PERSPECTIVE

Weight stigma is overlooked in commercial-grade mobile applications for weight loss and weight-related behaviors

KayLoni L. Olson[1,2] | Stephanie P. Goldstein[1,2] | Jason Lillis[1,2] | Emily Panza[1,2]

[1]The Department of Psychiatry and Human Behavior, Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA
[2]The Weight Control and Diabetes Research Center, The Miriam Hospital, Providence, Rhode Island, USA

Correspondence
KayLoni L. Olson, Weight Control and Diabetes Research Center, Department of Psychiatry and Human Behavior, Warren Alpert Medical School of Brown University, The Miriam Hospital, 196 Richmond St, Room 210, Providence, RI 02903, USA.
Email: KayLoni_Olson@Brown.edu

1 | INTRODUCTION

Behavioral treatments for weight loss and weight-related behaviors increasingly leverage commercially available health-focused mobile applications (i.e., "apps") to assist participants in changing weight-related behaviors (e.g., monitoring caloric intake, body weight, and physical activity).[1,2] This includes weight loss treatments in which the content and behavior change tools are delivered entirely through a single mobile application (e.g., Noom or WW) as well as mobile applications that can act as adjuncts to existing programs to assist participants with making changes to specific weight-related behaviors (i.e., monitoring caloric intake, body weight, and physical activity). The benefits of using commercial mobile apps to augment obesity treatments are evident: these apps are widely available, easily accessed, and portable.[3] As such, apps have potential to improve adherence to weight-related behaviors and enhance engagement.[1,2,4] As app usage and variety expands,[5] researchers have begun investigating and expressing concern about the lack of evidence-based strategies incorporated into commercially available apps in particular.[1,2,4] However, this work has not examined one topic that may have crucial implications for the utility of apps: weight-related stigmatization.

Weight-related stigmatization refers to social devaluation of an individual based on body weight through negative stereotyping (e.g., being lazy, unintelligent, and lacking self-control).[6] It is perpetuated in a number of ways including, but not limited to, media portrayals of individuals of higher body weight, overt discrimination, language, and environmental barriers.[6] Weight-related stigma is pervasive as it remains a socially acceptable form of bias.[6,7] As such, the possibility exists that stigma may be unintentionally embedded into health-focused apps via language, images, and functionality. Despite beliefs by some that these experiences will motivate individuals to be healthier, growing evidence indicates that weight-related stigma can interfere with achieving or maintaining a healthy weight through mechanisms such as elevated physiological stress, reduced motivation, obesogenic eating behaviors, exercise avoidance, and reduced access to healthcare.[6,7]

Weight-stigmatizing experiences can have a lasting influence on subsequent health behaviors (e.g., as a result of experiencing weight stigma, individuals might avoid exercise or engage in eating behaviors that are inconsistent with goals).[6] Thus, apps that have weight stigmatization unintentionally embedded within them may de-incentivize behavior change and/or cause emotional distress. This is problematic because: (1) apps have massive reach[8] and (2) apps have potential to reach a population that may already feel stigmatized for their weight or other characteristics.

To illustrate, consider a user who has entered data reflecting low levels of physical activity and then receives automated feedback including language describing performance as "lazy" or "slacking off". While perhaps attempting to be light-hearted and colloquial, this language reinforces negative stereotypes about individuals of higher body weight; namely that they do not exercise and are sedentary (and thus may negate any constructive suggestions that follow).

These stereotypes are compounded by the pervasiveness of anti-fat attitudes among exercise professionals,[9] assumptions that individuals of higher body weight are unmotivated or unable to exercise,[9,10] and also by factors signaling that individuals with larger bodies are not welcome within physical activity spaces due to equipment that cannot accommodate their size or by treatment from others.[11] This weight stigmatizing language is embedded in the context of an evidence-based strategy as self-monitoring of exercise behavior and receiving feedback is not only theoretically grounded but empirically supported as an effective tool for behavior change.

However, the presence of weight stigma in commercially available apps used for weight loss has received minimal investigation. To begin generating awareness and informing future research in this important area, Table 1 provides examples of content within currently existing apps which may be perceived as stigmatizing. Extensive work has been conducted to define, document, and investigate the consequences of weight stigma in non-virtual settings.[6] The examples provided in Table 1 draw on this existing work to highlight how weight stigma that has been documented across settings, in real life, can be perpetuated within technology via apps. Table content includes a description and explanation of potentially weight stigmatizing content (which can be found in the second and third columns), citations supporting the stigmatizing nature of this content, and each example is labeled with a corresponding evidence-based strategy(ies) to demonstrate how this content can occur within the context of utilizing evidence-based practice.

The table provides multiple examples of stigmatizing content evident in these apps, including but not limited to using stigmatizing labels, reinforcing stereotypes associated with overweight and obesity, and promoting an unrealistic thin ideal and equating it with positive health status. Because some examples may be more intuitive than others, an explanation of how content could be perceived as stigmatizing has also been included. Importantly, the potential for information to be stigmatizing does not guarantee that all users would report feeling stigmatized after encountering the content. However, these tools should be developed in a way that does not risk the miscommunication of negative stereotypes related to body size. Additionally, we highlight that evidence-based strategies and the absence of stigmatizing content are not mutually exclusive, underscoring the important contributions of both areas of research in the study of commercially available apps for weight-related behaviors.

2 | POTENTIAL FUTURE DIRECTIONS

2.1 | Clearly define the problem

An important step is systematic evaluation of the form, prevalence, and scope of weight stigmatizing content within commercially available, health-focused mobile apps. Behavioral researchers undertaking systematic reviews of apps to determine prevalence of evidence-based strategies might expand their criteria to include presence and form of weight stigma. Collaboration between mobile health researchers and

weight stigma researchers will be particularly advantageous, where the end result will serve to advance both groups' concerns.

2.2 | Evaluate user perception of weight stigma

In addition to documenting the presence of weight stigma within commercially available apps, it will be important to conduct research to better understand how users experience this content, whether it is perceived as stigmatizing, how it impacts motivation to change behavior and app engagement, and ultimately how it impacts behavior change. This may be complicated by the fact that potential app users may actually endorse and request weight stigmatizing features of an app as many individuals internalize negative weight-related attitudes.[12]

2.3 | Harm reduction at the individual level

It is not necessary to wait until the scope of weight stigma in commercial apps is defined and well-understood to imagine some proactive steps forward. At an individual level, researchers and clinicians may prioritize taking a more involved approach when recommending apps within research studies and clinical practice (e.g., using apps and reviewing content prior to recommending use). To do this effectively, sensitivity to the issue of weight stigma is required and current knowledge of research related to weight stigma. It is important to become educated on these issues[6,7] or build collaborative relationships with those who have the necessary expertise.

2.4 | Develop a framework/tool for researchers and providers

For the majority of researchers and practitioners who are not experts in weight stigma, systematically reviewing commercially available apps for stigmatizing content may be an unworkable agenda. Alternatively, there may be benefit to developing a framework or set of guidelines that researchers and providers can use to review a small set of apps they are considering for use prior to prescribing.

2.5 | Building a better app

There is growing acknowledgment that researcher-developed apps rarely achieve the same reach as commercially available apps. Therefore, industry-research collaborations are more important than ever. Partnerships between industry and behavioral researchers provides the ideal opportunity to develop evidence-based tools that can be disseminated widely. These partnerships may benefit from content experts in weight stigma specifically, to ensure that evidence-based behavioral strategies are adapted for smartphone delivery without the potential for users' to feel stigmatized. Working

TABLE 1 Illustrative examples of content within currently existing smartphone applications that could be perceived as weight stigmatizing

Evidence-based strategy[a]	Example of weight stigmatizing content within App	Explanation of why this could be stigmatizing conceptually
Self-monitoring and feedback	Based on physical activity level, step count, or duration of activity, individual receives feedback that they have been "lazy" or "slacking off"	• The assumption that individuals of higher body weight are "lazy" is a quintessential example of weight stigmatization, especially given that most apps make this attribution without assessing alternative contextual factors that may drive low activity (e.g., illness and work/home responsibilities). Thus, this language reinforces fallacious stereotypes about obesity particularly related to their capacity and engagement with exercise/physical activity.[11,17-19]
Self-monitoring and feedback	Based on quality of food intake or calories reported, individual receives feedback that they can have "better control" of their health/choices tomorrow.	• The assumption that individuals of higher body weight lack self-control are another common example of weight stigma. The App's default assumption about the user's food intake is that it resulted from loss of control, rather than other plausible explanations (e.g., planned eating out), reinforcing this type of weight bias.[20,21]
Self-monitoring and feedback	Individual enters food into tracking system and receives feedback that an item was a "C-."	• Rating food items with a traditional grading system involves implicit ideas about passing and failing. This reinforces black and white ideas about food (good foods vs. bad or "cheating" foods) and by association a passing or failing mentality about eating behaviors.[22,23]
Goal setting and planning/ self-monitoring and feedback	Based on body weight, eating, or exercise behavior, the individual receives feedback that they can be a "better" version of themselves by losing weight or changing weight-related behaviors.	• This feedback reinforces the idea that body weight, eating behaviors, or performance of physical activity is an indicator of self-worth and obesity represents a moral failing on the part of the individual. This reinforces societal attitudes about the relative value of an individual based on body size.[24-26]
Goal setting and planning/ rewards and incentives/ social components	Individual is asked to participate in a "beach body" challenge, or is given motivational feedback to keeping working for their "beach body."	• "Motivational" messaging or peer challenges that encourage people to work to achieve a "beach body" reinforces ideas that certain spaces (beaches) and/or clothing (swimsuits) are reserved only for people who have certain or ideal bodies. • This messaging also connects health behaviors with purely aesthetic benefits that may also be unrealistic, reducing likelihood of sustained engagement.[27,28]
Goal setting and planning	Individual enters their height and weight and is given feedback based on BMI that does not portray the nuances of BMI as an assessment tool or marker of health.	• BMI is an imperfect tool for assessing potential health risk related to body adiposity. One form of weight stigma involves assuming that individuals of higher body weight are unhealthy solely based on their body size, and providing BMI feedback within Apps can exacerbate these assumptions by over-interpreting BMI (e.g., suggesting that an individual with a BMI in the overweight or obese range is not healthy or could become healthier, implying lack of health) or by providing feedback to uninformed users where misunderstanding and shame may be experienced (i.e., being labeled obese without any information for understanding that feedback).[13-15]
Goal setting and planning	Stock photos or avatars embedded within App feature only thin and/or fit bodies.	• Lack of inclusive visual representation in body size (i.e., using only thin and/or very fit individuals) suggests that individuals of higher body weight are not represented among those who eat healthfully and exercise.[29]

TABLE 1 (Continued)

Evidence-based strategy[a]	Example of weight stigmatizing content within App	Explanation of why this could be stigmatizing conceptually
Goal setting and planning	Planning features of the App encourage individual to "imagine getting rid of all the fat on your thighs, stomach, etc." when trying to resist tempting foods.	• This language encourages people to think about food in relation to societally prescribed standards about body weight and shape that reinforce fear of fatness and negative attitudes about individuals of higher body weight. Further, ridding a body part entirely of body fat is not only impossible but unhealthy.[30]
Social components	Receiving or sending a "taunt" message from peers in relation to physical activity tracking.	• Receiving or sending "taunt" messages to/from peers that an individual has connected with on physical activity apps condones and promotes bullying about exercise behaviors. This reinforces shaming around health behaviors that is characteristic of weight stigmatizing experiences.[31]

Note: Each example includes discussion regarding how the content could reinforce weight bias and that these experiences can be embedded within evidence-based strategies for weight loss.

Evidence based-features/categories were taken from Pagoto S, Schneider K, Jojic M, DeBiasse M, & Mann D. (2013). Evidence-based strategies in weight-loss mobile apps. *Am J Prev Med*;45(5):576-582.[a]

with individuals of varying body sizes during the user-input phase of development will also be crucial.

This review was informed by decades of research documenting weight stigma across various settings. The lessons learned and potential solutions identified in the existing literature can be used to guide change within apps as well. For example, the UConn Rudd Center for Food Policy and Obesity (http://www.uconnruddcenter.org/) provides information and resources for combatting weight stigma. An example includes resources for health care providers to discuss obesity with patients in a way that does not reinforce obesity stereotypes or equate smaller body size with characterological improvement (examples 1, 2, and 4 illustrated in Table 1). These same resources can provide guidance for tackling miscommunications about BMI and body size within apps (examples 6 and 8 illustrated in Table 1). For example, apps could provide brief education about the limits of BMI as a health marker.

Further, existing literature highlights that individuals often vary in the terms they prefer to use when discussing their body size (i.e., obesity, larger body, higher weight, and fat).[13-15] This provides an opportunity to include features that allow users to select the language they will encounter during app use, resulting in a more personalized experience. Resources from the Rudd Center also include a media gallery where images of individuals with larger bodies can be accessed and used to increase representation of various body sizes within commercially available apps (examples 5 and 7 illustrated in Table 1).

3 | CONCLUSION

The proliferation of commercially available health-focused apps used for weight loss and changing weight-related behavior presents a great opportunity for both obesity researchers and clinicians to better serve their patients. However, the perpetuation of weight stigma within commercially available apps has the potential to unintentionally interfere with behavior change and harm the well-being of users. It is incumbent on obesity researchers and practitioners to address this issue on both a macro and micro level to ensure the availability of apps that are guided by an evidence-base of both weight management and weight stigma research.[16] Developing thoughtful partnerships for app development is critical in this process. Apps have potential to expand the reach and impact of evidence-based approaches to weight control. To fully realize the potential of these tools, it will be critical to acknowledge and eliminate the potential harm in the form weight stigmatization.

CONFLICT OF INTEREST

The authors declared no conflicts of interest.

AUTHOR CONTRIBUTIONS

KayLoni L. Olson generated the initial idea for this perspective piece and prepared the manuscript. All co-authors contributed to formalizing the content and revising the manuscript.

ORCID

KayLoni L. Olson https://orcid.org/0000-0001-7946-9570

REFERENCES

1. Pagoto S, Schneider K, Jojic M, DeBiasse M, Mann D. Evidence-based strategies in weight-loss mobile Apps. *Am J Prev Med.* 2013; 45(5):576-582.
2. Chen J, Cade JE, Allman-Farinelli M. The most popular mobile Apps for weight loss: a quality assessment. *JMIR Mhealth Uhealth.* 2015;3(4):e104.

3. Research2Guidance. *mHealth App Economics: Current status and future trends in mobile health.* 2017 Nov. https://research2guidance.com/product/mhealth-economics-2017-current-status-and-future-trends-in-mobile-health/.

4. Zhao J, Freeman B, Li M. Can mobile phone Apps influence people's health behavior change? An evidence review. *J Med Internet Res.* 2016;18(11):e287.

5. Poushter J. Mobile ownership and internet usage continues to climb in emerging economies. *Pew Res Center.* 2016;22:1-44.

6. Puhl RM, Himmelstein MS, Pearl RL. Weight stigma as a psychosocial contributor to obesity. *Am Psychol.* 2020;75(2):274.

7. Tomiyama AJ. Stress and obesity. *Annu Rev Psychol.* 2019;70:703-718.

8. Rivera J, McPherson A, Hamilton J, et al. Mobile apps for weight management: a scoping review. *JMIR Mhealth Uhealth.* 2016;4(3):e87.

9. Panza GA, Armstrong LE, Taylor BA, Puhl RM, Livingston J, Pescatello LS. Weight bias among exercise and nutrition professionals: a systematic review. *Obes Rev.* 2018;19(11):1492-1503.

10. Lozano-Sufrategui L, Carless D, Pringle A, Sparkes A, McKenna J. "Sorry mate, you're probably a bit too fat to be able to do any of these": men's experiences of weight stigma. *Int J Men's Health.* 2016;15(1):4-23.

11. Schvey NA, Sbrocco T, Bakalar JL, et al. The experience of weight stigma among gym members with overweight and obesity. *Stigma Health.* 2017;2(4):292.

12. Puhl RM, Himmelstein MS, Quinn DM. Internalizing weight stigma: prevalence and sociodemographic considerations in US adults. *Obesity.* 2018;26(1):167-175.

13. Puhl R, Peterson JL, Luedicke J. Motivating or stigmatizing? Public perceptions of weight-related language used by health providers. *Int J Obes.* 2013;37(4):612-619.

14. Tanas R, Bernasconi S, Marsella M, Corsello G. What's the name? Weight stigma and the battle against obesity. *Italian J Pediatrics.* 2020;46:1-3.

15. Puhl RM. What words should we use to talk about weight? A systematic review of quantitative and qualitative studies examining preferences for weight-related terminology. *Obes Rev.* 2020;21(6):e13008.

16. Wykes T, Schueller S. Why reviewing apps is not enough: transparency for trust (T4T) principles of responsible health app marketplaces. *J Med Internet Res.* 2019;21(5):e12390.

17. Myre M, Glenn NM, Berry TR. Exploring the impact of physical activity-related weight stigma among women with self-identified obesity. *Qual Res Sport Exerc Health.* 2020:1-18. https://doi.org/10.1080/2159676X.2020.1751690.

18. Greenleaf C, Klos L, Hauff C, Hennum A, Pozoliniski B, Serafin G. "Unless you puke, faint, or die, keep going!" Exploring weight stigma in the gym on the Biggest Loser. *Fat Studies.* 2019;8(2):110-126.

19. Schwartz MB, Chambliss HON, Brownell KD, Blair SN, Billington C. Weight bias among health professionals specializing in obesity. *Obes Res.* 2003;11(9):1033-1039.

20. Ogden J, Clementi C. The experience of being obese and the many consequences of stigma. *J Obes.* 2010;2010:429098.

21. Vartanian LR. Disgust and perceived control in attitudes toward obese people. *Int J Obes.* 2010;34(8):1302-1307.

22. Sogg S, Grupski A, Dixon JB. Bad words: why language counts in our work with bariatric patients. *Surg Obes Relat Dis.* 2018;14(5):682-692.

23. Palascha A, van Kleef E, van Trijp HC. How does thinking in Black and White terms relate to eating behavior and weight regain? *J Health Psychol.* 2015;20(5):638-648.

24. Ringel MM, Ditto PH. The moralization of obesity. *Social Sci Med.* 2019;237:112399.

25. Wu YK, Berry DC. Impact of weight stigma on physiological and psychological health outcomes for overweight and obese adults: a systematic review. *J Adv Nurs.* 2018;74(5):1030-1042.

26. Lieberman DL, Tybur JM, Latner JD. Disgust sensitivity, obesity stigma, and gender: contamination psychology predicts weight bias for women, not men. *Obesity.* 2012;20(9):1803-1814.

27. Nutter S, Russell-Mayhew S, Saunders JF. Towards a sociocultural model of weight stigma. *Eat Weight Disord*; 2020. https://doi.org/10.1007/s40519-020-00931-6.

28. Kwan S. Competing motivational discourses for weight loss: means to ends and the nexus of beauty and health. *Qual Health Res.* 2009;19(9):1223-1233.

29. Heuer CA, McClure KJ, Puhl RM. Obesity stigma in online news: a visual content analysis. *J Health Commun.* 2011;16(9):976-987.

30. Wellman JD, Araiza AM, Newell EE, McCoy SK. Weight stigma facilitates unhealthy eating and weight gain via fear of fat. *Stigma Health.* 2018;3(3):186.

31. Flint SW, Reale S. Weight stigma in frequent exercisers: overt, demeaning and condescending. *J Health Psychol.* 2018;23(5):710-719.