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The Transition into Young Adulthood: a Critical Period for Weight Control

Autumn Lanoye[1,2] · **Kristal L. Brown**[1] · **Jessica G. LaRose**[1]

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Abstract
Purpose of Review Emerging adulthood (age 18–25) represents a critical period for weight control: rate of weight gain is greatest during these years and the prevalence of overweight and obesity is estimated to be at least 40% among emerging adults. Unique behavioral, psychosocial, and cognitive risk factors among this population must be specifically addressed within weight management programs. We review extant treatment approaches, including lessons learned from the nascent literature specifically targeting this population. Lastly, we provide suggestions to inform future work in this area.
Recent Findings The EARLY consortium comprises seven clinical trials targeting weight control in young adults age 18–35. Though these studies encompass a broader age range, two of the trials enrolled large numbers of 18–25-year-olds. Results from these trials and other recent pilot trials provide a foundation for next steps with respect to developing weight management interventions for emerging adults.
Summary The design of targeted weight control approaches for emerging and young adults has contributed to improved outcomes for this high-risk population. However, suboptimal engagement and variability in response pose challenges. Identifying and intervening on individual-level behavioral and psychological variables may enhance the effects of these adapted treatments.

Keywords Emerging adulthood · Weight management · Overweight · Obesity · Intervention

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✉ Jessica G. LaRose
jessica.larose@vcuhealth.org

Autumn Lanoye
autumn.lanoye@vcuhealth.org

Kristal L. Brown
brownkl26@vcu.edu

[1] Department of Health Behavior and Policy, Virginia Commonwealth University School of Medicine, 830 East Main Street, Richmond, VA 23219, USA

[2] Department of Psychology, Virginia Commonwealth University, 806 West Franklin Street Box 842018, Richmond, VA 23284, USA

Introduction

Weight gain during emerging adulthood (i.e., ages 18–25) is greater than any other period in the developmental life course. In fact, data indicate that the greatest gains occur in the early twenties and among those who are already overweight [1, 2]. This is particularly concerning given the high rates of overweight and obesity that already exist among emerging adults, with general prevalence estimates over 40% and soaring above 50% among African-American and Hispanic/Latino populations [3]. Moreover, the looming cardiometabolic risks associated with weight gain and obesity in these years are well documented [4•, 5, 6–8]. Compounding this problem is the relative lack of effective evidence-based weight control approaches for emerging adults. Weight-promoting developmental concerns and risk factors unique to this age group are not addressed in standard adult intervention approaches, perhaps contributing to their inadequacy for this population.

Defining Emerging Adulthood

The developmental period now known as emerging adulthood is a relatively recent addition to our conceptualization of the lifespan. Over the past several decades, shifts in Western societal expectations and norms have given rise to delays in marriage and parenthood, a prolonged educational process, and greater allowance for individual freedom and exploration—all of which serve to lengthen the period between adolescence and adulthood proper. While emerging adulthood encompasses this transition, it is associated with unique features that distinguish it as its own developmental period rather than an extended adolescence or a young adulthood [9, 10]. This stage is defined by identity exploration, instability, self-focus, feeling in-between, and the perception of possibilities [11]. Though these processes of course follow individual timelines, emerging adulthood typically spans ages 18 through 25 if not beyond [9, 11]. Importantly, while this conceptualization of emerging adulthood appears to be a phenomenon currently limited to industrialized nations, it is seen across educational and socio-economic strata therein [11]. It is also possible that this developmental experience will become more normative across cultures with increasing globalization over the coming years [12].

Socially, these years are associated with frequent transitions in the domains of work, school, family, and romantic relationships. The majority of emerging adults anticipate changing career paths at least once throughout their lifetime and expect to receive additional training or schooling at some point during midlife [13]. Living situations vary widely and fluctuate frequently, as moving rates peak during this period [14]. Living situations of emerging adults are roughly evenly distributed across living at home with parents, living with husband/wife, living with friends/roommates, living alone, and living with a boyfriend/girlfriend [15]. Though only 30% live with their family of origin, more than half are in daily contact with their parents, and 60% receive at least occasional financial support from parents [15]. With respect to romantic relationships, emerging adults place high value on finding a long-term partner [15, 16], though few remain in the same relationship throughout the ages of 18–25 [17].

While its hallmark characteristics are psychosocial in nature, biology may also play a role in the behavioral patterns exhibited throughout emerging adulthood. Advances in neuroscience imaging have furthered our understanding of brain development across the lifespan. Evidence suggests that post-adolescent frontal lobe maturation continues into the third decade of life [18, 19], which may correspond to neuropsychological development in associated areas of executive functioning including organization/planning, response inhibition, emotion regulation, goal-directed behavior, and metacognition [19–21]. However, the extent to which these physiological changes map onto real-world behavior remains unknown [22].

Given this context, it is not entirely surprising that it has proven to be particularly challenging to recruit, engage, and retain emerging adults in programs that promote self-regulation of health behaviors. This is perhaps most evident within the context of weight gain prevention and weight loss interventions, which require multiple health behavior changes reliant upon collecting, evaluating, and making adjustments in accordance with personal data in the form of weight, dietary intake, physical activity, and other goal attainment. In order to design effective programs for emerging adults, it is necessary to account for the considerations unique to this developmental period rather than simply applying standard adult programs to this population. Calls for weight control approaches targeting young adults [23, 24] represent a shift toward acknowledging this point, however, fall short of recognizing the distinction between emerging adulthood and young adulthood—the critical distinction between which is the "figuring out" of adulthood versus the early establishment of adulthood [11]. In fact, in asking emerging adults to determine priorities and accept individual responsibility in the context of weight control programs, we are guiding them toward bridging this gap.

The Risks

Behavioral Risk Factors

Eating The transition into early adulthood is associated with myriad unhealthy eating behaviors. Evidence suggests that very few emerging adults are consuming the recommended fruit and vegetable amounts [25]. Further, data point to increases in fast-food consumption [26, 27] and intake of sugared beverages [28], as well as increased alcohol use and binge drinking during these years [29]. Moreover, beverage and fast-food companies have successfully created campaigns that specifically target emerging adults through price reduction, utilizing known athletes, promoting late-night meals, and expanding beverage selections to include various sports drinks [30].

Physical Activity The majority of emerging adults are not meeting the recommended national physical activity guidelines [31]. Physical activity declines during the transition from adolescence into emerging adulthood, and this drop continues as emerging adults reach young adulthood [32]. Of note, data indicate that emerging adults are interested in exercise and this might be a point of entry for weight control interventions [33•], yet findings also suggest this population experiences barriers to physical activity that might be exacerbated by this

transitional developmental period, including lack of time [33•, 34, 35], motivation [34], and social support [34].

Routine and Sleep While average sleep duration increases throughout the transition from adolescence into adulthood, nearly 9% of emerging adults report less than 6 hours of sleep per night [36]. Inconsistent routines due to holding multiple jobs [37], working while attending school [15], and nontraditional work schedules [38] contribute to poor sleep quality and short sleep duration in this age group [39]. Though much remains to be discovered regarding the relation between sleep and weight, extant evidence supports a significant link between inadequate sleep and poor weight-related and cardiometabolic outcomes [40–42]. The link between insufficient sleep and obesogenic behavior is thought to be mediated by disruption of appetite-regulating hormones, resulting in excess caloric intake [43, 44]. Of note, the association between inadequate sleep and BMI/waist circumference appears to be stronger among emerging and young adults compared to other age groups [45].

Psychosocial and Cognitive Risk Factors

Stress and Emotions Compared to other adults, emerging adults find this time in their lives to be stressful [15] and are more likely to manage this stress by engaging in unhealthy weight-promoting behaviors such as eating and drinking alcohol [46]. They report often feeling anxious and depressed [15], and one out of five emerging adults will meet clinical criteria for a depressive episode during these years [47]—the highest prevalence of any age group [48]. To make matters worse, emerging adults are unlikely to seek [47] and receive [47, 49] adequate treatment for depression. While periods of acute stress are typically associated with appetite suppression and potential weight loss [50], there is some evidence to suggest that chronic stress promotes weight gain [51]. Importantly, emerging adults specifically identify stress as an interrupter of healthy habits and a barrier to successful weight loss attempts [33•].

Physical and Interpersonal Environment Maintaining a healthy weight can be challenging when residing in an obesogenic [52] environment (i.e., abundant fast food restaurants, limited fresh-food options); the natural response is to indulge in high-calorie food [53]. While the USA as a whole arguably is exposed to this toxic environment [54, 55], emerging adults face unique challenges in terms of their physical environment, including leaving their family of origin for the first time, transitioning into secondary education and/or workforce, living on their own, and navigating meal preparation and the cost of healthful eating [14, 56, 57]. Further, 20.5 million emerging adults attend American colleges and universities [58] and thus are exposed to amenities (i.e., all-you-can-eat buffets) and a new lifestyle (i.e., snacking late at night, increased alcohol consumption) that is perceived to influence weight-related behaviors [34, 35]. Moreover, college meal plans and dining options increase access for unhealthy food consumption and overeating [35]. In addition to the physical environment, evidence suggests the social environment may play a critical role during these years. Data indicate emerging adults with overweight and obesity have more overweight romantic partners, friends, and social contacts relative to their non-overweight peers [59]. Furthermore, among individuals seeking obesity treatment, being part of a social network where eating healthy is not the norm and having overweight friends is associated with poorer weight loss outcomes [60].

Executive Functioning Though it remains unknown to what extent continued normative development of the prefrontal cortex influences health behaviors among emerging adults [22], individual differences in executive functioning have been linked to weight status such that obesity is associated with poorer planning and problem-solving abilities [61]. Among young adults in particular, strengths in task initiation and inhibitory control have been associated with intake of fruits/vegetables and avoidance of high-fat foods, respectively [62]. To date, most research in this area has been correlational; thus, the directionality of these relationships cannot be determined. Given that executive functioning has been proposed to underlie self-regulation [63]—a critical process in achieving and sustaining successful weight loss [64, 65]—this domain warrants additional research as it relates to weight management efforts in this population.

Weight Loss Treatment for Emerging Adults

The challenge of overweight and obesity in emerging adulthood is compounded by the fact that traditional methods for addressing weight loss appear to be insufficient in meeting the needs of this population. Other adults might choose to discuss weight management with their primary care physician, join a commercial weight loss program, or participate in a behavioral weight loss trial; however, these avenues seem to be either unappealing, inaccessible, or unknown to emerging adults, given their paltry representation in such settings.

Historically, emerging adults have been less likely to maintain health insurance and engage in preventive care services compared to other age groups [66–68]. While the 2010 Affordable Care Act has successfully improved access to health care in some respects [66], significant barriers remain for this high-risk population. While those ages 18–26 are now insured at higher rates, they find it difficult to navigate the transition from pediatric to adult health care systems [69•]. Further, despite an array of recommendations developed and

implemented in medical specialty clinics, no standardized guidelines exist specifically for preventive care targeting emerging adults [70]. Even if emerging adults were to present in preventive care settings at rates comparable to other age groups, it is unlikely that they would receive effective weight management counseling given that evidence-based counseling occurs at alarmingly low rates within the primary care setting. In fact, previous reports indicate that weight loss recommendations in accordance with NHLBI standards is low for the general patient population [71], and weight reduction advice occurs at less than 4% of primary care visits with emerging adults [69•]. Interestingly, while emerging adults represented only 8% of patients enrolled in a multi-site primary care survey study, they were also the most willing to participate in a comprehensive weight loss program [72]. However, some evidence suggests that such programs may not be as effective for young adults compared to middle-aged adults [73]. Furthermore, emerging adults generally are underrepresented in studies examining the effects of primary care-based weight management programs, where mean participant ages range from 40 to 55 [74, 75].

A similar pattern is seen with respect to commercially available weight loss approaches such as Weight Watchers, Jenny Craig, and Nutrisystem among others. These programs are generally marketed toward middle-aged or older adults, as evidenced by program spokespeople (e.g., Oprah Winfrey, Kirstie Alley, Marie Osmond) and specialized plans designed for members aged 60+. The mean age of customers in such programs hovers around 40 [76, 77], with data suggesting that early dropout is associated with younger age [78]. Young adults who have lost weight successfully were significantly less likely than other adults to have done so with the assistance of a commercial program [79]. While commercial programs developed over the past decade (e.g., 21 Day Fix, Shakeology, Insanity) appear to target a younger demographic, little is known about the effectiveness of such approaches for weight loss.

Behavioral weight loss clinical trials also suffer from a dearth of emerging adult enrollees, thus limiting the generalizability of findings to this population [80]. Further, extant data indicate that young adult participants in these studies fare worse than their older adult counterparts with respect to weight loss outcomes, engagement, and retention [80]. An awareness of the need for targeted approaches to weight control in young adults has been growing over the past decade [24, 25, 80], leading NIH to fund seven randomized controlled trials testing weight management approaches among participants age 18–35: the EARLY trials (Early Adult Reduction of weight through LifestYle intervention; www.earlytrials.org). A brief description and results of each of the trials are presented in Table 1. Even among these targeted studies, mean/median ages ranged between 27.5 and 30.9 for all but two trials and none of the trials targeted emerging adults 18–25 years specifically; further, other participant characteristics of these samples (e.g., college students, majority non-Hispanic White) limit generalizability of findings to emerging adults more broadly. Moreover, it is unclear whether differing trial goals—i.e., weight gain prevention versus weight loss—differentially attract emerging versus young adults.

Thus, despite demonstrating clear and unique weight-related risks throughout the years of 18 to 25, emerging adults have minimal opportunities for weight control treatment and support. It is no surprise that they are more likely than other adults to attempt weight loss on their own—perhaps due in part to this lack of options [79]. At the same time, evidence suggests they would be interested in participating in a weight loss program if it were well suited to their needs, highlighting a critical area for continued research and development [33•]. The large-scale efforts of the EARLY consortium, in combination with other formative work and smaller randomized pilot trials, provide a foundation from which to draw for future endeavors to recruit and engage an emerging adult population in weight management programs.

Lessons Learned

Recruitment

Formative data conducted with young and emerging adults indicate a general need to adapt standard recruitment methods in order to reach this otherwise difficult to reach [99] population. With respect to messaging, emerging adults expressed that an emphasis on the broad benefits of lifestyle change (e.g., improved energy, fitness, and health) is more appealing than a narrow focus on "weight loss" [33•, 86]. Young adults also recommended highlighting specific aspects of trials when advertising, such as incentives and convenience [86]. Trial branding including study name, logo, colors, taglines, and images has also proven to be an effective strategy for recruiting emerging and young adults into weight management trials [88, 91, 100]. Images in particular have the potential to either sink an ad or make it hit home for emerging adults and should depict people with relatable body types engaging in healthy behaviors to appeal to this age group [33•].

Recruitment avenues proposed by young and emerging adults include Internet-based outlets such as social media, website ads, and email blasts in addition to more traditional methods such as print flyers and in-person tabling events at colleges and community events [82, 86]. The ability to learn more about the study and complete the screening process online rather than via phone or in person was especially salient in focus groups with emerging adults [33•], though this strategy was implemented by a minority of EARLY trials—of note, not only are other screening methods associated with higher staff burden [81], but failure to utilize online recruitment and

Table 1 Overview of EARLY trials

Trial	Sample Characteristics	Intervention	Main outcomes
[a]Choosing Healthy Options in College Environments and Settings (CHOICES) [81–83, 84•, 85]	*N* = 441 67.6% female 72.6% White 100% student (2-year college) Age = 22.7 (5.0)[b] BMI = 25.4 (3.8)[b]	24-month weight gain prevention intervention Intervention: 1-credit college course + intervention website with social support, resources, and self-monitoring platform Control: Quarterly health promotion information	No difference in BMI, weight, waist circumference, or body fat percentage between intervention and control at 24 months Significant reduction in prevalence of BMI ≥ 25 in intervention compared to control at 24 months
Cell Phone Intervention for You (CITY) [86, 87•]	*N* = 365 69.6% female 56.2% White 34.3% student Age = 29.4 (4.3)[b] BMI = 35.2 (7.8)[b]	24-month weight loss intervention Intervention 1 (CP): Comprehensive interactive cell phone app used for both intervention delivery and self-monitoring Intervention 2 (PC): Delivered via group sessions and personal coaching; self-monitoring via smartphone Control: Provided 3 handouts on healthy eating and physical activity	No difference in weight loss between groups at 24 months Significantly greater weight losses in PC compared to both CP and Control at 6 and 12 months
eMoms [88]	*N* = 1689 (ITT) 100% pregnant women 68.0% White (student status not reported) Age = 27.5 (4.7)[b] BMI = 25.4 (4.3)[b]	See footnote[d]	See footnote[d]
Innovative Approaches to Diet, Exercise, and Activity (IDEA) [89, 90•]	*N* = 471 71.1% female 77.2% White 25.7% student Age = 30.9 (27.8–33.7-)[c] BMI = 31.2 (28.4–34.3-)[c]	24-month weight loss intervention Intervention 1 (Standard): in-person group behavioral weight loss + phone counseling/study website; self-monitoring via website Intervention 2 (Enhanced): in-person group behavioral weight loss + phone counseling/study website; self-monitoring via provided wearable device + web platform	No difference in body composition, physical activity, or dietary behaviors between groups Significantly greater weight losses in Standard compared to Enhanced at 12, 18, and 24 months
Study of Novel Approaches to Weight Gain Prevention (SNAP) [91, 92, 93•]	*N* = 599 78.3% female 73.1% White	4-month weight gain prevention intervention with low-intensity follow-up (average 3 years)	Significantly greater weight losses in both LC and SC compared to Control at primary endpoint (average follow-up of 3 years);

Table 1 (continued)

Trial	Sample Characteristics	Intervention	Main outcomes
	24.3% student (full-time) Age = 28.2 (4.4)[b] *26.2% age 18–24.9* BMI = 25.4 (2.6)[b]	Intervention 1 (SC): 10 group in-person sessions followed by online weight reporting with feedback and quarterly online refreshers; instructed to make small, daily changes to eating and activity Intervention 2 (LC): 10 group in-person sessions followed by online weight reporting with feedback and quarterly online refreshers; instructed to make large changes initially to produce weight loss of 5-10lbs to create buffer against future gains Control: 1 group in-person meeting providing an overview of both SC and LC approaches	significantly greater weight losses in LC compared to SC at primary endpoint
[a]Social Mobile Approaches to Reduce Weight (Project SMART) [94–96, 97•]	*N* = 404 70.3% female 41.8% White 100% student Age = 22.7 (3.8)[b] BMI = 29.0 (2.8)[b]	24-month weight loss intervention Intervention: Delivery across multiple channels—Facebook, mobile apps, website, email, text, & health coaching Control: Access to general health education website without social networking components	No difference in weight loss between intervention and control at 24 months Significantly greater weight loss in intervention at 6 and 12 months compared to control
Treating Adults at Risk for Weight Gain with Interactive Technology (TARGIT) [98]	*N* = 330 48.8% female 57.3% White (student status not reported) 100% current smokers Age = 29.7 (4.2)[b] BMI < 25: 23.0% 25–29.9: 37.6% 30+: 39.4%	See footnote[d]	See footnote[d]

Italics signify information/findings directly applicable to emerging adults ages 18–25

[a] Mean age of enrolled participants within emerging adult range

[b] Mean (standard deviation)

[c] Median (25th–75th percentile)

[d] Full study description and outcomes not yet available for these trials. Additionally, both trials concerned weight control in specific populations: pregnant women (eMoms) and current smokers (TARGIT); therefore, results may not be applicable to weight management more generally in a young adult population

screening tools might have contributed to lower enrollment of 18–25-year-olds in many of these trials. Underscoring this point, the TARGIT trial found that participants who responded to technology-based advertisements were on average 3 years younger than those who heard about the study through other methods [98]. In our own work with emerging adults, a very small minority of potential participants choose to complete the screening process via phone or in person, instead of opting for the convenience of an online questionnaire.

However, much remains to be investigated about the ways in which emerging adults engage in technology-based advertising for weight management programs. Advertisements posted through "organic" methods (i.e., an established online profile with social capital) may yield different results compared to those purchased and appearing as sponsored ads. Further, popularity of specific platforms within the 18-to-25-year-old demographic changes rapidly, necessitating a flexible recruitment strategy focused less on particular domains and more on overall approach. Nuances such as these may partially explain the unexpected finding that Facebook advertising did not produce a significant return on investment in the CITY trial despite formative work emphasizing the importance of advertising on social media [86].

An analysis of the recruitment methods implemented in the CITY [86] and SNAP [91] trials highlights mass mailings as an effective method for reaching young adults as a whole; however, mass mailings were found to be significantly *less* effective for enrolling emerging adults 18–25 years compared to young adults age 26–35 [91]. This finding makes sense in the context of emerging adults moving frequently between living situations [14]. Instead, SNAP investigators found that relatively low-cost methods such as print flyers, word of mouth, and posting to free email listservs appeared to be popular among the youngest participants; CHOICES investigators recruiting on college campuses reported similar success with email blasts and information tables [81].

Project SMART investigators propose the use of marketing strategy when recruiting for clinical trials, explicitly conceptualizing recruitment as a buyer decision process wherein potential participants recognize a problem, search for information, and evaluate alternatives [95]. Further, they endorse the simultaneous use of multimedia outlets in order to create a media blitz, thus raising awareness and building brand recognition. This approach contributed to their success in on-time and within-budget recruitment for their EARLY trial targeting weight loss among college students [95]. We have used a similar approach successfully in our previous pilot trials with emerging adults [100, 101] as well as our ongoing fully powered weight loss trial (REACH; www.reachtrialrva.com) targeting 18- to 25-year-olds, which has thus far enrolled 181 participants—diverse with respect to race/ethnicity as well as student status. In this endeavor, we have found social media, broadcast radio, and online radio (e.g., Pandora) to provide the greatest yield of eligible participants. Echoing the call put forth by Gupta and colleagues [95], we have found it crucial to continuously evaluate the market and develop a recruitment strategy capable of responsiveness to trends within the target population.

Program Components and Structure

Focus on Overcoming Unique Challenges Formative work conducted with emerging adults has yielded a consensus that weight management programs must provide solutions for the challenges associated with this developmental period in order to be appealing and effective. Juggling responsibilities between school, work, family, and social life leaves little time for the gym and makes high-calorie convenience foods more attractive—or conversely, perhaps contributes to skipping meals [33•, 82]. Stress has also been identified as a significant barrier to maintaining motivation for healthy lifestyle change, sparking an "unraveling" of any progress made [33•, p. 351]. Moreover, programs designed for emerging adults must go beyond current standard behavioral weight loss to provide content specifically targeting time and stress management in addition to other key areas identified in formative work such as alcohol use, sugar-sweetened beverage consumption, environmental barriers, and sleep [33•, 82].

Role of Technology In addition to the previously noted importance of technology in the recruitment and screening process, emerging adults also expressed interest in a weight management program involving technology, though importantly, perhaps not solely reliant upon technology. Limiting intervention delivery exclusively to technology-based modalities has the potential to reduce perceived accountability and accelerate disengagement over time for young adults [96]. These factors may hamper the impact of such programs, as evidenced by modest and attenuated intervention effects reported by Project SMART, which was delivered via integration across social media, text messaging, mobile apps, and a website [97•].

Findings of formative work conducted with emerging adults reflect a split preference between a technology-delivered program and an in-person program [33•], with a suggestion for combined delivery modality [82]. This hybrid approach seems to provide a balance between emerging adults' preference for a flexible, convenient program and their desire for minimal face-to-face interaction with an interactive or experiential focus [33•, 82]. Blending a technology platform with in-person activities has demonstrated promise in emerging adult samples [100, 102]; a randomized pilot trial targeting 18–25-year-olds specifically conducted a direct comparison of technology-only (i.e., web-based platform), in-person-only, and hybrid delivery of behavioral weight loss found that the hybrid approach was most successful in

promoting engagement and yielding clinically significant weight loss outcomes [100].

Similarly, there is some evidence from the EARLY trials to suggest that a hybrid approach might hold promise for this population in the short term, although sustained effects remain elusive. The CITY trial found a hybrid approach comprising in-person group classes and individual coaching phone calls supplemented with smartphone-based self-monitoring to be more effective than control at 6 months [87•], whereas the smartphone-based intervention alone was not significantly different from control at 6 months. Of note, effects were dissipated by longer-term follow-up, highlighting the continued challenges of sustained engagement and non-use attrition in technology-based trials, as well as the multi-faceted challenge of weight loss maintenance. Similarly, the IDEA trial found that their hybrid intervention delivery (6 months of group in-person treatment followed by use of intervention website, text messages, and brief monthly coaching phone calls) was more effective on its own than with the addition of a wearable physical activity monitor during the maintenance phase [90•].

The CHOICES trial delivered a weight gain prevention trial across two phases: a one-credit college course followed by an intervention website offering social support, additional materials, and a self-monitoring platform [83]. Participants were able to choose between taking the course solely online and having some degree of face-to-face contact, with a relatively even split between these preferences. While there were no overall intervention effects on BMI compared to control, the prevalence of overweight/obesity was significantly reduced in the intervention condition [84•]. Further, retention was highest among participants who chose the face-to-face course [85]; however, because delivery modality was not randomized, it is unclear whether this finding is due to individual-level characteristics.

Lastly, the SNAP trial compared two self-regulation approaches to weight gain prevention (large changes and small changes) and a self-guided control group. The intervention groups received ten in-person sessions (eight weekly group sessions followed by two monthly group sessions), after which participants reported their weights online and received monthly automated feedback via email [92]. In addition, the program offered annual 4-week refresher courses, primarily delivered via the Internet. Impressively, both active interventions in SNAP successfully prevented weight regain compared to control at a mean follow-up of 3 years post-baseline [93•].

Role of Autonomy Developmentally, emerging adulthood is a time of increasing autonomy, identity exploration, and self-focus [11]. At the same time, this period is also marked by feeling in-between [11], which may represent an uncertainty regarding the extent to which emerging adults want to commit to their autonomy. While desire for autonomy and choice emerged as a central theme in our formative work with emerging adults [33•], they have also identified individual choice as a potential barrier due to a tendency to be influenced by peer pressure or environmental factors [82]. This apparent tension between a need for both autonomy and accountability may be resolved by promoting choice within the context of an autonomy-supportive coaching relationship. We piloted this approach in a randomized trial compared to standard delivery and found that an autonomy-supportive approach facilitated engagement and retention in a weight loss trial for emerging adults [101]; however, it will be important to replicate these results within the context of a fully powered trial.

Related, emerging adults' desire for autonomy is also seemingly at odds with their enthusiastic support of financial incentives within the context of a weight management program [33•, 82]. However, recent data suggest that a compromise may be possible between these two approaches: an incentive paradigm involving small payouts linked to discrete behaviors (i.e., self-monitoring of weight and energy intake) has been shown to enhance program engagement and weight loss outcomes without undermining intrinsic motivation [103]. In our ongoing 3-arm randomized controlled weight loss trial with emerging adults (REACH), we are testing the effects of this incentive paradigm within the context of a behavioral economics arm compared to both a self-determination theory-based arm and a standard behavioral weight loss arm in order to assess effects on intrinsic/extrinsic motivation in addition to weight and cardiometabolic outcomes. The delivery mode across all arms is an identical hybrid approach consisting of minimal in-person contact (one in-person group session and one in-person individual session) followed by a technology-mediated platform.

Self-Monitoring Within the context of behavioral weight management programs, self-monitoring is imperative for success [64, 65, 104]. Trials targeting emerging adults are no exception, where self-monitoring of weight, calorie intake, and physical activity are associated with better weight loss outcomes [100]. However, teaching the concept of self-monitoring to emerging and young adult populations carries unique concerns and considerations. The first is the question of whether self-monitoring of these behaviors could promote unintended consequences such as depression and disordered eating due to increased emphasis on areas of dissatisfaction. However, available evidence suggests that self-monitoring within the context of weight management trials does not lead to deleterious effects. Among young adult participants enrolled in the SNAP trial, frequent self-weighing was not associated with unhealthy weight control practices [105]. In our own work, we have demonstrated the feasibility of encouraging 18-to-25-year-olds to increase their self-weighing frequency over the course of a 3-month lifestyle intervention [106]; this increase was associated with greater weight loss success at

post-treatment. Further, frequent self-weighing—that is, weighing 4 or more days per week—was associated with achievement of clinically significant weight loss at post-treatment.

The second issue is how to best to promote engagement in self-monitoring among emerging and young adults, as this practice is not inherently rewarding and can be viewed as a chore. One potential solution is incorporating technology to decrease demands on effort and time. The idea of "the quantified self" [69•] is not unfamiliar with the advent of wearable technology such as the FitBit and online dietary self-monitoring apps such as LoseIt and MyFitnessPal. Despite its increasing presence in our zeitgeist, it is unclear whether emerging adults in particular are engaging in this trend of tracking health behaviors. In our weight loss trials with emerging adults, we highly encourage the use of such apps, but still see significant declines in self-monitoring behaviors over the course of the intervention. Another avenue of interest is enhancing motivation specifically for self-monitoring, which is one aim of our ongoing REACH trial.

Lastly, even if engagement in self-monitoring were to remain high across the course of a trial, the extent to which emerging and young adults actively use these data to inform decisions about their own weight-related behaviors is unclear. The IDEA trial found that the addition of wearable technology did not result in weight loss maintenance above and beyond a standard behavioral weight loss intervention for young adults [90•], underscoring the fact that self-monitoring alone is only half the story. Fostering a framework of self-regulation wherein emerging and young adults are able to leverage self-monitoring data to make informed decisions about food choice and exercise on a day-to-day basis is crucial for long-term success. Additional work is needed in order to develop best practices for expressing the importance of these behaviors within the context of a self-regulation framework to promote self-efficacy in this population. While technology-aided self-monitoring may be appealing to emerging and young adults due to reduced burden, we must take care not to promote these tools as a way to eliminate cognitive effort. This could prove to be a difficult balance to strike, and use of these tools to deliver programs might require innovative methods for teaching self-regulatory concepts and enhancing participant engagement.

Conclusion and Future Directions

Secondary analyses of emerging adults' performance in the EARLY trials will provide insight into key differences between those age 18–25 and those age 26–35, even within the context of adapted programs. For example, the CITY trial found that their youngest participants lost more weight than did their oldest participants. Despite a lack of treatment effects for their smart-phone based intervention and a lack of sustained treatment effects for their hybrid approach relative to control, the possibility that both treatments were more successful with younger participants is an exciting finding. However, due to overall low emerging adult enrollment, it may be difficult to conduct further analyses regarding predictors of success within this age group.

As it stands, there exist several challenges that must be reckoned with in order to bolster the effectiveness of lifestyle interventions for emerging adults. While some studies have demonstrated success in producing clinically meaningful weight loss among those 18–25, variability in treatment response is broad, reflecting a wide range of outcomes [100, 107]. Identifying variables associated with success—related to both individual characteristics (e.g., depression/stress, executive functioning, race/ethnicity) and process (e.g., early weight losses, engagement)—will be a crucial endeavor in coming years.

Fostering sustained motivation and engagement is another concern, as we know that this is linked to treatment success, but tends to be relatively elusive in emerging adult samples. In their CHOICES trial, investigators reported declines in online engagement as soon as 4 weeks post-treatment launch; course module completion rarely surpassed 90%, and face-to-face attendance tended to be below 80% [84•]. In Project SMART, the proportion of highly engaged participants drastically declined over the first 3 months of the trial, and overall engagement declined at a relatively steady rate across 24 months [95]. Additional research is needed in order to determine the best ways to promote re-engagement with lifestyle interventions, such as coach reach-outs, specialized content, provision of resources, etc. Deploying effective strategies within the context of adaptive interventions may help to reduce overall variability in treatment response and enhance effects for emerging adults.

A relative lack of racial/ethnic minority participants limits generalizability of the findings of many of these trials. Even among studies with strong initial minority recruitment, differential loss of these participants throughout the screening process remains an issue [81, 98]. In addition, results from the IDEA trial reflected significantly poorer weight loss outcomes for non-White participants [106]. This pattern across trials is especially concerning given that racial/ethnic minorities are at greater risk for obesity and related health consequences [3, 108] and underscores the importance of extending the reach of future interventions to meet the needs of those emerging adults at highest risk.

One theme that does appear to be clear is a caution against the overreliance on technology for emerging adults. Due to the constantly evolving tech landscape, investing in specific approaches may limit generalizability or become a confounding variable in multi-year trials. Social media approaches especially may fall prey to ebbs and flows in popularity and

acceptability among emerging adults. Even within automated approaches to intervention delivery, a human touch may improve acceptability and engagement with this population. Based on the work conducted to date, it appears as though delivering weight management interventions solely through technological modalities is insufficient to effect significant change in weight among emerging and young adults. At the same time, increasing our investment in the avenues whereby technology has proven to be particularly helpful—i.e., recruitment websites, online screening, long-term reporting of key behaviors—will allow for greater success in these areas.

Continued work with this population has the potential for immense public health impact—not only with respect to curtailing the trajectory of weight gain and obesity on an individual level but also in terms of decreased medical costs and halting generational transmission of obesity. Further, fostering a wide range of health habits within the context of a lifestyle intervention (i.e., dietary quality, physical activity, stress management, sleep quality) has the potential to improve not only weight and cardiometabolic outcomes but also psychosocial outcomes such as depression and perceived stress. Emerging adults are at a prime time in their lives to establish the habits that they will implement as they continue to age and as life circumstances become more stable; if they can achieve success amidst the chaos associated with the transition to adulthood, this may bode well for continued success during future stressors. Further, accomplishing goals with respect to weight management may promote the sense of individual responsibility necessary to successfully navigate the transition from emerging adult to young adult.

Compliance with Ethical Standards

Conflict of Interest Autumn Lanoye, Kristal L. Brown, and Jessica G. LaRose declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article is a review of previously conducted research so this did not involve human subjects. Reviewed studies performed by the authors were conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

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