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Combining Self-Affirmation With Implementation Intentions to Promote Fruit and Vegetable Consumption

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Objective: The current study tested whether self-affirmation in the context of a threatening health message helps promote a health behavior (fruit and vegetable consumption) over a 3-month period, and whether adding a manipulation to support the translation of intentions into behavior (an implementation intentions induction) enhances the impact of self-affirmation. ***Methods:*** Participants (N = 332, 71% women) reported their baseline consumption and were randomly assigned to condition in a 2 (self-affirmation: *yes, no*) × 2 (implementation intentions: *formed, not formed*) between-subjects factorial design. They completed a self-affirmation/control task and then read a health communication advising eating at least 5 portions of fruit and vegetables daily. Next participants reported intentions for behavior change, after which they formed/did not form relevant implementation intentions. Consumption was measured again 7 days and 3 months postintervention. ***Results:*** Self-affirmed (vs. nonaffirmed) participants reported eating more fruit and vegetables at both follow-ups. Forming (vs. not forming) implementation intentions was also beneficial for consumption. At 7 days, there was also a significant self-affirmation × implementation intentions interaction: consumption was highest when self-affirmed participants also formed implementation intentions. ***Conclusions:*** The present study offers new evidence concerning the impact and durability of self-affirmation on health behaviors and the role of implementation intentions in enhancing the impact of self-affirmation.

Keywords: health behavior change, healthy eating, implementation intentions, motivation, self-affirmation

Encouraging people to adopt healthier lifestyles can be challenging. The targeted audience may avoid the message or resist its personal relevance; those who do accept the message may fail to act or may respond initially but later relapse. In response, researchers have developed a range of strategies and methods to encourage and support health-behavior change. Yet few methods are available to overcome an early obstacle to change in the form of defensive resistance to the message (Rothman & Salovey, 2007). Evidence that self-affirmation (the process of reflecting upon important personal values or strengths) appears to reduce such resistance (Harris & Epton, 2009) is therefore promising, as it raises the prospect of developing self-affirmation interventions to assist behavior change. However, there is a need for more evidence that self-affirmation manipulations can foster salutary health behavior change. The current study therefore tested whether self-affirmation helps promote an important health behavior (fruit and vegetable

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consumption) over a 3-month period and whether adding a manipulation to support the translation of intentions into behavior (an implementation intentions induction) enhances the impact of self-affirmation on consumption.

Importance of Fruit and Vegetable Consumption

A diet high in fruit and vegetables can reduce the risk of many leading causes of death, including heart disease, stroke, and some cancers (Centers for Disease Control & Prevention [CDCP], 2010; Hung et al., 2004; Joshipura et al., 2001; Parkin & Boyd, 2011). As a result, the WHO recommends a minimum consumption of 400 g daily. In many countries (e.g., the United Kingdom), this is operationalized as a recommendation to eat at least five 80-g portions of fruit and vegetables per day. However, despite widespread awareness of the "5-a-day" target and its associated health benefits, many people still fail to meet these minimum levels of consumption (e.g., CDCP, 2010; DEFRA, 2012). In sum, fruit and vegetable intake is an important target for health promotion, and it constituted the principal outcome in this study.

Self-Affirmation and Health Behavior Change

In experimental research on self-affirmation people are asked to think about an important aspect of their self-concept (e.g., a core value). Such manipulations are derived from Self-Affirmation Theory, which posits that a) people resist information that threatens their sense of being rational, morally adequate, and in control of important outcomes, but b) bolstering their sense of self-adequacy or "self-integrity" in one domain can offset threat and reduce motivation to resist information in another domain (Sherman & Cohen, 2006; Steele, 1988). For example, a smoker reminded of the dangers of smoking faces not only a physical threat but also—as the agent of such risky health behavior—a threat to her sense of self-adequacy. By reassuring herself she is self-adequate through self-affirming in another domain (e.g., by thinking about her generosity), she is able to process information about smoking more open-mindedly (Sherman & Cohen, 2006; Steele, 1988). Thus, self-affirmation may ameliorate defensive resistance to threatening information, such as personally relevant health-risk information, and—if the message is sufficiently strong (e.g., Correll, Spencer & Zanna, 2004)—should thereby enhance message uptake.

Research has largely confirmed that self-affirmation is effective in this regard. For example, when presented with relevant health-risk information, self-affirmed (vs. nonaffirmed) participants typically show more message acceptance and stronger motivation to change behavior (see Harris & Epton, 2009, 2010). Currently, however, the evidence regarding the impact of self-affirmation on health-related behavior is both limited and inconsistent. Self-affirmation has been shown to promote improvements in dietary behavior (Epton & Harris, 2008; Pietersma & Dijkstra, 2011) and on dietary-related physical markers, such as body mass index (BMI) and weight (Logel & Cohen, 2012), and to reduce reported alcohol consumption (Armitage, Harris & Arden, 2011). Combined self-affirmation and positive affect interventions have promoted physical activity in coronary patients (Peterson et al., 2012) and medication adherence in hypertensive African Americans (Ogedegbe et al., 2012). However, there have also been null effects of self-affirmation on health behaviors at follow-up (Harris, Mayle, Mabbott, & Napper, 2007 [smoking]; Harris & Napper, 2005 [alcohol consumption]; Reed & Aspinwall, 1998 [caffeine consumption]) and self-affirmation did not augment the effects of a multicomponent intervention on activity in asthma patients (Mancuso et al., 2012).

Self-Affirmation and Implementation Intentions

One potential explanation for such inconsistent effects on behavior lies in the fact that a motivating message is not always sufficient to generate behavior change (Webb & Sheeran, 2006). In particular, additional support may be required to help motivated participants translate their intentions into behavior (Gollwitzer & Sheeran, 2006). Without this support a motivating message may not provide sufficient impetus, even when combined with a self-affirmation manipulation to enhance uptake (Harris & Epton, 2010). There is considerable evidence that people who form implementation intentions (i.e., if-then plans) specifying where, when, and how they will achieve their goals are more likely to translate their intentions into action (see Gollwitzer & Sheeran, 2006, for a meta-analytic review). Forming implementation intentions offers motivated people more chance of translating their intentions into behavior by increasing the accessibility of situational cues, strengthening the cue-action link and, ultimately, automatizing the behavior (Gollwitzer & Sheeran, 2006). Self-affirmation reduces defensive responding and thus releases more of the motivational potential of behavior change interventions. Implementation intentions enhance the ability of motivated participants to act on their intentions. Consequently, we hypothesized that adding an implementation intentions induction to the self-affirmation manipulation would augment the impact of the motivational message on behavior.

Present Study

Participants in the present study were randomly assigned to a self-affirmation or control condition before reading about the health benefits of fruit and vegetables and then completing measures of intentions to change behavior. The message was based on one previously shown to elicit different responses in self-affirmed and nonaffirmed participants (Epton & Harris, 2008). Subsequently, participants were randomly assigned to form or not form implementation intentions. Fruit and vegetable consumption was measured at baseline and 7 days and 3 months postintervention. The study tested whether a) self-affirmation enhanced the impact of the message on fruit and vegetable consumption over a 3-month period and b) adding an implementation intentions induction increased the impact of the self-affirmation manipulation on consumption.

Method

Design and Procedure

The study used a 2 (self-affirmation: *yes*, *no*) × 2 (implementation intention: *formed*, *not formed*) between-subjects factorial design. Participants were randomly assigned to complete a values affirmation or control task and then presented with a health com-

munication followed by measures of intentions. After completing these, participants were randomly assigned to the implementation intentions formed or not formed (control) conditions. E-mails were sent automatically by the online survey software to each Participant 7 days and 90 days after completing the first set of measures (90% [7 day], 86% [90 day] response rate ≤3 days of receipt). The ethics of the research were approved by the designated committee of the University of Sheffield.

Participants

Research staff, graduate, and undergraduate students at the University of Sheffield were invited by e-mails distributed via central email lists to take part in the study in return for entry into a prize drawing. Interested participants (N = 1,271) followed a link to an online site, where eligible participants (N = 973) obtained the link to the study pages; 447 (45.9%) followed the link, of whom 332 (74.3%) completed the manipulations and all measures at Time 1 and therefore comprise the Time 1 sample (see Figure 1). The sample had a mean age of 22.3 years (18–54 years, SD = 5.9); 94% (N = 312) were students; 71.7% (N = 238) were female; and 79.2% (N = 263) described themselves as white Caucasian, 12.3% (N = 41) as Asian, and 3.3% (N = 11) as of mixed ethnic origin.

Of the Time 1 sample, N = 250 (75.3%) completed the 7-day follow-up measures and N = 162 (48.8%) completed the measures at 3 months. There was no evidence of differential retention by condition at any time point: Time 1, $\chi^2(1, N = 332) = .20$, $p = .66$; 7 days, $\chi^2(1, N = 250) = .67$, $p = .41$; 3 months, $\chi^2(1, N = 162) = .12$, $p = .73$.

Materials

Pretest measures. The pretest contained demographic questions (sex, age, occupation) and an eligibility question (adapted from Wiedemann et al., 2009): *Currently, do you eat at least 5 portions of fruit and vegetables on a typical day?* (1, *No, and I do not intend to do so*; 2, *No, but I am thinking about it*; 3, *No, but I strongly intend to*; 4, *Yes, but it is difficult for me*; 5, *Yes, and it is easy for me*). Those responding 1–4 were deemed eligible for the study and given the link to the baseline measures.

Fruit and vegetable consumption was assessed using three measures. A link to National Health Service information on portion sizes was provided on each page. Measure 1 (Steptoe et al., 2003) assessed consumption on a typical day (one item each for fruit and vegetables, e.g., *How many portions of fruit—of any kind—do you eat on a typical day?*). Measure 2 (from the Cambridge Food Frequency Questionnaire, Bingham et al., 1994) assessed fruit and vegetable consumption in the previous 24 hours by providing participants with a comprehensive list of vegetables and fruit and asking them to indicate how many portions of each they had eaten. Measure 3 (Wardle, Parmenter, & Waller, 2000) assessed con-

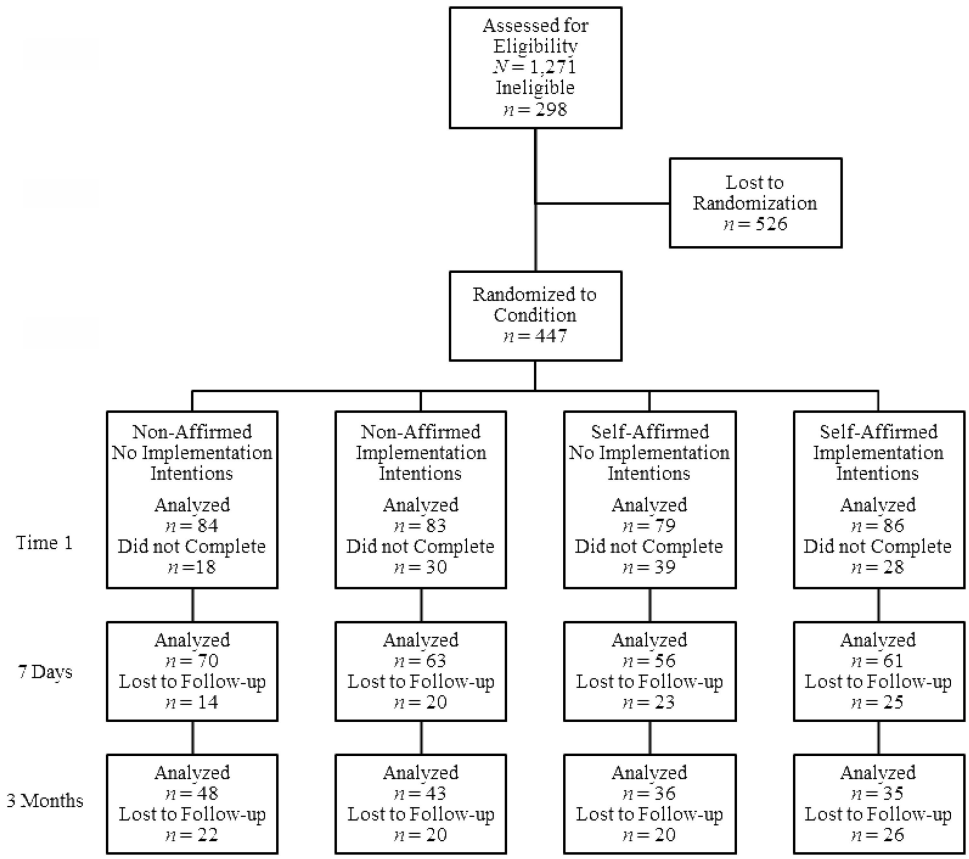

Figure 1. Participant flow through the phases of the experiment.

sumption in a typical week by asking participants to record how many portions they ate from a list of foodstuffs using a 7-point scale (*None; less than 1 a week; 1–2 a week; 3–5 a week; 6–7 a week; 8–11 a week; 12 or more a week*). Given the different response scales, the measures were standardized before being combined ($\alpha = .67$). Principal component analysis confirmed the presence of a single factor accounting for 61% of the variance, on which each of the scales loaded >.70.

Self-affirmation manipulation and manipulation check. Using a method developed by Sherman et al. (2009), participants in the self-affirmation condition provided three reasons why their most important value was important to them and one example of something they had done that demonstrated its importance. Participants in the nonaffirmation condition provided three reasons why their least important value might be important to someone else and an example of something that person might do to demonstrate its importance (a standard control condition in self-affirmation research).

The manipulation check comprised three bipolar items (from Napper, Harris, & Epton, 2009) placed after the Time 1 dependent measures: *The task on values made me think about . . . , things I don't like about myself* [1] – *things I like about myself* [7]; *things I'm bad at* [1] – *things I'm good at* [7]; *things I don't value about myself* [1] – *things I value about myself* [7] ($\alpha = .85$).

Health message. The message (971 words) used materials from the U.K. Department of Health (2010) describing the health benefits of eating fruit and vegetables, augmented by information about the implications for heart disease from Crowe et al. (2011). It began with a screen explicitly stating the U.K. guidelines, followed by screens briefly describing the evidence concerning the benefits to health, outlining how fruit and vegetables may work, and why vitamin supplementation is less beneficial. It ended with reminders to eat at least 5 portions every day, advice on portion size and how to increase consumption, and details of where to get more information.

Intentions. *Intentions* were measured by four items, two using global statements of intentions, for example, *In the next 3 months, I intend eating at least 5 portions of fruit and vegetables every day* (1, *strongly disagree*; 7, *strongly agree*), and two measuring expectations, one each for fruit and vegetables, for example, *In the next 3 months, how many portions of fruit—of any kind—do you expect to eat on a typical day?* The items were standardized and a mean score calculated ($\alpha = .73$).

Implementation intentions manipulation and manipulation check. Participants randomly assigned to form implementation intentions were asked to make plans about how to eat more fruit and vegetables using a thought bubble format (from Brown, Sheeran, & Reuber, 2009). Each plan had an *If . . . , then . . . structure*. The *if* part of the plan specified an opportunity for, or threat to, fruit and vegetable consumption (e.g., *If I eat out during the day,*). Participants completed the *then*-part of the plans (e.g., *then [write in what fruit you will have]!*). An example was provided for each plan (e.g., *If I eat out during the day, then I will have a banana after my food!*). Participants were invited to form 5 action plans, targeting buying, eating, and cooking fruit and vegetables (e.g., *If I have had my dinner, then [write in what fruit you will have]!*) and 2 coping plans, targeting excuses to avoid fruit and vegetable consumption (e.g., *If I start to talk myself out of eating fruit and vegetables [write in your excuse] then [write in what you will say to yourself to prevent excuses from working]!*). Participants assigned to the control condition proceeded straight to the end of the questionnaire. As a manipulation check, two coders (first author and a graduate student), both blind to condition, rated each plan on a 3-point scale (0, *nothing/irrelevant*; 1, *plan*; 2, *extensive plan*). Interrater agreement was high ($.97 \leq r \leq 1.0$), so an overall mean was calculated from the mean of the ratings ($\alpha = .73$).

Follow-up consumption. This was assessed using the same measures of fruit and vegetable consumption as taken at baseline.

Results

Randomization and Manipulation Checks

There were no differences between eligible participants who followed the link ($N = 447$) and those who did not ($N = 526$) in sex, $\chi^2(1, N = 973) = 2.40$, $p = .122$, age, ($F < 1$), or baseline fruit and vegetable consumption ($F < 1$). Likewise, there were no differences between the Time 1 sample ($N = 332$) and those who also followed the link but did not complete at Time 1 ($N = 115$) in sex, $\chi^2(1, N = 447) = 1.28$, $p = .258$, or baseline fruit and vegetable consumption, $F(1, 445) = 1.07$, $p = .302$, $\eta p^2 = .002$. However, those completing the Time 1 measures were on average a year older than those not completing them, $F(1, 445) = 4.34$, $p = .038$, $\eta p^2 = .01$, ($M = 22.30$, $SD = 5.86$ vs. $M = 21.09$, $SD = 3.49$, respectively).

There were no differences among conditions in age (largest $F = 2.26$, $p = .134$, $\eta p^2 = .007$) or sex, $\chi^2(3, N = 332) = 1.17$, $p = .761$ (see Table 1). Most importantly, there were no significant differences in baseline fruit and vegetable consumption (largest $F = 1.80$, $p = .181$, $\eta p^2 = .005$). Thus, random assignment of participants to conditions was successful. One-way ANOVA re-

Table 1
Baseline Measures by Condition

	Non-affirmed		Self-affirmed		
Baseline measures	Control $n = 84$	Imps[a] $n = 83$	Control $n = 79$	Imps $n = 86$	Total $N = 332$
Age in years	21.98 (5.56)	21.63 (6.71)	22.13 (4.19)	23.41 (6.50)	22.30 (5.86)
Number of females	58 (69.0%)	60 (72.3%)	60 (75.9%)	60 (69.8%)	238 (71.7%)
Consumption[b]	−0.07 (0.65)	−0.06 (0.59)	0.02 (0.63)	0.07 (0.94)	−0.01 (0.72)

Note. Standard deviations in parentheses, unless indicated otherwise.
[a] Imps = Implementation intentions formed. [b] Data are *z* scores (standard deviations in parentheses).

Table 2
Consumption by Condition Over Time

Baseline				7 Days				3 Months			
Non-affirmed		Self-affirmed		Non-affirmed		Self-affirmed		Non-affirmed		Self-affirmed	
Control $n = 84$	Imps[a] $n = 83$	Control $n = 79$	Imps $n = 86$	Control $n = 70$	Imps $n = 63$	Control $n = 56$	Imps $n = 61$	Control $n = 48$	Imps $n = 43$	Control $n = 36$	Imps $n = 35$
—	—	—	—	−0.09 (0.06)	−0.11 (0.07)	−0.03 (0.07)	0.26 (0.07)	−0.18 (0.09)	−0.04 (0.09)	0.07 (0.10)	0.24 (0.10)

Note. Data are *z* scores adjusted for baseline consumption (standard errors in parentheses).
[a] Imps = Implementation intentions formed.

vealed a significant main effect of self-affirmation condition on the manipulation check measure, $F(1, 328) = 8.66$, $p = .003$, $\eta p^2 = .026$; participants were more self-affirmed in the experimental than control condition ($M_{SA} = 4.59$, $SD = 1.41$; $M_{NA} = 4.14$, $SD = 1.34$). There were no differences between conditions in either quantity ($M_{SA} = 6.80$, $SD = 0.76$; $M_{NA} = 6.89$, $SD = 0.42$) or quality ($M_{SA} = 1.31$, $SD = 0.36$; $M_{NA} = 1.33$, $SD = 0.32$) of plans completed, Fs < 1.

Impact of the Manipulations on Subsequent Fruit and Vegetable Consumption

Explanatory analyses. We first conducted explanatory analyses by analyzing the *z* scores for consumption at each time point separately, using two-way analysis of covariance (ANCOVA), with between-subjects independent variables of self-affirmation condition (self-affirmation, no affirmation) and implementation intention condition (formed, not formed) and baseline consumption as a covariate (see Table 2). At the 7-day follow-up, there was a significant main effect of the self-affirmation manipulation, $F(1, 245) = 9.91$, $p = .002$, $\eta p^2 = .039$. Self-affirmed participants reported eating significantly more portions of fruit and vegetables than did nonaffirmed participants ($M_{SA} = 0.11$, $SE = 0.05$; $M_{NA} = -0.10$, $SE = 0.05$). There was also a significant main effect of implementation intention condition, $F(1, 245) = 4.04$, $p = .046$, $\eta p^2 = .016$, ($M_{imps} = 0.07$, $SE = 0.05$; $M_{control} = -0.06$, $SD = 0.05$). Participants in the implementation intentions condition reported eating significantly more portions of fruit and vegetables than did those not forming implementation intentions. These effects were qualified by a significant self-affirmation × implementation intentions interaction, $F(1, 245) = 5.40$, $p = .021$, $\eta p^2 = .022$ (see Figure 2). Simple effects analyses indicated that self-affirmed participants showed significantly higher consumption than nonaffirmed participants in the implementation intentions formed condition ($M_{SA} = 0.26$, $SE = 0.07$; $M_{NA} = -0.11$, $SD = 0.07$), $F(1, 247) = 12.17$, $p = .001$, but not in the control condition ($M_{SA} = -0.03$, $SD = 0.07$; $M_{NA} = -0.09$, $SD = 0.06$), $F(1, 247) = 1.83$, $p = .178$. This shows that implementation intentions not only increased consumption but also strengthened the effect of self-affirmation, producing a synergistic effect.

At the 3-month follow-up, there was again a significant main effect of the self-affirmation manipulation, $F(1, 157) = 7.43$, $p = .007$, $\eta p^2 = .045$, with self-affirmed participants reporting eating significantly more portions of fruit and vegetables than nonaffirmed participants ($M_{SA} = 0.15$, $SE = 0.07$; $M_{NA} = -0.11$, $SE = 0.06$). The main effect of implementation intentions approached significance, $F(1, 157) = 2.75$, $p = .099$, $\eta p^2 = .017$, but the self-affirmation × implementation intentions interaction did not, $F(1, 157) < 1$, $p = .891$.

Overall, therefore, there were significant main effects of self-affirmation at both follow-ups, and of implementation intentions at 7 days. The main effects at 7 days were qualified by a significant self-affirmation × implementation intentions interaction.

Modeling impacts across both follow-ups. To estimate the effects of the manipulations across both follow-ups simultaneously, we subjected the data from the 250 participants who provided data at 7 days to Mixed Model Analysis using generalized linear modeling (in SPSS version 20). This enables estimates of effects to be obtained without restricting the analysis to the subset of participants ($n = 162$) providing data at all time points. This mixed model analysis revealed significant overall main effects of both self-affirmation, $F(1, 246.58) = 13.34$, $p < .001$, and implementation intentions, $F(1, 247.09) = 6.02$, $p = .015$; however, neither the self-affirmation × implementation intentions interaction, $F(1, 248.08) = 1.72$, $p = .191$, nor self-affirmation × implementation intentions × time interaction, $F(1, 209.85) = 2.23$, $p = .137$, were significant. (No effects involving time were significant.)

Overall, therefore, this analysis indicates the presence of two main effects when the data are collapsed across both follow-ups.

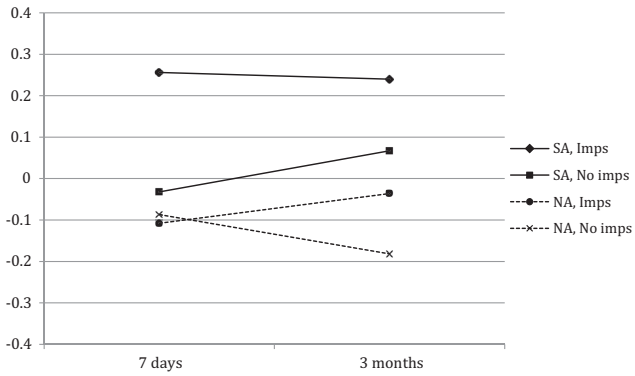

Figure 2. The impact of self-affirmation condition and implementation condition on consumption at 7 days and 3 months. The scores are mean *z* scores adjusted for baseline consumption.

Impact of Self-Affirmation on Intentions

Intentions were measured before randomization to the implementation intentions condition and were therefore analyzed using one-way ANOVA. The effect of self-affirmation approached significance, $F(1, 330) = 3.54$, $p = .061$, $\eta p^2 = .011$, ($M_{SA} = 0.09$, $SD = 0.91$; $M_{NA} = -0.09$, $SD = 0.80$).

Discussion

Self-affirmed (vs. nonaffirmed) participants reported eating more fruit and vegetables at both 7 day and 3 month follow-ups. The implementation intentions and self-affirmation manipulations combined synergistically at 7 days, but not at 3 months, indicating that the if–then plans particularly enhanced the initiation of behavior change in the self-affirmed group (although this finding did not emerge in mixed model analyses using data from both follow-ups). Forming (vs. not forming) implementation intentions was also beneficial for consumption.

First, and most important, the current study provides evidence that a) self-affirmation helps promote health behavior and b) the short-term effects (over 7 days) of self-affirmation on fruit and vegetable consumption reported by Epton and Harris (2008) extend over a much longer time period. By using a 3-month behavioral follow up, the present study provides one of the longest follow-ups in research on self-affirmation and health behavior to date. Moreover, the impact of the manipulation on behavior observed here was of meaningful magnitude: on average, the difference in consumption between self-affirmed and nonaffirmed participants at 3 months was approximately 1.2 extra portions per day. Such a difference in fruit and vegetable consumption can make a significant contribution to future health, especially in reducing the risk of cardiovascular disease (Hung et al., 2004; Joshipura et al., 2001). For instance, data from the Nurses Health Study and Health Professional's Follow-Up Study (Hung et al., 2004) suggest that an increment of one serving per day of fruit and vegetables is associated with reductions in relative risks to 0.96 (95% confidence interval [CI] = 0.92 to 1.00) for major chronic disease and 0.88 (95% CI = 0.81 to 0.95) for cardiovascular disease.

Second, there was evidence that the implementation intentions induction interacted with self-affirmation. After 7 days, fruit and vegetable consumption was much higher among self-affirmed than nonaffirmed participants when they completed the if–then plans; those not completing plans showed no such difference. The current findings therefore provide the first evidence of synergy between self-affirmation and implementation intentions and offer some early indication that these manipulations may be usefully combined in interventions to foster health behavior change (though see Jessop, Sparks, Buckland, Harris, & Churchill, 2013). Evidence of synergistic effects on behavioral initiation is especially encouraging, as initiating behavior represents a critical point at which many people fail in the behavior change process, despite having the requisite motivation (Gollwitzer & Sheeran, 2006; Rothman & Salovey, 2007).

However, this pattern did not emerge at 3 months. One potential explanation of this finding is that the if–then plans formed by participants were helpful to self-affirmed participants in addressing self-regulatory problems in starting to increase fruit and vegetable consumption, but were not sufficient to overcome additional problems that participants had to face in the longer term. In particular, the plans specified what to buy and when to eat fruit and vegetables, and how to cope with worries about expense and excuses not to eat fruit and vegetables. However, participants could have faced other problems, such as lack of product availability, dealing with unhelpful nutritional gatekeepers, or social pressure to eat other foodstuffs. If this analysis is correct, then it could prove valuable to teach participants to use implementation intentions as a metacognitive strategy in order to form additional if–then plans to deal with new problems in consuming fruit and vegetables that they encountered. Further research is needed to test this idea.

Nevertheless, at 3 months consumption among participants in the combined condition remained relatively high, showing evidence of continuing benefits of the combined intervention. By this stage, however, there were also benefits to consumption of having been exposed to either manipulation relative to neither, which evidently contributed to the changed pattern of effects. The findings demonstrate that undertaking either task had benefits for consumption in the longer term, whereas relying on the motivational message alone did not.

Levels of intentions following the message were relatively high, confirming previous evidence that the message is motivating (Epton & Harris, 2008). Nonetheless, the difference between self-affirmed and nonaffirmed participants approached significance, suggesting that the self-affirmation manipulation had some additional effect on the motivational impact of the message, albeit insufficient to warrant tests of mediation. Interestingly, the previous study involving fruit and vegetable consumption (Epton & Harris, 2008) also obtained effects on rated intentions that only approached significance. It is likely that levels of motivation for change induced by the motivational message are sufficiently high irrespective of condition and this reduces the ability of the manipulation to have significant additional impact on expressed intentions.

Research showing the benefits of implementation intentions on behavior is reasonably well established and the mechanisms underlying these effects have been tested and refined in recent years (see Gollwitzer & Sheeran, 2006). In contrast, research into the effects of self-affirmation on health behavior is relatively recent and knowledge about the underlying mechanisms is correspondingly uncertain. There is a range of possible mechanisms, none of them mutually exclusive. One possibility is that participants take the experience of self-affirming away from the laboratory and apply it subsequently in their everyday lives, with benefits for behavioral self-regulation (see Harris, 2011). For example, the ability to self-affirm has been credited with interrupting negative feedback loops in which difficulties are interpreted as failures that undermine motivation and persistence (e.g., Logel & Cohen, 2012). Likewise, there is evidence that self-affirmation manipulations may provide participants with self-control (Schmeichel & Vohs, 2009), working memory (Logel & Cohen, 2012), and other resources to better cope with the setbacks and stressors (e.g., Creswell et al., 2005) associated with behavior change attempts. There is also evidence that, after self-affirmation, participants may naturally form plans for change that are somewhat more implemental (Ferrer, Shmueli, Bergman, Harris & Klein, 2012), which may foster their ability to change behavior. Delineating the mechanisms by which self-affirmation allows potent behavior change interventions to break through participants' defense systems and

whether it also adds to the impact of such interventions are key research issues.

Several features of the current study present potential limitations. As in other self-affirmation research, the sample was literate, educated, and relatively young, and the findings rely on self-reported behavior. Attrition across the follow-ups was relatively high (approximately 25% and 50% attrition at 7 days and 3 months, respectively) but typical for a study of this sort in which there were limited inducements and no support (such as follow-up telephone calls) to encourage continued participation. Nevertheless, such attrition rates have potential implications for external validity (Amico, 2008). Fortunately, attrition was homogenous, suggesting no consequences for internal validity: There was no evidence of differential attrition by condition, and few indicators of differences between eligible participants who elected to take part and those who did not (reducing to some extent concerns about external validity). Future studies would benefit from using samples of less well-educated or older participants, alongside proven methods for encouraging retention, in order to enhance the database concerning the breadth and impact of self-affirmation in promoting dietary change.

Notwithstanding these limitations, the present research offers several important advances. We observed that self-affirmation affects long-term self-reported health behaviors over one of the longest follow-up periods in published research to date. We obtained clear evidence that implementation intentions can augment the effects of self-affirmation on behavior. Moreover, we obtained initial evidence that implementation intentions may do so synergistically. Such findings suggest many avenues for further research. Researchers should assess whether the beneficial effects of self-affirmation persist for periods beyond 3 months and whether some form of booster in the form of one or more additional self-affirmation or implementation intention exercises later in the process helps to sustain behavior. The latter point is essential given the frequent tendency for researchers and practitioners to combine theoretical approaches and behavior change tools when designing interventions. These issues should be examined with other health-promoting behaviors (e.g., physical exercise) and with health-damaging behaviors (e.g., smoking). Additional research on factors that mediate the impact of self-affirmation manipulations on health behavior change is also warranted, as are further tests involving implementation intentions and other behavior change techniques in order to maximize the beneficial effects of self-affirmation on health decisions and actions.

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