):361–378.
90. Miller CE, Johnson JL. Motivational interviewing. *Can Nurse*. 2001;97(7):32–33.
91. Miller WR, Rollnick S. The effectiveness and ineffectiveness of complex behavioral interventions: impact of treatment fidelity. *Contemp Clin Trials*. 2014;37(2):234–241.
92. Miller WR, Rollnick S. Meeting in the middle: motivational interviewing and self-determination theory. *Int J Behav Nutr Phys Act*. 2012;9:25.
93. Miller WR, Rollnick S. Ten things that motivational interviewing is not. *Behav Cogn Psychother*. 2009;37(2):129–140.
94. Pietrabissa G, Sorgente A, Rossi A, et al. Stages of change in obesity and weight management: factorial structure of the Italian version of the University of Rhode Island Change Assessment Scale. *Eat Weight Disord*. Epub 2016 May 10.
95. Cipresso P, Serino S, Villani D, et al. Is your phone so smart to affect your states? An exploratory study based on psychophysiological measures. *Neurocomputing*. 2012;84:23–30.
96. Eysenbach G. Can tweets predict citations? Metrics of social impact based on Twitter and correlation with traditional metrics of scientific impact. *J Med Internet Res*. 2011;13(4):e123.
97. Fiordelli M, Diviani N, Schulz PJ. Mapping mHealth research: a decade of evolution. *J Med Internet Res*. 2013;15(5):e95.
98. Whittaker R. Issues in mHealth: findings from key informant interviews. *J Med Internet Res*. 2012;14(5):e129.
99. Riper H, Andersson G, Christensen H, Cuijpers P, Lange A, Eysenbach G. Theme issue on e-mental health: a growing field in internet research. *J Med Internet Res*. 2010;12(5):e74.
100. Eysenbach G. What is e-health? *J Med Internet Res*. 2001;3(2):E20.
101. Castelnuovo G, Pietrabissa G, Manzoni GM, et al. A stepped care mhealth-based approach for promoting patient engagement in chronic care management of obesity with type 2 diabetes. *Transformative Healthcare Practice through Patient Engagement*. 2016:192–214.
102. Santoro E, Castelnuovo G, Zoppis I, Mauri G, Sicurello F. Social media and mobile applications in chronic disease prevention and management. *Front Psychol*. 2015;6:567.
103. Manzoni GM, Pagnini F, Corti S, Molinari E, Castelnuovo G. Internet-based behavioral interventions for obesity: an updated systematic review. *Clin Pract Epidemiol Ment Health*. 2011;7:19–28.
104. Rao G, Burke LE, Spring BJ, et al. New and emerging weight management strategies for busy ambulatory settings: a scientific statement from the American Heart Association endorsed by the Society of Behavioral Medicine. *Circulation*. 2011;124(10):1182–1203.
105. Chomutare T, Fernandez-Luque L, Arsand E, Hartvigsen G. Features of mobile diabetes applications: review of the literature and analysis of current applications compared against evidence-based guidelines. *J Med Internet Res*. 2011;13(3):e65.
106. Shaw RJ, Bosworth HB, Silva SS, et al. Mobile health messages help sustain recent weight loss. *Am J Med*. 2013;126(11):1002–1009.
107. Sharifi M, Dryden EM, Horan CM, et al. Leveraging text messaging and mobile technology to support pediatric obesity-related behavior change: a qualitative study using parent focus groups and interviews. *J Med Internet Res*. 2013;15(12):e272.
108. Schoffman DE, Turner-McGrievy G, Jones SJ, Wilcox S. Mobile apps for pediatric obesity prevention and treatment, healthy eating, and physical activity promotion: just fun and games? *Transl Behav Med*. 2013;3(3):320–325.
109. Rodrigues JJ, Lopes IM, Silva BM, Torre Ide L. A new mobile ubiquitous computing application to control obesity: SapoFit. *Inform Health Soc Care*. 2013;38(1):37–53.
110. Hebden L, Balestracci K, McGeechan K, et al. ‘TXT2BFIT’ a mobile phone-based healthy lifestyle program for preventing unhealthy weight gain in young adults: study protocol for a randomized controlled trial. *Trials*. 2013;14:75.
111. Bacigalupo R, Cudd P, Littlewood C, Bissell P, Hawley MS, Buckley Woods H. Interventions employing mobile technology for overweight and obesity: an early systematic review of randomized controlled trials. *Obes Rev*. 2013;14(4):279–291.
112. Schiel R, Kaps A, Bieber G. Electronic health technology for the assessment of physical activity and eating habits in children and adolescents with overweight and obesity IDA. *Appetite*. 2012;58(2):432–437.
113. Pellegrini CA, Duncan JM, Moller AC, et al. A smartphone-supported weight loss program: design of the ENGAGED randomized controlled trial. *BMC Public Health*. 2012;12:1041.

114. 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(6):388–394.
115. Martinez-Perez B, de la Torre-Diez I, Lopez-Coronado M. Mobile health applications for the most prevalent conditions by the World Health Organization: review and analysis. *J Med Internet Res.* 2013;15(6):e120.
116. Turner-McGrievy GM, Beets MW, Moore JB, Kaczynski AT, Barr-Anderson DJ, Tate DF. Comparison of traditional versus mobile app self-monitoring of physical activity and dietary intake among overweight adults participating in an mHealth weight loss program. *J Am Med Inform Assoc.* 2013;20(3):513–518.
117. Cafazzo JA, Casselman M, Hamming N, Katzman DK, Palmert MR. Design of an mHealth app for the self-management of adolescent type 1 diabetes: a pilot study. *J Med Internet Res.* 2012;14(3):e70.
118. Burke LE, Styn MA, Sereika SM, et al. Using mHealth technology to enhance self-monitoring for weight loss: a randomized trial. *Am J Prev Med.* 2012;43(1):20–26.
119. Simpson SG, Slowey L. Video therapy for atypical eating disorder and obesity: a case study. *Clin Pract Epidemiol Ment Health.* 2011;7:38–43.
120. Sockalingam S, Cassin SE, Wnuk S, et al. A pilot study on telephone cognitive behavioral therapy for patients six-months post-bariatric surgery. *Obes Surg.* 2017;27(3):670–675.
121. Dennison L, Morrison L, Lloyd S, et al. Does brief telephone support improve engagement with a web-based weight management intervention? Randomized controlled trial. *J Med Internet Res.* 2014;16(3):e95.
122. Tufano JT, Karras BT. Mobile eHealth interventions for obesity: a timely opportunity to leverage convergence trends. *J Med Internet Res.* 2005;7(5):e58.
123. Jensen CD, Aylward BS, Steele RG. Predictors of attendance in a practical clinical trial of two pediatric weight management interventions. *Obesity (Silver Spring).* 2012;20(11):2250–2256.
124. Mohammadzadeh N, Safdari R. Patient monitoring in mobile health: opportunities and challenges. *Med Arch.* 2014;68(1):57–60.
125. Castelnovo G, Mauri G, Waki K. mHealth and eHealth for obesity and types 2 and 1 diabetes. *J Diabetes Res.* 2016;2016:9627602.
126. Castelnovo G, Pietrabissa G, Cattivelli R, Manzoni GM, Molinari E. Not only clinical efficacy in psychological treatments: clinical psychology must promote cost-benefit, cost-effectiveness, and cost-utility analysis. *Front Psychol.* 2016;7:563.
127. Bigi S. The persuasive role of ethos in doctor-patient interactions. *Commun Med.* 2011;8(1):67–76.
128. Macagno F, Walton D. What we hide in words: emotive words and persuasive definitions. *J Pragmat.* 2010;42(7):1997–2013.
129. Kahn MW. Etiquette-based medicine. *N Engl J Med.* 2008;358(19):1988–1989.
130. Castelnovo G. 5 years after the Kahn's etiquette-based medicine: a brief checklist proposal for a functional second meeting with the patient. *Front Psychol.* 2013;4:723.
131. Kushner RF. Weight loss strategies for treatment of obesity. *Prog Cardiovasc Dis.* 2014;56(4):465–472.
132. Manzoni GM, Cesa GL, Bacchetta M, et al. Virtual reality-enhanced cognitive-behavioral therapy for morbid obesity: a randomized controlled study with 1 year follow-up. *Cyberpsychol Behav Soc Netw.* 2016;19(2):134–140.
133. Serino S, Scarpina F, Keizer A, et al. A novel technique for improving bodily experience in a non-operable super-super obesity case. *Front Psychol.* 2016;7:837.
134. Pallavicini F, Serino S, Cipresso P, et al. Testing augmented reality for cue exposure in obese patients: an exploratory study. *Cyberpsychol Behav Soc Netw.* 2016;19(2):107–114.
135. Wiederhold BK, Riva G, Gutierrez-Maldonado J. Virtual reality in the assessment and treatment of weight-related disorders. *Cyberpsychol Behav Soc Netw.* 2016;19(2):67–73.
136. Gutierrez-Maldonado J, Wiederhold BK, Riva G. Future directions: how virtual reality can further improve the assessment and treatment of eating disorders and obesity. *Cyberpsychol Behav Soc Netw.* 2016;19(2):148–153.
137. Cardenas-Lopez G, Torres-Villalobos G, Martinez P, et al. Virtual reality for improving body image disorders and weight loss after gastric band surgery: a case series. *Stud Health Technol Inform.* 2014;196:43–47.
138. Cesa GL, Manzoni GM, Bacchetta M, et al. Virtual reality for enhancing the cognitive behavioral treatment of obesity with binge eating disorder: randomized controlled study with one-year follow-up. *J Med Internet Res.* 2013;15(6):e113.
139. Riva G, Bacchetta M, Cesa G, et al. Is severe obesity a form of addiction? Rationale, clinical approach, and controlled clinical trial. *Cyberpsychol Behav.* 2006;9(4):457–479.
140. Riva G, Alcaniz M, Anolli L, et al. The VEPSY UPDATED project: technical and clinical rationale. *Stud Health Technol Inform.* 2002;85:395–401.
141. Riva G, Alcaniz M, Anolli L, et al. The VEPSY UPDATED Project: clinical rationale and technical approach. *Cyberpsychol Behav.* 2003;6(4):433–439.
142. Riva G, Alcaniz M, Anolli L, et al. The VEPSY updated project: virtual reality in clinical psychology. *Cyberpsychol Behav.* 2001;4(4):449–455.

Psychology Research and Behavior Management

Publish your work in this journal

Psychology Research and Behavior Management is an international, peer-reviewed, open access journal focusing on the science of psychology and its application in behavior management to develop improved outcomes in the clinical, educational, sports and business arenas. Specific topics covered in the journal include: Neuroscience, memory and decision making; Behavior

modification and management; Clinical applications; Business and sports performance management; Social and developmental studies; Animal studies. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/psychology-research-and-behavior-management-journal>

Dovepress