

Harnessing adolescent values to motivate healthier eating

Christopher J. Bryan^{a,1}, David S. Yeager^{b,1}, Cintia P. Hinojosa^a, Aimee Chabot^c, Holly Bergen^d, Mari Kawamura^d, and Fred Steubing^e

^aUniversity of Chicago Booth School of Business, Chicago, IL 60637; ^bDepartment of Psychology, University of Texas at Austin, Austin, TX 78712; ^cDuke University Fuqua School of Business, Durham, NC 27708; ^dDepartment of Psychology, University of California, San Diego, La Jolla, CA 92093; and ^eCanyon Middle School, New Braunfels, TX 78130

Edited by Julie Lumeng, University of Michigan, and accepted by Editorial Board Member Susan T. Fiske July 23, 2016 (received for review March 19, 2016)

What can be done to reduce unhealthy eating among adolescents? It was hypothesized that aligning healthy eating with important and widely shared adolescent values would produce the needed motivation. A double-blind, randomized, placebo-controlled experiment with eighth graders (total $n = 536$) evaluated the impact of a treatment that framed healthy eating as consistent with the adolescent values of autonomy from adult control and the pursuit of social justice. Healthy eating was suggested as a way to take a stand against manipulative and unfair practices of the food industry, such as engineering junk food to make it addictive and marketing it to young children. Compared with traditional health education materials or to a non-food-related control, this treatment led eighth graders to see healthy eating as more autonomy-assertive and social justice-oriented behavior and to forgo sugary snacks and drinks in favor of healthier options a day later in an unrelated context. Public health interventions for adolescents may be more effective when they harness the motivational power of that group's existing strongly held values.

adolescent health behavior | construal | field experiment |
intertemporal choice | temporal discounting

Stemming the rising obesity rate is both important and urgent. In the coming decades, obesity is expected to cause enormous increases in disease, death, and the economic cost of health care (1).

In response to this, a large number of school-based preventative interventions have sought to improve children's and adolescents' eating habits (2, 3).^{*} These have primarily involved a combination of health and nutrition education and behavioral skills training (e.g., goal-setting, analysis of barriers to behavior change). Such approaches have yielded some success among young children, but a meta-analysis showed null effects for adolescents (3). Such results have led to pessimism among some experts, reflected in sentiments like the following one from a leading expert on adolescent development: "Classroom-based health education is an uphill battle against evolution and endocrinology, and it is not a fight we are likely to win" (ref. 4, p. 714).

One might be tempted to conclude from this that health interventions should only be targeted at young children. But even if interventions are successful at changing behavior in early childhood, healthy habits cannot be counted on to survive adolescence. Adolescents undergo physiological and psychological changes that alter their childhood appetites and food preferences (5). Adolescence also brings new freedoms and increased disposable income and, consequently, more control over personal choices such as which snacks to buy. A major limitation of current theories in behavioral science, then, is their inability to offer strategies that produce internalized changes in adolescent food preferences.

We suggest that a critical reason for the failure of past interventions is their overwhelming tendency to rely on the (usually implicit) assumption that adolescents are already motivated by a desire to be healthier in the distant future.[†] Consistent with this assumption, programs have tended to focus on giving participants an appreciation for the health implications of their food choices and/or on teaching

them the cognitive skills necessary to pursue the presumed goal of future health (3). However, this motivational assumption is questionable even for adults (7), and findings from developmental science suggest it is even less appropriate for adolescents (4, 8–10).

Although adolescents might not be motivated by health in the distant future, they are certainly not apathetic, as popular stereotypes suggest. Adolescents are known to be highly motivated to live up to important values that are shared with their peers, most likely as a means to demonstrate their value to the peer group (9). This drive for peer status and respect has been documented at neural, hormonal, and behavioral levels of analysis (8, 9, 11).

The desire for status and respect has often been associated with unhealthy or high-risk behavior, but we propose that it is possible instead to harness this desire as a driver of positive behavior. We seek to do this by aligning the behavior (healthy eating) with important, widely shared adolescent values. Two such values are autonomy and a concern for social justice.

Autonomy

Adolescents are extremely sensitive to perceived encroachments on their autonomy. They frequently express reactance in response

Significance

Behavioral science has rarely offered effective strategies for changing adolescent health behavior. One limitation of previous approaches may be an overemphasis on long-term health outcomes as the focal source of motivation. The present research uses a rigorous randomized trial to evaluate an approach that aligns healthy behavior with values about which adolescents already care: feeling like a socially conscious, autonomous person worthy of approval from one's peers. It improved the health profile of snacks and drinks participants chose in an ostensibly unrelated context and did so because it caused adolescents to construe the healthy behavior as being aligned with prominent adolescent values. This suggests a route to an elusive result: effective motivation for adolescent behavior change.

Author contributions: C.J.B., D.S.Y., C.P.H., A.C., H.B., M.K., and F.S. designed research; C.J.B., D.S.Y., C.P.H., A.C., H.B., M.K., and F.S. performed research; C.J.B., D.S.Y., C.P.H., H.B., and M.K. analyzed data; and C.J.B., D.S.Y., and C.P.H. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission. J.L. is a Guest Editor invited by the Editorial Board.

Data deposition: All data are available on Open Science, <https://osf.io/rxa93>.

[†]To whom correspondence may be addressed. Email: christopher.bryan@chicagobooth.edu or dyeager@utexas.edu.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1604586113/-DCSupplemental.

^{*}Our review and analysis focuses on "universal prevention" programs—those with the goal of promoting healthy behavior in the general population before people are obese rather than treating a selected group of obese individuals.

[†]Some researchers have begun to explore approaches designed to foster intrinsic motivation for health behavior in adolescents by tailoring programs to their personal preferences. Randomized, controlled tests of this idea are still lacking. Yet initial small-sample, quasi-experimental studies suggest some reason for optimism (6).

to such encroachments (12, 13), rejecting or ignoring adults' attempts to influence their behavior—or even endorsing the opposite—to reassert their autonomy (14).

For instance, in one study, simply framing a request in terms of what one “should” do as opposed to what one “might consider” doing prevented adolescents from internalizing a message or changing their behavior (13). In another recent study, adolescents who watched video clips of their mothers telling them how they should change their behavior (e.g., cleaning your room, being nice to your sister) showed a pattern of neural activity that suggested they were not processing the criticism or planning to alter their behavior, but they were feeling angry (14).

The autonomy motive can often be a barrier to behavioral health interventions since such interventions typically involve telling adolescents how they should make personal choices (e.g., about what to eat). In this research, we seek to turn adolescents' strong autonomy motive from a barrier into an asset.

Social Justice and Beyond-the-Self Aims

Adolescents are sometimes characterized as concerned only with short-term selfish aims, but recent developmental science highlights that this is a period of increased concern for social justice and beyond-the-self aims (15, 16). This phenomenon is instantiated by attraction to social movements such as vegetarianism or antiglobalization activism (17) and is tied to neural and endocrine system developments that heighten attention to unfairness (18) and create a greater concern for finding meaning in life (19).

This attention to social justice often manifests as reactance against authorities (e.g., parents and teachers); adolescents are often highly motivated to avoid being seen as aligned with the interests of unjust adult authorities. But it can also manifest as a more general condemnation of societal unfairness and motivate prosocial action to address that unfairness (16). The opportunity to have a meaningful impact on the world beyond the self can create a powerful feeling of eudaimonic reward in the immediate term (15–17, 19).

Harnessing Adolescent Values to Motivate Healthy Eating

To capture the motivating power of these values, we designed a treatment to reshape adolescents' construal of healthy eating as autonomous behavior that serves the purpose of social justice. We hypothesized that this would increase the perception of healthy eating as a status-enhancing behavior and in doing so motivate healthier choices. To achieve this shift in construal, we took a two-pronged approach.

First, our healthy eating message was framed as an exposé of manipulative food industry marketing practices designed to influence and deceive adolescents and others into eating larger quantities of unhealthy foods than they otherwise would choose to eat. We described journalistic accounts of such industry practices as engineering processed foods to maximize addictiveness and encourage overconsumption and using deceptive labeling to make unhealthy products seem healthy (20, 21). Our goal here was to portray healthy eating as a way to “stick it to the man”—we cast the executives behind food marketing as controlling adult authority figures and framed the avoidance of junk food as a way to rebel against their control.

Second, we emphasized the social justice consequences of these manipulative industry practices: for example, disproportionately targeting poor people and very young children with advertisements for the unhealthiest products. Our goal here was to portray healthy eating as a way to take a stand against injustice—to stand up for vulnerable people who lack the ability to protect themselves.

The Present Research

To evaluate the exposé treatment, we conducted a double-blind, randomized, controlled experiment with the full eighth grade class in a Texas middle school in two consecutive school years (i.e., two cohorts). The primary outcome was the effect of treatment on snack

and drink choices 1 d posttreatment, when participants were unaware they were being observed. Survey items, administered immediately posttreatment, allowed us to test the psychological mechanism. We expected that if the treatment messages led adolescents to reconstrue healthy eating as more autonomous (indicated by agreement with statements like “When I eat healthy, I feel like I'm taking control of my food choices”) and more consistent with social justice (indicated by agreement with statements like “When I eat healthy, I'm doing my part to protect kids who are being controlled by food companies”), this would cause adolescents to see healthy behavior as having greater social status appeal (indicated by agreement with statements like “I respect healthy eaters more than unhealthy eaters”). Because adolescents strongly value social status, we expected that increasing the perceived social status appeal of healthy eating would motivate healthy choices. We tested this theoretical model using mediation analysis.

We also examined whether the food industry exposé treatment might have had another potentially important effect: By directly targeting adolescents' construal of food marketing, we expected to change their reactions to ads for junk food products—essentially to inoculate them against the persuasive power of food ads. That is, we sought to transform adolescents' construal of food ads from tempting enticements into anger-inducing reminders of the unjust practices of food marketers.

Analyses throughout the paper are “intent-to-treat”: Data were analyzed based on participants' random assignment to a condition, regardless of whether they successfully completed the treatment. Two separate controls were used: a “standard practice” health appeal control and a “no health treatment” control, see *Method* for details. As expected, the control groups did not differ on any outcome (P s > 0.4), so they were combined in all analyses.

Results

Equivalence Among Experimental Groups. Confirming that random assignment was successful, the experimental groups did not differ in terms of demographic characteristics, including age in years, $\chi^2(6) = 6.06$, $P = 0.42$; body mass index (BMI; only measured in year 2), $F(2, 242) = 0.62$, $P = 0.54$; gender, $\chi^2(2) = 3.73$, $P = 0.15$; percent Hispanic/Latino, $\chi^2(2) = 4.03$, $P = 0.13$; percent white, non-Hispanic, $\chi^2(2) = 3.90$, $P = 0.14$; or percent economically disadvantaged, $\chi^2(2) = 1.65$, $P = 0.44$.

Alignment of Healthy Eating with Adolescent Values. As expected, the exposé treatment significantly increased the extent to which adolescents saw healthy eating as aligned with the values of autonomy and social justice ($M_{\text{Control}} = 2.18$, $SD = 0.71$; $M_{\text{Exposé}} = 3.33$, $SD = 0.99$), $t(487) = 14.56$, $P < 0.001$, Cohen's $d = 1.41$.[‡]

Social Status Appeal of Healthy Eating. Consistent with our theoretical model, the exposé treatment increased the social status appeal of healthy eating on the immediate posttreatment survey ($M_{\text{Control}} = 3.25$, $SD = 1.00$; $M_{\text{Exposé}} = 3.61$, $SD = 0.98$), $t(488) = 4.47$, $P < 0.001$, $d = 0.40$. A mediation analysis showed that treatment effects on the social status appeal of healthy eating were mediated by changes in participants' construal of healthy eating as consistent with the core adolescent values of autonomy and social justice [indirect effect from exposé treatment to social status appeal through autonomy/social justice composite, $b = 0.47$ (0.35, 0.62), $P < 0.001$].

Effect on Free-Choice Unhealthy Snacking 1 d Posttreatment. The primary dependent measure was the total number of free-choice unhealthy food and drink choices (range, 0–3) 1 d posttreatment. Adolescents chose fewer junk food options in the exposé

[‡]The effect of the treatment was also highly significant (P s < .001) when considering the autonomy and social justice items separately.

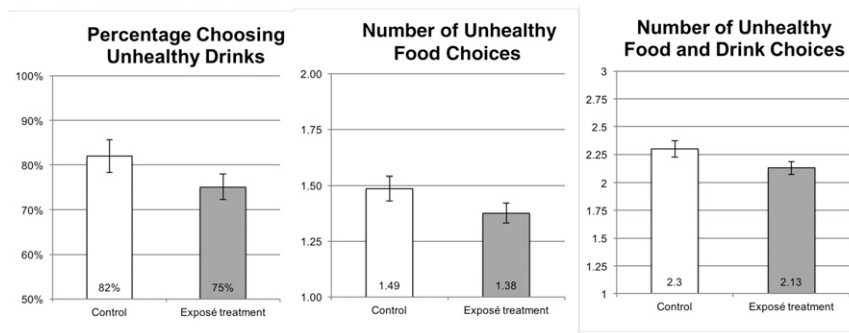


Fig. 1. Effect of exposé treatment on free-choice unhealthy food and drink choices, 1 d postintervention. $n = 469$. Bars represent SEM.

condition than in the control: $M_{\text{Control}} = 2.30$, $SD = 0.79$; $M_{\text{Exposé}} = 2.13$, $SD = 0.85$; ordered logistic regression, $\chi^2(1) = 5.34$, $P = 0.020$, $d = 0.22$ (Fig. 1).

Other ways of analyzing the behavioral outcome yield similar results and shed additional light on the practical significance of the effect. For example, the treatment condition resulted in a 7 percentage point increase (compared with the controls) in the rate at which participants opted to forgo sugary drinks in favor of water (see Fig. 1) and an 11 percentage point increase in the rate at which they opted to forgo at least one unhealthy snack (chips or cookies) in favor of something healthy (fruit, carrots, or nuts): Control = 46%, Exposé = 57%, $\chi^2(1) = 4.58$, $P = 0.03$. From a nutritional perspective, it resulted in a 4.26-g (or 7%) reduction in mean total carbohydrate content, $t(466) = 2.59$, $P = 0.009$, and a 3.60-g (or 9%) reduction in the total sugar content of selections, $t(467) = 2.33$, $P = 0.020$ (see Table 1). And both of these numbers undersell the nutritional significance of the effect. None of the sugar in the healthy choices is added, but almost all of the sugar in the unhealthy options is added,[§] and none of the carbohydrates in the healthy options are simple (or “bad”) carbohydrates, but all or almost all of the carbohydrates in the unhealthy choices are.

Treatment effects were not moderated by study year (interaction effect P s > 0.5) or by BMI (Supporting Information). Thus, in sum, when teens were faced with a seemingly unrelated private choice among snacks and drinks, in a different class a day later, those who had received the exposé treatment made significant and substantially healthier choices than those who had not.

Mediation of Behavioral Effect. In support of our broader theoretical model, mediation analyses showed that the exposé treatment increased perceptions of the social status appeal of healthy eating, which in turn led to healthier food and drink choices the next day.

Increased perceptions of the social status appeal of healthy eating significantly predicted reductions in unhealthy food and drink choices, $r(420) = -0.16$, $P < 0.001$, demonstrating that framing healthy eating as consistent with important and widely shared adolescent values was effective in increasing the perceived social status appeal of that behavior. Further, there was a significant indirect effect of the exposé treatment on next-day food and drink choices mediated through ratings of the social status appeal of healthy eating [ordinary least squares, $b = -0.05$ (-0.10, -0.02), $P < 0.001$] (Fig. 2). In the mediation model, the direct effect of treatment on behavior became nonsignificant ($P > 0.4$), consistent with full mediation.

Perceptions of Marketing of High-Calorie Beverages. In the year 2 sample only, we administered an additional survey measuring

perceptions of high-calorie beverage marketing (e.g., Coca Cola) 2 d after participants completed the treatment. The exposé treatment caused participants to respond to soda ads with more anger ($M_{\text{Control}} = 1.21$, $SD = 0.51$; $M_{\text{Exposé}} = 1.64$, $SD = 0.87$), $t(267) = 4.40$, $P < 0.001$, $d = 0.54$, and less desire to consume soda ($M_{\text{Control}} = 3.10$, $SD = 0.98$; $M_{\text{Exposé}} = 2.69$, $SD = 1.10$), $t(267) = 2.96$, $P = 0.003$, $d = 0.36$, compared with the control treatments.

These results extend the research in two ways. First, they show that adolescents internalized content from the treatment in a way that had detectable effects at least 2 d later. Second, they suggest the tantalizing possibility that the exposé treatment could produce lasting changes in healthy eating behavior by altering emotional reactions to the food ads to which adolescents are continually exposed.

Discussion

The present research showed that framing healthy eating as a way to assert their autonomy from adult control and take a stand in favor of social justice could increase the social status appeal of healthy eating. This change in construal substantially improved the health profile of food and drink choices adolescents made a day later when they did not believe they were being observed. Evidence for this came from a large-sample, double-blind design that was replicated in two cohorts.

This research suggests potential revisions to basic theories of self-regulation. A classic challenge in motivating people to forgo immediate temptation in favor of more important long-term benefits is that people discount the value of temporally distant rewards to an extreme and irrational degree. So the reward value of succumbing to temptation in the immediate term reliably outweighs the reward of abstaining. Traditional self-regulation approaches focus on cognitive strategies to either counter the emotional power of the immediate reward (7) or to bridge the cognitive divide between the present and the distant benefit (e.g., intermediate goal-setting) (22). Neuroscientific research with adolescents has provided a reason for pessimism about such approaches in this age group (4, 10).

The present research transforms this problem by eliminating the need to think about long-term material benefit. Instead, it offers an immediate symbolic benefit (and, consequently, eudaimonic reward) for resisting temptation: feeling like a high-status and respect-worthy person right now because one is acting in accordance with important values shared with one’s peers. Previous neuroscientific research shows that adolescents are especially likely to experience an immediate feeling of reward, comparable to what one feels in response to positive hedonic experiences, when they are made to feel socially valuable (19). We suggest that the immediacy of this eudaimonic reward gives it the emotional and motivational power to compete effectively with the anticipated hedonic reward of succumbing to temptation (19). This general approach might be effective at any age if the relevant behavior can be construed in terms appropriate to the target audience. In adults

[§]It is impossible to say exactly what the difference in added sugar is because regulations at the time of the study did not require companies to disclose the added sugar content of their products.

Table 1. Effect of exposé treatment on major behavioral and nutritional outcomes (measured 1 d posttreatment)

Outcome	Control	Treatment	Absolute difference	Relative difference, %	Significance level, <i>P</i>
Total number of unhealthy choices, mean (SD)	2.30 (0.79)	2.13 (0.85)	0.17	7	0.020
Percent choosing a sugary drink	82	75	7	9	0.112
Percent choosing only unhealthy snacks	54	43	11	20	0.030
Carbohydrate content, g, mean (SD)	60.18 (18.53)	55.92 (19.67)	4.26	7	0.009
Sugar content, g, mean (SD)	40.40 (16.03)	36.66 (16.79)	3.6	9	0.020

Extrapolation to daily consumption based on statistics for current average consumption by adolescents in the United States.

with young children, for example, it might be optimal to frame healthy eating as a way to be a good parent by setting a positive example.

In addition to their theoretical importance, these findings have practical value. Policy analysts have argued that preventing people from ever becoming obese is both more effective and less expensive than treating people who are already obese (23). Recent research suggests that dietary habits are a more important cause of obesity than exercise habits (24). This research demonstrates the potential power of a novel strategy to motivate healthier food choices in adolescence—late enough that habits established at this stage of life could carry through to adulthood but early enough that prevention (rather than treatment) of obesity is still a relevant goal for most people (25).

This work was not designed to provide a blueprint for a comprehensive intervention that would be expected to produce lasting changes in eating habits or body weight or to change behavior in contexts outside of the school setting. Rather, its contribution is to demonstrate the potential power of a novel theory of behavior change—to show that aligning a target behavior with existing strongly held values can be a more effective way to motivate behavior change than traditional efforts. The present results suggest there is cause for optimism, though, about the potential for the “values harnessing” approach to lead to lasting change. Our finding that the exposé treatment changed participants’ emotional reactions to soda ads suggests we might be able to change adolescents’ construal of food marketing, undercutting its tempting effects and even co-opting it as an ongoing motivator of healthy choices. Moreover, an intervention based on this work could use tactics—such as school-wide campaigns with student-designed posters and online videos—that could create a lasting and self-reinforcing social movement that could also reduce countervailing peer pressures (17). Although we refrained from using such tactics in our experiment to prevent spillover from the treatment to the control group, they might be fruitful avenues for future implementations.

This approach of framing healthy behavior in terms that align it with a group’s existing strongly held values suggests the potential for success where past approaches have failed: It produced internalized motivation for healthy eating in eighth grade adolescents. This research represents a theoretical breakthrough

toward designing developmentally appropriate health behavior programs for adolescents, and this general approach could produce similar breakthroughs in motivating important behaviors in other age groups.

Method

Study data and all measures used in this research are available at <https://osf.io/a627d/>. The institutional review board at the University of Texas, Austin, approved the study. Parents were informed of the research in advance and given the opportunity to withdraw their children from the study. Written consent was not required.

Participants. In 2 consecutive years, all students attending eighth grade at a large, public, rural/suburban middle school in Texas were invited to participate in the study, and 536 (92% of those who had not participated in a pilot) did. It was a diverse sample, ethnically and socioeconomically. Fifty-one percent were female, 51% were Latino, 46% were white, and the rest were Black/African American or of mixed racial/ethnic origin. Forty percent were officially designated as economically disadvantaged based on parental income. See [Supporting Information](#) for details of how sample size was determined.

Procedure. The study was fully blinded; neither students nor teachers were aware that this was an experiment designed to determine the effects of different treatments, nor were they aware of any of the research hypotheses. The researchers who conducted the research were kept blind to condition.

In year 1, students were randomly assigned at the individual level (within classrooms) to an exposé condition or a traditional public health appeal. In addition, 34 students in two eighth grade science classes were assigned to a quasi-experimental no-treatment control condition and only provided behavioral outcome data the day after the treatment. This allowed us to compare the randomly assigned control group to a group of students who were never visited by researchers. In year 2, we fully randomized participants to the exposé condition or to one of the two controls (the traditional health appeal or a neutral control described below) at the individual level. In neither year did control conditions differ from each other on any outcome (all *P*s > 0.4).

The day after the treatment and control exercises were administered, the primary dependent variable was measured: students’ food and drink choices for a “snack pack,” announced by the principal as a reward to the entire eighth grade class for their hard work during the state testing period that had just ended. To ensure that students would not see the snack pack as related to the study, we arranged for the principal to announce it weeks before students heard anything about the study.

Manipulation and survey. We report all manipulations. The experimental session occurred during science classes and involved a brief (20- to 40-min)

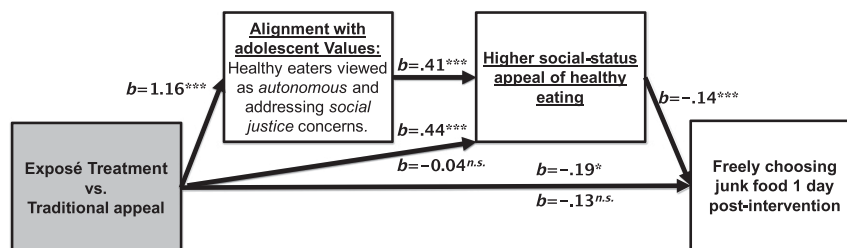


Fig. 2. Path model for effect of exposé treatment on unhealthy snack choices (range, 0–3) through psychological measures. Numbers above lines correspond to direct effects (c paths); numbers below lines correspond to direct paths controlling for mediators (c’ paths). *b*, unstandardized OLS regression coefficient. **P* < 0.05; ****P* < 0.001; n.s., nonsignificant.

reading and writing activity that students completed privately and quietly at their desks. Research assistants introduced the activity as an opportunity to provide feedback on novel curricula for schools. Assistants, working with teachers, maintained a quiet and focused atmosphere until all students were finished, but all manipulated content was delivered in the written materials, not orally, so that participants in different conditions could participate in the same classroom. Cardboard dividers were placed on each student's desk to provide privacy and prevent contamination across conditions. Facilitators reported that very few if any students discussed the content with each other during the sessions.

All experimental materials were distributed in unmarked manila envelopes containing a series of stapled packets, each numbered and completed sequentially: (i) a treatment or control article, (ii) treatment or control writing exercises, (iii) survey items assessing psychological process variables, and (iv) packets of neutral word-search puzzles to keep any student who finished early busy and quiet until the end of the period.

Exposé treatment. The treatment article summarized recent journalistic works exposing the deceptive and manipulative marketing practices of food companies and describing their harmful effects on society—with a particular emphasis on harm to young children and the poor. In particular, it described practices such as formulating foods based on scientific research specifically to maximize its addictiveness (or “craveability”), using deceptive labels and product names to create the perception that unhealthy products are healthy, and disproportionately targeting very young children and the poor with advertisements for many of their unhealthiest products. To tap into the stereotype of the controlling, hypocritical adult and thus activate teens’ drive to assert their autonomy, the article included pictures of four specific food industry executives or consultants (all white, middle-aged men in business attire) and described their hypocritical behavior (e.g., “[Name] is a former tobacco executive who oversaw Kraft. He calls himself ‘a bit of a fitness freak.’ So he avoids the sweet drinks and fatty snacks that his company sells.”).

So that adolescents would internalize this information, the treatments used techniques that are now standard in “wise” psychological interventions (26). First, to create a descriptive norm in support of the treatment message after reading the article, participants read a brief report from an ostensible survey of older students in their school district suggesting that most such students felt outraged about food company practices and planned to “fight back” (e.g., “. . . almost all 9th graders said they planned to **fight back** against the companies by **buying and eating less processed food**”; bold in original). Students then read a series of purported quotes from students who had completed that survey designed both to contribute to the perception of widespread outrage and to suggest how that outrage could be channeled to fight back against the injustice perpetrated by food companies by eating less unhealthy, and more healthy, food. Second, students wrote essays explaining why they were outraged and how they might fight back against the companies—a so-called “saying is believing” exercise (26, 27).

Traditional public health message: The active placebo control. The randomized control activities were designed to encourage healthy eating without communicating the theoretically relevant treatment messages—that is, an autonomous, social justice construal of healthy eating.

The placebo control article was based heavily on existing middle school health textbooks and conveyed scientific information about how the body processes foods and how this relates to weight and health in general. It included colorful, appealing pictures of healthy foods, informative tips about reading nutrition labels, and recommendations for eating a healthy and balanced diet. Like the exposé article, it was developed through a process of prototyping and piloting with adolescents and science teachers to ensure it was evocative and age-appropriate. The control materials involved reading normative quotations purportedly from adults (parents, health educators, etc.) who stated that most teens should read and follow the recommendations. Finally, participants were asked to write essays explaining why it is important to make healthy eating choices. They were also asked to describe some active steps they might take if they wanted to follow the advice of the article and of the adults who endorsed it. Hence, like the treatment, it involved active interaction with the messages.

Altogether, the active placebo control was more informative about the science of health and nutrition (i.e., self-interest-based reasons why it is important to eat healthily) than the treatment. It also involved explicit entreaties to drink water; avoid food high in salt, fat, and sugar; eat fruit; and make other healthy dietary choices. In this way, it was a strong control, allowing for a conservative test.

No-treatment control group. In year 1, the no-treatment control group simply received no content. In year 2, one-third of students received an unrelated reading and writing activity about the brain, how it functions, how it adapts to middle school, and what implications that has for learning. Hence, it was

informative, scientific, involved quotes from peers, and required adolescents to write, but it never mentioned food or weight.

Measures.

Self-reports. Six survey items, presented in a single randomly determined order, assessed three focal constructs outlined below. Each item was rated on a 5-point scale (1 = “not at all true/not at all like me”; 5 = “extremely true/extremely like me”). For the sake of brevity, we wrote items for each subscale that were a priori expected to be conceptually related but not redundant.

Alignment of healthy eating with adolescent values. Two items assessed adolescents’ construal of healthy eating as addressing social justice concerns: “When I eat healthy, I’m doing my part to protect kids who are being controlled by food companies” and “When I choose to eat healthy, I’m helping to make the world a better place.” In year 1 only, three additional questions were also asked. Including these showed the same statistical significance levels for all tests. However, because they were not administered in year 2 (for the sake of efficiency), they are not included in the final composite.

Next, two items assessed individuals’ construal of healthy eating as independent and autonomy-assertive behavior: “Eating healthy is a way to stand up to people who are trying to control us” and “If people eat junk food, it’s because they want to, not because someone made them” (reverse-coded). As above, in year 1 only, additional questions were asked; these showed the same statistical significance levels for all tests but were not used in the composite because they were not asked in year 2.

Items measuring autonomous construal of healthy eating were strongly correlated with the prosocial construal of healthy eating (average $r = 0.71$, $P < 0.001$), and so the four social justice and autonomy items were combined into a composite ($\alpha = 0.75$).

Social status appeal of healthy eating. Finally, two items assessed the social status appeal of healthy eating: “I like the idea of being a healthy eater” and “I respect healthy eaters more than unhealthy eaters.” These were averaged ($\alpha = 0.59$).

In year 2, we sought to rule out the potential concern that the use of the noun phrasing alone could be producing our behavioral effects, because prior research has shown that the noun phrasing can drive people to enact behavior consistent with desired identities or refrain from behavior consistent with undesired identities (28). Therefore, in year 2 only, we randomly assigned half of all participants to have the words “healthy eater” replaced with “healthy eating.” This showed no statistically significant interactions with treatment effects on snack choice behavior. Regardless, we reanalyzed the items including a dummy variable indicating noun/verb condition from year 2; this did not change any of the results reported in the manuscript.

Emotional responses to food advertisements. Two days posttreatment, participants viewed three advertisements for sugary drinks (Coca Cola Classic, Sprite, and Gatorade) and rated “How angry does this ad make you?” (1 = “not angry at all”; 5 = “extremely angry”) and “How much does this ad make you want to drink this product?” (1 = “not at all”; 5 = “a great deal”). Supporting the validity of the measure, adolescents who rated the advertisements as making them want to consume the sugary drinks tended to be the ones who had made more junk food choices the previous day, $r(237) = 0.19$, $P = 0.003$.

Free-choice unhealthy snacking behavior. Students completed the snack forms in their homerooms (a different setting from the one in which they had received the treatment). Teachers instructed students to complete the snack pack order forms with no discussion and without looking at any other students’ forms. Students completed the forms immediately upon arriving at their first-period (i.e., homeroom) class. Teachers then collected the forms and sent them to the office, where the research team prepared the snack packs out of sight of students to prevent participants from noticing a connection with the previous day’s activities.

The snack menu allowed students to select one of five possible drinks (two healthy and three unhealthy) as well as two of six possible food items (three healthy and three unhealthy). Unhealthy drinks were Coca Cola Classic, Sprite, and Hi-C, whereas healthy drink options were sparkling and still bottled water (Topo Chico and Arrowhead, respectively). Unhealthy snack options were Oreos, Doritos, and Hot Cheetos, and healthy snack options were a fruit cup, trail mix, and baby carrots. We calculated variables indicating whether students chose an unhealthy drink (0 = “water”; 1 = “sugary drink”) and how many unhealthy foods were chosen (0–2). The focal analysis was an ordered logistic regression predicting the total number of unhealthy choices (0–3).

ACKNOWLEDGMENTS. The authors thank Carol Dweck and Kristy Pathakis for feedback on earlier drafts and gratefully acknowledge funding from the New Paths to Purpose Project at the Chicago Booth Center for Decision Research and from The Character Lab. The preparation of this manuscript was supported by a fellowship from the FMC faculty research fund at the University of Chicago’s

Booth School of Business (to C.J.B.), by grants from the Raikes Foundation and the National Institute of Child Health and Human Development (Grant

10.13039/100000071 R01HD084772-01), and by a fellowship from the Center for Advanced Study in the Behavioral Sciences (CASBS) (to D.S.Y.).

1. Wang YC, McPherson K, Marsh T, Gortmaker SL, Brown M (2011) Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet* 378(9793):815–825.
2. Katz DL, et al. (2005) *Public Health Strategies for Preventing and Controlling Overweight and Obesity in School and Worksite Settings: A Report on Recommendations of the Task Force on Community Preventive Services* (Center for Disease Control, Atlanta, GA).
3. Stice E, Shaw H, Marti CN (2006) A meta-analytic review of obesity prevention programs for children and adolescents: The skinny on interventions that work. *Psychol Bull* 132(5):667–691.
4. Steinberg L (2015) How to improve the health of American adolescents. *Perspect Psychol Sci* 10(6):711–715.
5. Nicklaus S, Boggio V, Chabanet C, Issanchou S (2004) A prospective study of food preferences in childhood. *Food Qual Prefer* 15(7–8):805–818.
6. Wilson DK, et al. (2005) A preliminary test of a student-centered intervention on increasing physical activity in underserved adolescents. *Ann Behav Med* 30(2): 119–124.
7. Metcalfe J, Mischel W (1999) A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychol Rev* 106(1):3–19.
8. Braams BR, van Duijvenvoorde ACK, Peper JS, Crone EA (2015) Longitudinal changes in adolescent risk-taking: A comprehensive study of neural responses to rewards, pubertal development, and risk-taking behavior. *J Neurosci* 35(18):7226–7238.
9. Crone EA, Dahl RE (2012) Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nat Rev Neurosci* 13(9):636–650.
10. Casey B, Caudle K (2013) The teenage brain: Self control. *Curr Dir Psychol Sci* 22(2): 82–87.
11. Chein J, Albert D, O'Brien L, Uckert K, Steinberg L (2011) Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Dev Sci* 14(2):F1–F10.
12. Brehm JW (1966) *A Theory of Psychological Reactance* (Academic Press, Oxford, UK).
13. Vansteenkiste M, Simons J, Lens W, Sheldon KM, Deci EL (2004) Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *J Pers Soc Psychol* 87(2):246–260.
14. Lee KH, Siegle GJ, Dahl RE, Hooley JM, Silk JS (2015) Neural responses to maternal criticism in healthy youth. *Soc Cogn Affect Neurosci* 10(7):902–912.
15. Yeager DS, et al. (2014) Boring but important: A self-transcendent purpose for learning fosters academic self-regulation. *J Pers Soc Psychol* 107(4):559–580.
16. Damon W, Menon J, Bronk KC (2003) The development of purpose during adolescence. *Appl Dev Sci* 7(3):119–128.
17. Robinson TN (2010) Save the world, prevent obesity: Piggybacking on existing social and ideological movements. *Obesity (Silver Spring)* 18(Suppl 1):S17–S22.
18. Eisenegger C, Naef M, Snozzi R, Heinrichs M, Fehr E (2010) Prejudice and truth about the effect of testosterone on human bargaining behaviour. *Nature* 463(7279): 356–359.
19. Telzer EH, Fuligni AJ, Lieberman MD, Galván A (2014) Neural sensitivity to eudaimonic and hedonic rewards differentially predict adolescent depressive symptoms over time. *Proc Natl Acad Sci USA* 111(18):6600–6605.
20. Moss M (2013) *Salt, Sugar, Fat: How the Food Giants Hooked Us* (Random House, New York).
21. Kessler DA (2010) *The End of Overeating: Taking Control of the Insatiable American Appetite* (Rodale Books, Emmaus, PA), reprint Ed.
22. Mann T, de Ridder D, Fujita K (2013) Self-regulation of health behavior: Social psychological approaches to goal setting and goal striving. *Health Psychol* 32(5):487–498.
23. Carneiro PM, Heckman JJ (2003) *Human Capital Policy* (Institute for the Study of Labor, Bonn, Germany).
24. Luke A, Cooper RS (2013) Physical activity does not influence obesity risk: Time to clarify the public health message. *Int J Epidemiol* 42(6):1831–1836.
25. Ogden CL, Carroll MD, Kit BK, Flegal KM (2014) Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA* 311(8):806–814.
26. Walton GM (2014) The new science of wise psychological interventions. *Curr Dir Psychol Sci* 23(1):73–82.
27. Aronson JM, Fried CB, Good C (2002) Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *J Exp Soc Psychol* 38(2):113–125.
28. Bryan CJ, Walton GM, Rogers T, Dweck CS (2011) Motivating voter turnout by invoking the self. *Proc Natl Acad Sci USA* 108(31):12653–12656.
29. Barlow SE; Expert Committee (2007) Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics* 120(Suppl 4):S164–S192.