

Biobehavioural approaches to prevention and treatment: A call for implementation science in obesity research

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Summary

Much progress has been made in the last 30 years in understanding the causes and mechanisms that contribute to obesity, yet widely available and successful strategies for prevention and treatment remain elusive at population levels. This paper discusses the biobehavioural framework and provides suggestions for applying it to enable greater progress in the science of obesity prevention and treatment, including an increased focus on implementation of science strategies. The objective is to promote a re-evaluation of current views about preventing and treating obesity within a unified biobehavioural framework. Further integration of research exploring how both behavioural and biological components interact is a critical step forward.

KEYWORDS

biobehavioural, implementation science, obesity

1 | INTRODUCTION

A 1982 Institute of Medicine (IOM) report titled *Health and Behavior*¹ introduced the term “biobehavioural sciences” to embrace the many interacting disciplines that contribute to health outcomes.

The term biobehavioral sciences is used ... to refer to the panoply of basic, applied, and clinical sciences that contribute to an understanding of behavior. It naturally includes the behavioral sciences that conduct experimental analyses of animal and human conduct. It also includes such basic sciences as neurology, neurochemistry, endocrinology, and

neuroanatomy, as well as the fields of psychology, ethology, sociology, and anthropology. ... All are part of the biobehavioral sciences.

Two years prior to this IOM report, the use of the term “biobehavioural” as related to obesity can be found.² Decades of previous work^{3–10} have gone deeply into discovering detailed mechanisms to understand the contributing factors driving obesity and its complications, and by leveraging these discoveries from recent decades, scientists in our community can develop new and creative approaches using the biobehavioural framework. This mechanistic research has resulted in a broad but fragmented literature base that needs to be more fully integrated into a systems approach. Greater efforts are

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needed to stimulate rapid evolution of obesity research and treatment approaches in all arenas, from basic science to public health, in recognition of the complexity and heterogeneity of this chronic disease.

Traditionally, behavioural scientists have strictly examined behavioural influences in the progression and treatment of obesity, while experts in basic sciences have investigated specific physiological processes. A push to integrate these two areas of research exists, and progress has been made¹¹; but thus far, obesity research has largely taken a behavioural¹² or biological⁴ approach to the disease. Historically, this is due to a variety of factors including departmental and funding silos. New approaches are needed to encourage greater collaboration and interdisciplinary crosstalk among students and faculty. This is important because research exploring strategies to prevent or treat obesity as a behavioural condition or biological condition in isolation fails to acknowledge the complex and multifactorial aetiology including but not limited to genetics, viral exposure, foetal programming, epigenetics, medications, health behaviours, environment, gut microbiome, and psychosocial factors that impact obesity development.^{13,14} Research has demonstrated the adaptive and compensatory nature of energy balance,^{15,16} and by focusing on only one aspect of the metabolic system, the impact of other biobehavioural aspects that respond to minimize the perturbation may be missed. Thus, a milieu of physiological, behavioural, and environmental factors merits simultaneous scrutiny in order to identify opportunities for further study and intervention. Researchers and clinicians should promote a re-evaluation of current views about preventing and treating obesity within a unified biobehavioural framework. Further integration of research exploring how both behavioural and biological components interact is a critical step forward.

2 | VIEWING OBESITY AS A BEHAVIOURAL CONDITION VERSUS PHYSIOLOGICAL CONDITION ALONE IS NOT PRODUCTIVE

The first course of action for both obesity prevention and treatment is often behavioural in nature, and while to some degree this has worked in preventing and treating obesity-related comorbidities, its effectiveness in reducing obesity at a population level has been limited.¹⁷ The US Diabetes Prevention Program (US-DPP) not only demonstrated the potential of lifestyle changes as a strategy to prevent or delay the onset of type 2 diabetes (T2D) but also showed the limitations of a programme using a strictly behavioural approach for weight reduction, with an average of 4 kg of weight loss achieved over a 4-year period.¹⁸ Additionally, weight regain following cessation of clinical trials that target obesity with a behavioural approach is common.¹⁹

Another important study designed to use intensive lifestyle intervention (ILI) to reduce harms from T2D and cardiovascular events in older adults (>45 years old) with overweight was the Look AHEAD trial.^{20,21} The intervention (ILI compared with a diabetes support and education group) was a combination of meal replacements used to attain target energy intakes based on baseline weight, physical activity, and social support over a 4-year period, followed by a less intensive

maintenance intervention consisting of biannual in-person contacts plus supplemental support as requested. Some have interpreted the outcomes of the Look AHEAD trial as “negative,” since it was stopped at 9.6 years for “futility” in finding no significant between-group differences, but in examining these results in light of more recent trials using pharmacological agents, there remains support for multimodal interventions for weight management and prevention of T2D.^{22,23}

Behavioural approaches to weight loss may be difficult to maintain, as biological adaptations including reduced energy expenditure and increased appetite may occur. These physiological changes can influence adherence, planning of weight loss behaviours, fatigue, and motivation,²⁴ creating a David-versus-Goliath imbalance where options that are resistant to homeostatic mechanisms are not available in the long run without increased risk for complications. Thus, therapies to ameliorate the intense physiological drive to reverse weight loss are needed.

One example is the use of pharmacotherapy; weight loss medication is currently recommended as an adjunct treatment to amplify outcomes of lifestyle modification.²⁵ Weight loss medications primarily work to reduce hunger, appetite, and energy intake but may not be as effective without accompanying behavioural modification.^{26,27} Behavioural modification coupled with weight loss medication often results in equal or greater weight loss than stand-alone approaches.²⁶⁻²⁸ Regardless, modest weight regain has been observed in clinical trials that incorporate a combination of intensive dietary restriction with weight loss medications.^{26,27} This is likely because weight loss medications are typically prescribed to assist with the initial weight loss phase, but weight often increases when medication is discontinued, and behavioural strategies may not be enough to sustain long-term weight loss on their own.³

Bariatric surgery, which to date results in the highest average percentage of total weight loss, is another biobehavioural treatment that alters fundamental aspects of digestive and hormonal physiology; however, behaviour change remains critical for long-term success,²⁹⁻³¹ as weight regain within 5 to 10 years is common.⁵ Both bariatric surgery and pharmacotherapy are commonly used in conjunction with behavioural therapy in treating T2D or hypertension but are less often used in cases of obesity that have not manifested comorbid conditions. Biobehavioural convergence as an approach to weight loss and obesity management may have the greatest impact on long-term obesity outcomes and thus prevents T2D and hypertension in many patients.

One reason a stand-alone behavioural treatment or a general, biologically rooted treatment for obesity such as pharmacotherapy may be limited in effectiveness is that multifactorial causes of obesity vary widely in each individual, causing heterogeneity in treatment effect. Twin, genetic, and developmental origins studies of obesity, along with inflammation, infection, and microbiome factors, show individual effects.³² Yet these potential contributors are not currently considered in prevention or treatment for obesity. No two people have become obese in exactly the same way. Conversely, it is difficult to predict which mode of therapy will be most effective, making a case for integrated, multidisciplinary treatment strategies, and to study the effects of various treatment modalities in younger people.³³⁻³⁵

3 | OTHER DISEASES ARE NOT TREATED THE SAME WAY

A strategy of approaching obesity from either a biological or a behavioural perspective differs from other chronic diseases, such as asthma. Although asthma and obesity are two different conditions, some parallels allow comparison of standard approaches to disease management.³⁶ Both are emergent phenotypes based on developmental, environmental, behavioural, and physiological interactions,^{14,37} are associated with morbidity and mortality,^{38,39} and adversely impact quality of life.⁴⁰⁻⁴² Both asthma and obesity disproportionately impact racial/ethnic minorities and individuals of lower socio-economic status.⁴³⁻⁴⁷ Nonetheless, approaches to understanding and treating obesity are very different than those for asthma.

The asthma care model includes components that may serve to guide our approach to understanding and treating obesity. For example, physicians are trained to treat asthma in medical school, but physicians often have little formal training in the aetiology of obesity or how to treat it.⁴⁸ Thus, providers report a lack of confidence in discussing weight management with patients⁴⁹ despite a large evidence base.⁵⁰ Obesity treatment is not often mentioned as part of a routine patient visit despite obesity diagnosis.⁵¹ Like obesity, asthma management benefits from early and regular surveillance by parents, school staff, and primary care physicians and merits lifelong care. Recognizing the importance of a multifactorial approach for asthma control, the Centers for Disease Control and Prevention released EXHALE,⁵² a technical package that incorporates behavioural, environmental, pharmacological, and policy strategies across multiple sectors to improve and maximize asthma control in all ages.

Instead of putting the onus on asthma sufferers to “just not do anything to trigger an attack,” which is like telling a person with obesity to “just eat less and move more,”⁵³ the holistic approach suggested in the EXHALE program addresses factors at individual (behavioural and physiologic), environmental, and policy levels to manage asthma over the life course.^{29,52} Approaches to understanding and treating obesity must become more interdisciplinary and move from an acute treatment model to a chronic disease model where lifelong treatment is expected and provided, to increase the impact of what has been accomplished to date.

4 | ISSUES AND POTENTIAL SOLUTIONS

The obesity community should focus on the critical issue of the heterogeneity of both causes of obesity and treatment responses, which demands new study recruitment and design approaches. Although studies that reflect treatment response heterogeneity may not be originally designed for this purpose,⁵⁴ data investigations have consistently observed treatment response heterogeneity in behavioural weight loss interventions.⁵⁵ This response heterogeneity discredits a one-size-fits-all approach to weight loss while adding credence for more tailored, precise, and cause-specific weight loss approaches.⁵⁶ Acknowledging sex and age differences is particularly important, as well as risk factors in

special populations. In particular, much progress has been made in biobehavioural prevention and treatment strategies for pregnant women, infants, and children.⁵⁷⁻⁶⁸ However, much work remains for groups with complex psychosocial risk factors.⁶⁹⁻⁷⁴ When heterogeneous responses are acknowledged, the community of researchers and clinicians may address potential prevention and treatment targets; and these factors would ideally be included in future studies to inform precision obesity medicine.⁷⁵ A new narrative focused on the personalization of treatment based on multifactorial biobehavioural factors, rather than one of individual responsibility, is urgently needed.⁷⁶

More than 90 potential contributors have been associated with weight gain and obesity, including factors such as genetics, diet, psychosocial influences, lack of physical activity, and environmental dynamics.³² Thus, in order to prevent and treat obesity, a biobehavioural approach towards obesity as a chronic medical condition requiring lifelong medical monitoring and care is most appropriate. Given the pervasive emphasis on an individual's responsibility to “eat less and move more,”⁵³ obesity prevention and treatment require a shift in cultural values and social norms.

One such shift must change the conduct of research and provision of clinical care for individuals with obesity, ensuring a biobehavioural approach wherever people live, work, and play.^{56,77-79} Broadening the scope of research and teaching students and trainees to include biological and behavioural interactional contributions to obesity could open additional strategies and clinical avenues that yield better treatment outcomes. Compared with other chronic diseases, there are relatively few ubiquitously used treatment strategies, and some remain unfunded or underfunded by insurance payers and underutilized by clinicians.

One way to address these issues is to include implementation science methods that rigorously test demonstrably effective interventions in resource-intensive, randomized controlled trials to determine how best to implement them in clinical- or community-based settings. Implementation science is “the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and hence, to improve the quality of effectiveness of health services”.⁸⁰ Implementation and obesity scientists share the same goal: ensuring that patients receive the best quality of care rooted in evidence-based practice. However, to date, there has been little merging of implementation science in treating obesity. A PubMed search of “implementation science” and “obesity” retrieved only 53 studies (accessed March 5, 2019), 24 of which focused on obesity or weight gain; the earliest was published in 2012. This shows that the field of implementation science for obesity has room for additional growth. However, implementation science has been used to improve real-world treatment outcomes for other complex multifactorial disease states. Where this shows success is when clinic-based programmes are moved into the public health realm.

One approach that aligns well with obesity is translating prevention programmes for T2D. Several large randomized controlled trials conducted in the United States, Finland, China, and India have come to the same conclusion; we can reduce the incidence of T2D by 29% to 58% in high-risk populations using lifestyle interventions, with generally successful maintenance up to 20 years later.^{81,82} Once effectiveness is

demonstrated in clinical trials, the research focus needs to move towards understanding why clinical trials were effective and how these programmes may work when implemented in real-world settings. The US-DPP, initially a resource-intensive model tested in randomized controlled trials, has been optimized to a less intensive curriculum delivered by non-medical personnel, which has lowered the overall costs of the programme without compromising effectiveness.⁸² Others have suggested that it is critical to have all health-care providers involved in obesity management and for them to not just focus on body size but health improvement for the whole patient.⁵⁶ This requires a paradigm shift for clinical practice customs in many countries.

In an implementation science framework, using the simplest and most practical measures customized to individual study and patient needs is a key. One promising development in obesity research is standardizing measurement across studies and developing core measures through a project known as Accumulating Data to Optimally Predict Obesity Treatment (ADOPT), which published six papers in *Obesity* in Spring, 2018.⁸³⁻⁸⁸ By focusing on standardized activities and measures to prevent weight gain, patients with obesity may manage potential health harms individually, with a better understanding of maintaining lifestyle modifications long term.

5 | SUMMARY

This commentary is not an extensive literature review or a succinct summary of all aspects of biobehavioural research to date. Rather, it is an attempt to add voices to those of others⁷⁶ who call for increased, concerted action to build on this large body of research in a way that moves obesity prevention and patient care forward. These perspectives are not new or novel yet seem to be lost among thousands of mechanistic studies that have illuminated the complexity of the problem more than they have pointed to simple solutions.

Biobehavioural research aims to direct obesity prevention and treatment through a broader, overall approach rather than narrowed scopes of biology or behaviour. A more robust biobehavioural model of obesity research integrating the complex interactions between biological, behavioural, and environmental factors is needed for moving the field forward, and this requires a shift in norms of training and research design. This must include public health and other prevention approaches, which we have not fully discussed here, in addition to increased engagement in implementation science. Costs and ethics associated with challenges for public health interventions require creative problem solving. Guidance of obesity research through the biobehavioural spectrum using implementation science will allow building on the foundation of previous research while creating interdisciplinary synergies to an ongoing epidemic.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTIONS

All authors were involved in writing the paper and had final approval of the submitted and published versions.

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