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Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake: A randomized trial

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ABSTRACT

Implementation intentions, namely specific plans regarding when, where and how an individual will act, increase the likelihood of action. There is evidence that implementation intentions should be particularly efficacious when combined with motivational interventions. However, this is yet to be tested in relation to the *reduction* of unhealthy behaviour. Thus the aim of this study was to examine the efficacy of combined motivation and implementation intention interventions for the reduction of saturated fat intake. It also tested a new form of implementation intention (reasoning implementation intentions). Participants from the UK ($n = 210$) were randomized to condition and asked either to form standard implementation intentions, reasoning implementation intentions, or received no implementation intention manipulation; and were exposed to protection motivation-based information, or not. Results showed that standard and reasoning implementation intentions were successful in reducing the proportion of food energy derived from saturated fat but the effects of the standard implementation intention were dependent on whether participants read the motivational message or not.

Consumption of bad fats (saturated fats, trans-fats) has been associated with increased risk of coronary heart disease (e.g., Hu et al., 1999; Willett et al., 1993) and there has been widespread call for their intake to be restricted (e.g., Institute of Medicine, 2002). When young people join university, or begin a new career, they are often leaving the family environment for the first time and begin to take greater responsibility for purchasing and preparing their own meals. As such, targeting food intake within students and other young professionals is an important issue. By establishing healthy eating habits early, in this period of relative independence, the health benefits are maximized. Behaviour change strategies need to be theoretically informed (e.g., Marteau, Dieppe, Foy, Kinmonth, & Schneiderman, 2006; Michie, Sheeran, & Rothman, 2007) to aid the identification of key variables that should be targeted by intervention and to allow an understanding of the mechanisms of change.

Past research has found that changing behaviour is difficult, and changing undesirable behaviour is the most difficult of all. This study used Protection Motivation Theory (Rogers, 1983) to help identify motivation as one source of the problem and to create a motivational message (for a review of interventions based on this theory, see Milne, Sheeran, & Orbell, 2000) concerned with reducing saturated fat intake. However, improving motivation is not always sufficient to create large changes in behaviour (see Webb & Sheeran, 2006). This study, therefore, also incorporated implementation intentions (Gollwitzer, 1993), specific plans in which an individual decides when, where and how they act. There is some evidence that combining motivational interventions with implementation

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intentions leads to more pronounced increases in the promotion of healthy behaviours than using either strategy alone (e.g., Prestwich, Lawton, & Conner, 2003). The present study is the first to combine these two types of intervention for the reduction of unhealthy behaviour. It also tests whether a new version of implementation intentions, called *reasoning* implementation intentions, can be effective without an additional (motivation-based) intervention.

Protection Motivation Theory

Communications based on Protection Motivation Theory (Rogers, 1983) typically involve a threat to one's well-being, such as highlighting the risk of a particular illness (e.g., coronary heart disease; assessed through perceived vulnerability, perceived severity and fear items), and information about a means to cope with such threat (e.g., avoid high-fat foods; assessed through items measuring response efficacy, self-efficacy and response costs). An individual's appraisal of the threat and their evaluation of the recommended coping response influence one's intention to engage in the precautionary behaviour. This theory was selected as it lends itself to simple, theoretically framed message-based interventions that have been shown to be effective in changing intentions (see Milne et al., 2000, for a review).

Implementation intentions

It has long been argued that a person's intentions represent a direct precursor to behaviour, and this has been reflected in a variety of models including Protection Motivation Theory. According to a recent review by Webb and Sheeran (2006), however, a "medium-to-large" change in intention ($d = .66$) leads to a "small-to-medium" change in behaviour ($d = .36$). Thus, even if one successfully changes a person's intentions towards avoiding foods that are high in saturated fat (and this change is medium to large) one should expect a smaller change in actual behaviour. This is supported by evidence that manipulating Protection Motivation Theory variables has greater impact on intentions than behaviour (see Milne et al., 2000). In order to generate more pronounced behaviour change, intentions must be successfully translated into action.

According to Sheeran, Milne, Webb, and Gollwitzer (2005), failing to articulate one's intentions (e.g., to avoid foods that are high in saturated fat), along with how (e.g., avoiding the chocolate, cheese and crisps aisles in supermarkets), when and where (e.g., every time one enters a supermarket) one can implement intentions, contributes to intention-behaviour discrepancies. Gollwitzer's (1993) implementation intentions deal directly with this issue by requiring individuals to decide in advance of action, when and where they will act.

Gollwitzer and Sheeran's (2006) meta-analysis, incorporating 94 independent tests of implementation intention effects, showed an overall medium-to-large effect on goal achievement. It also provided some evidence that implementation intentions can change dietary behaviours. However, in the dietary studies, the intervention periods have been a week or less (e.g., Bamberg, 2002; Verplanken & Faes, 1999) and/or generated weak effects (e.g., Armitage, 2004; Bamberg, 2002). Moreover, within Gollwitzer and Sheeran's meta-analysis, only two of the published studies were concerned with the *reduction* of unwanted behavioural responses (binge drinking – Murgraff, White, & Phillips, 1996; smoking – Higgins & Conner, 2003). Whether implementation intentions can reduce saturated fat intake is thus an unresolved issue.

There is theoretical (e.g., Model of Action Phases, Gollwitzer, 1990) and empirical evidence that combining motivational and implementation intention (or planning)-based interventions should yield greater changes in behaviour than using either strategy alone. However, much of the empirical evidence is either fully (e.g., Abraham et al., 1999; Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Norman & Conner, 2005; Wiedemann, Schüz, Sniehotta, Scholz, & Schwarzer, in press) or partly (Sheeran, Webb, & Gollwitzer, 2005) correlational making causal inferences difficult. Few studies have directly manipulated both motivation and implementation intention use. Although the evidence suggests that combining both types of interventions promotes greater behaviour change (Milne, Orbell, & Sheeran, 2002; Prestwich et al., 2003; Sheeran, Milne, et al., 2005), the goal has been to promote desirable behaviours rather than to reduce undesirable behaviours. Therefore the overall objective of the present study was to manipulate motivation *and* implementation intentions to reduce unhealthy behaviour.

Reasoning implementation intentions

In addition to the standard implementation intentions, activating supportive cognitions in critical situations should help one to avoid performing the unhealthy behaviour. We term this new form of planning, *reasoning* implementation intentions. Specifically, they associate the critical situation with a reason that supports one's action (rather than the behaviour directly). As the strategy attempts to generate positive intentions within critical situations, the manipulation might be less dependent on the strength of one's initial motivation. Additionally, this strategy might take advantage of evidence that the self can be a powerful source of persuasion (c.f. Nicholson, 2007) and combine the personalised advantages of tailoring and the efficiency of minimal interventions. Consequently, in addition to the standard implementation intention, a reasoning implementation intention was manipulated in one group of participants to examine its effect on saturated fat intake.

Hypotheses

The following hypotheses were tested:

Hypothesis 1. Saturated fat intake will be reduced significantly more for the participants exposed to the protection motivation message than those not so exposed.
Hypothesis 2. Saturated fat will be reduced significantly more for the participants asked to form standard implementation intentions than those who were not asked to form implementation intentions.

Hypothesis 3. Standard implementation intentions will reduce saturated fat intake significantly more for those who read the protection motivation message than those who did not read the message.
Hypothesis 4. Saturated fat will be reduced significantly more for participants asked to form reasoning implementation intentions than those who did not form implementation intentions.

In the absence of studies comparing the efficacy of different types of implementation intentions, it was predicted that:

Hypothesis 5. There will be no difference between those asked to form standard or reasoning implementation intentions in saturated fat intake.
Hypothesis 6. Reasoning implementation intentions will reduce saturated fat intake equally for those who read the protection motivation message and those who did not read the message.

Methods

Recruitment

The study was conducted between February 2005 and December 2006 and employed three main waves of recruitment (February 2005–April 2005; February 2006–March 2006; November 2006–December 2006), two methods of recruitment (email: $n = 130$, verbal advert within a lecture or workplace: $n = 80$), three sites in the UK (Essex University: $n = 173$; Leeds University: $n = 20$; travel agency in Manchester: $n = 17$); participants completed the measures either inside ($n = 93$) or outside ($n = 117$) the laboratory. The sub-sample of young professionals (travel agents) enhances, albeit to a small extent, the generalisability of the study findings. There were no exclusion criteria. Participants were entered into a prize draw or received course credit.

Prior to recruitment, all participants were informed verbally (or in writing for those participants recruited via email), by one of the three authors, that the study concerned people's healthy eating attitudes and behaviours. After recruitment, within the baseline questionnaire, participants were informed that the study concerned people's healthy eating attitudes and behaviours, specifically in relation to saturated fats; how saturated fats are derived and that foods must contain less than 1% of saturated fat to be classified as low in saturated fat and more than 3% to be classified as high in saturated fat, and given examples of foods high in saturated fat. Similar information was also presented at the beginning of the 1-month follow-up questionnaire.

Sample

Required sample sizes were calculated a priori to detect a moderate sized interaction effect at $p < .05$, with 80% power, allowing 25% drop-out. Two hundred and ten volunteers (191 students, 19 non-students; 50 men, 160 women; mean age = 22.20 years, SD = 5.68 years), therefore, were recruited following ethical approval.

Randomization

Participants were randomized to one of six groups based on a 3 (implementation intention: standard, reasoning, none) × 2 (protection motivation manipulation: yes/no) design and completed measures of food intake at baseline and 1-month follow-up. Those participants responding to the verbal advert were randomly allocated to condition via random distribution of questionnaires within a lecture or the workplace; those recruited via email were allocated to condition using a computer-generated randomization list. In each case, there was no restriction in who was allocated to each condition. The same person generated the allocation sequence (this applied to those completing the measures in the laboratory only; there was no allocation sequence for the lecture-based recruitment), enrolled the participants and assigned participants to their groups. Although it is recommended that different people are used for each of these three stages, as there were no eligibility criteria there was no risk of selection bias. Additionally, different research staff members were employed across the three sites.

Those administering the test were not optimally blinded to condition (e.g., by using sealed envelopes), thus there was some risk of bias. However, the method of distribution, particularly through random distribution of visually similar questionnaires within a lecture hall or workplace, made such bias less probable. Furthermore, the method of distribution (plus period of recruitment, method of recruitment and study site) did not moderate any of the effects of the interventions and thus these factors are not discussed further. To minimize the risk of contaminating the experimental manipulations, the need to refrain from communicating with other people about the study was stressed to all participants. Participants (by not discussing the trial with others), the person entering the data (by receiving only the dependent measures), and the data analyst (by receiving information regarding the study groups coded by number rather than name) were blinded to condition.

Manipulations (interventions)

The control group received no messages.

The group receiving both protection motivation and standard or reasoning implementation intention manipulations received the protection motivation manipulation first. Each manipulation was delivered to the participants as written material within the baseline questionnaire after the measure of food intake. The interventions were thus delivered indirectly (i.e. not face-to-face), individually, did not require training or supervision of the treatment provider, and were of minimal intensity (comprising a single session in which the vast majority of participants completed the baseline measure and manipulation inside 30 min). This single session also minimized issues concerning treatment adherence.

Protection motivation

After completing a baseline measure of food intake, approximately half of the participants were exposed to the protection motivation manipulation. This was a threatening message concerned with severity of the consequences of saturated fat intake and messages to increase response efficacy. For example, the information 'When they (the arteries) become so narrow, coronary heart disease (CHD) occurs and it can cause angina, which results in severe pain and distress and an inability to walk for even short distances' was some of the information used to manipulate perceived severity, while the statement, 'Preventative action can be taken and the earlier in life it starts, the quicker the process of atherosclerosis will halt, and the lower the risk of CHD will be; reducing the intake of saturated fat has been shown to prevent CHD by decreasing the levels of cholesterol and fat in the bloodstream and lowering blood pressure' was designed to increase response efficacy.[1]

Standard implementation intention

Participants in this condition were exposed to a manipulation, within a questionnaire, asking them to form a plan to help them to avoid buying foods that are high in saturated fat. They were informed that their plan should take the form: IF (I'm in situation X) THEN (I will) NOT (do Y) – so that it (a) begins with the word IF; (b) identifies the situations in which they could potentially buy foods that are high in saturated fat; (c) identify what they will do in the situation so that they do not buy foods that are high in saturated fat, and (d) contains the words IF, THEN and NOT in that order. After being presented with suitable examples (e.g., IF I'm in the supermarket THEN I will check the food labels of the product and NOT buy the product if the label says the food contains more than 1.5% (or 1.5 g per 100 g) saturated fat), they were given space to write their plan.

To aid fidelity, participants were then given a checklist of questions, requiring a yes or no response to ensure that their plans were sufficient ('Does your plan identify all of the situations in which you might buy foods that are high in saturated fat over the next month?') and accurately formed (e.g., 'Do your plan(s) identify what you will do in the situation so that you do NOT buy foods that are high in saturated fat?'). They were asked to write further plans if they responded 'no' to any of these questions.

Reasoning implementation intention

This manipulation was identical to the standard implementation intention manipulation with the following exceptions. First, the participants in this condition were informed that their plan should take the form: IF (I'm in situation X) THEN I WILL SAY TO MYSELF (Y so that I do not buy foods that are high in saturated fat.). Second, after identifying the risky situations, they had to identify what they would say to themselves to motivate them not to buy foods that are high in saturated fat. Third, they were presented with different examples of suitable plans (e.g., 'IF I'm in the supermarket and tempted to buy a food that is high in saturated fat THEN I WILL SAY TO MYSELF I don't want to die of a heart attack'). As with the standard manipulation, participants in this condition were presented with a checklist of questions pertaining to the sufficiency of their plans, and space to write additional plans, if necessary.

Measurement of outcomes

Those participating within the laboratory did so in individual cubicles. Participants who received the study materials in the lecture room were asked to complete the materials individually in their own time in a quiet location of their choice. Participants in each condition completed the food intake measure pre-manipulation and at 1-month follow-up. Some motivational measures (perceived severity, perceived vulnerability, fear, and response efficacy) were assessed immediately after the protection motivation manipulation, and the remaining motivational measures (response costs, self-efficacy and intentions) were assessed immediately after the implementation intention manipulation, as manipulation checks.

Primary outcome measure

A validated self-report index of food intake (Margetts, Cade, & Osmond, 1989) was used to measure saturated fat intake. The scale requires participants to rate the frequency that they consumed 63 common foods over the previous month using a 6-point scale (two or more times per day; everyday; three to five times per week; one to two times per week; one to three times per month; rarely or never). The scale has good test–retest reliability ($r(411) = .61$; Armitage & Conner, 1999), convergent validity with 24-h dietary records (e.g., Margetts et al., 1989) and 10-day weighed records (Thompson & Margetts, 1993), and construct validity (Armitage & Conner, 2001). Based on their responses to the 63 foods, a range of dietary scores were generated (Armitage, 2004). The *proportion of energy from saturated fat intake* was the primary outcome calculated at baseline and 1-month follow-up. It was calculated based on 1 g saturated fat providing 9 kcal and using the following formula: grams of saturated fat $\times$ 900/kcal derived from food.

Secondary outcome measures

Each psychological construct relevant to Protection Motivation Theory, including fear, was assessed as a check on the protection motivation manipulation. These self-report measures incorporated 7-point scales and the items were identical to those used by Milne et al. (2002), with the exception that the response efficacy, self-efficacy, response cost and intention items were modified to reflect the behaviour (not buy foods that are high in saturated fat) and time frame (one month) in this study (rather than exercise and 1-week). Alphas are reported in Table 2.

Statistical methods

Missing cells within the food intake measure at time 2 were replaced with responses to equivalent items at time 1, and vice versa (i.e. treated as having no change), and the

[1] A full version of this protection motivation message, and the other interventions, is available from the first author upon request.

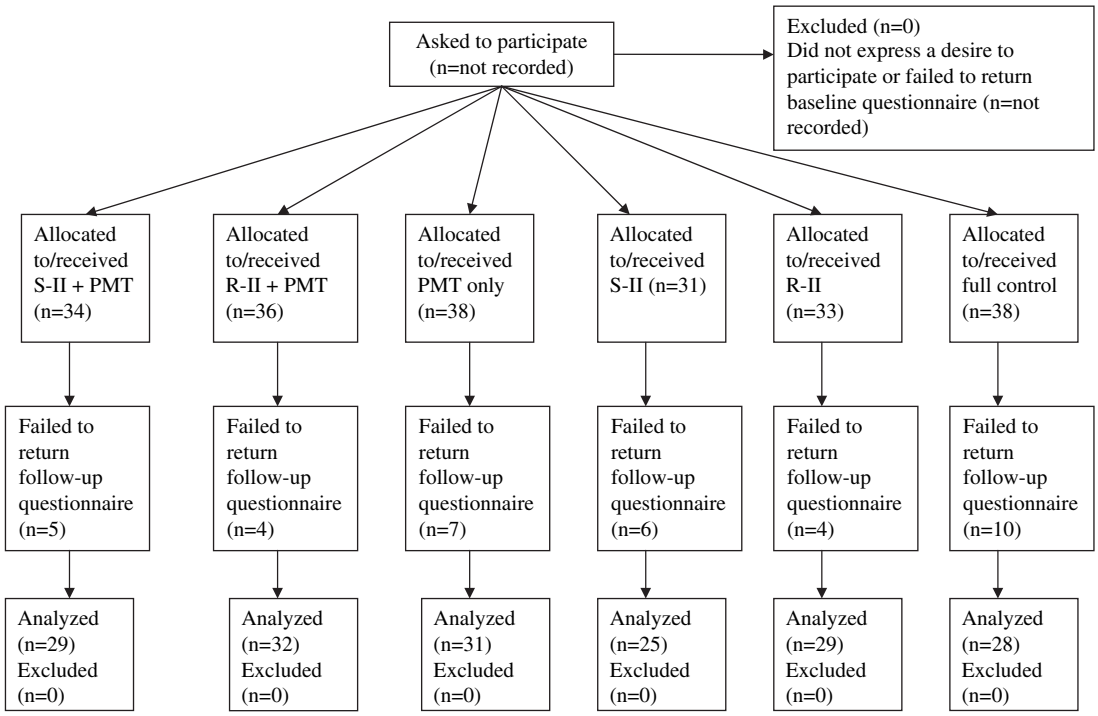

Fig. 1. Sampling frame. Note: S-II = Standard Implementation Intentions; R-II = Reasoning Implementation Intentions; PMT = Protection Motivation Theory Intervention.

analyses are reported on this basis. Missing data were also treated using two alternative methods (replacing all missing values with the value 6 – to denote rare/no consumption of the food; or leaving missing data blank). The results (and thus the conclusions) did not vary significantly according to the method of treating missing data.

ANOVAs examined differences between those completing the study and those who did not, baseline differences between the six conditions and the separate effects of the protection motivation and implementation intention manipulations on secondary outcomes. Chi-square compared the proportion of men and women randomly allocated to condition. ANCOVA tested the effects of the interventions on reducing the proportion of food energy derived from saturated fat during the intervention period, using as between-subjects variables implementation intention type (none, reasoning, and standard implementation intention) and protection motivation (yes, no), and the proportion of food energy derived from saturated fat at baseline as the covariate. Effect sizes *d* are also provided. The data are analysed on an intention-to-treat basis.

Results

There was no investigator-determined exclusion of participants through ineligibility, withdrawal from treatment, or poor adherence to trial protocol. Concerning the last point, of the 134 participants required to form implementation intentions, 23 participants deviated from the protocol. For example, 10 identified risky situations and stated that they would avoid high saturated fat foods but not specifically how they would do this. Thirty-six participants were lost to follow-up. There were no differences between those who dropped out of the study and those who did not on, total energy intake ($F = .78$), the proportion of food energy derived from saturated fat ($F = .00$), age ($F = 1.50$), fear ($F = .09$), or the protection motivation variables (response efficacy: $F = 1.32$; perceived severity items: both $F < .07$; response cost items: both $F < 1.64$; self-efficacy: $F = .06$; intention: $F = .94$, all $p > .20$). An exception was a trend for participants with lower perceived vulnerability to be more likely to dropout ($F = 3.93$, $p = .05$). The flow of the participants through each stage of the study is illustrated in Fig. 1. Two-tailed *p* values are reported throughout.

Baseline characteristics of the sample

The baseline characteristics of the sample are summarized in Table 1. Across the six conditions at baseline, there were no significant differences in the proportion of food energy intake from saturated fat ($F = 1.07$), total energy intake ($F = 1.09$), age ($F = .99$), at baseline (all $p > .36$), proportion of men and women, $\chi^2(5) = 5.49$, $p = .36$, or the proportion of participants being entered into the prize draw or receiving course credit, $\chi^2(5) = 1.29$, $p = .94$.

Protection motivation manipulation check

The protection motivation manipulation significantly increased most of the motivational variables expected to change as a result of the motivation manipulation (see Table 2).

Table 1
Mean (SD) of baseline characteristics of the sample across implementation intention and protection motivation conditions

Variable	Standard II + protection motivation	Reasoning II + protection motivation	Protection motivation only	Standard II	Reasoning II	Full control
	$n = 34$	$n = 36$	$n = 38$	$n = 31$	$n = 33$	$n = 38$
Age	23.29 (7.88)	20.47 (3.46)	22.74 (5.74)	22.13 (5.71)	22.39 (4.99)	22.18 (5.53)
Total food energy intake (kcal)	1720 (699)	1747 (726)	1672 (583)	1569 (407)	1599 (603)	1875 (671)
Percentage of food energy from saturated fat	14.60 (3.01)	14.49 (3.22)	14.58 (2.70)	14.77 (4.16)	15.90 (3.53)	15.47 (3.18)
Number of men/women	8/26	4/32	9/29	7/24	11/22	11/27

Note: II = Implementation intention.

Change in energy intake from saturated fats

As shown in Table 3, those in the no-intervention control (mean change in the proportion of food energy intake derived from saturated fat +.49%), protection motivation message only (+.41%) and standard implementation intentions (no protection motivation message) (+.36%) conditions each reported deriving more food energy from saturated fat at follow-up than baseline. Those asked to form reasoning implementation intentions, regardless of whether they received the protection motivation message (−.51%) or not (−.81%), reported a reduction in the proportion of food energy derived from saturated fat. Those forming standard implementation intentions after reading the protection motivation message reported the greatest reduction (−2.21%). The results of the ANCOVAs comparing the various interventions are summarized in Table 4.

Hypotheses 1, 2, 4, 5: reduction in fat intake after protection motivation message and standard and reasoning implementation intentions.

A significant main effect of protection motivation (ANCOVA 1) indicated that those exposed to the protection motivation message had lower proportions of food energy derived from saturated fat at time 2 than those not exposed to this message ($p = .02$; $d = .26$).[2] Hypothesis 1 was, therefore, accepted.

The main effects of implementation intention type (ANCOVA 2–3) showed that those who were asked to form reasoning implementation intentions consumed proportionally less saturated fat than those not asked to form implementation intentions ($p = .04$; $d = .28$); and those asked to form standard implementation intentions derived a significantly smaller proportion of food energy from saturated fat than those not asked to form implementation intentions ($p = .004$; $d = .40$). Hypotheses 2 and 4 were, therefore accepted. Hypothesis 5 was also accepted as the efficacy of the standard and reasoning implementation intentions did not differ (when exposure to the protection motivation message was controlled $p = .48$; $d = .10$).

Hypotheses 3 & 6: Did the efficacy of the implementation intention manipulations vary depending on whether they were paired with a motivational intervention, or not?

The significant two-way interaction in ANCOVA 1 showed that the efficacy of one of the implementation intention groups (standard, reasoning, or no implementation intention group) varied depending on whether or not they were asked to read the protection motivation message. The significant two-way interactions in ANCOVAs 2 ($p = .01$; $d = .35$) and 4 ($p = .008$; $d = .36$) revealed that the effects of standard implementation intentions on self-reported behaviour increased when combined with the protection motivation message. Hypothesis 3 was, therefore, accepted. A non-significant two-way implementation intention × protection motivation message interaction in ANCOVA 3 ($p = .83$; $d = .03$) suggested that the efficacy of reasoning implementation intentions (and the no implementation intention control) did not vary according to whether the participants read the protection motivation message or not, supporting hypothesis 6.[3]

Secondary outcomes

The implementation intention manipulation (standard, reasoning none) had no effect on intentions, $F(2, 206) = 1.84$, $p = .16$, self-efficacy, $F(2, 206) = .13$, $p = .88$, or response costs (item1: $F(2, 206) = 2.35$, $p = .10$; item 2: $F(2, 206) = 1.04$, $p = .36$). This indicates that the effects of the implementation intention strategies cannot be attributed to a within-session increase in motivation.

Discussion

The research findings show that combining standard implementation intentions and protection motivation

[2] Effect size d was calculated using the formula: $d = 2\sqrt{((F(1-\rho^2)(df_w - 1))/(n(df_w - 2))}$, where ρ (.693) represents the correlation between the baseline and follow-up dependent variable scores and df_w represents the residual df.

[3] In relation to multiplicity, similar effects emerged on the proportion of food energy derived from saturated fat measure using equivalent analyses (i.e. three-way implementation intention × protection motivation message × time ANOVAs). In addition, although we had a single primary outcome, it is possible to generate a measure representing the proportion of energy derived from *overall fat intake*. Additional ANCOVAs on this measure revealed similar effects. Specifically, a main effect of implementation intention type (II-S; II-M; No II), $F(2, 167) = 5.05$, $p = .007$, and an implementation intention type x protection motivation message interaction, $F(2, 167) = 4.56$, $p = .01$, emerged. Follow-up ANCOVAs revealed that II-M showed a marginally greater reduction in the proportion of food energy derived from fat compared to the controls, $F(1, 115) = 3.33$, $p = .07$, while the II-S showed significant benefit over the controls, $F(1, 108) = 11.44$, $p = .001$. Again, the efficacy of II-S was dependent on its pairing with the protection motivation message (with message: $F(1, 57) = 22.06$, $p < .0005$; without message: $F(1, 50) = .08$, $p = .78$).

Table 2
Means (SD) of motivation variables across groups and associated univariate *F* tests ($n = 208$[a])

	Protection motivation message ($n = 106$)	No protection motivation message ($n = 102$)	*F*	Estimated between-group difference	CI_{95}
Intention ($\alpha = .88$)	4.92 (1.46)	4.50 (1.56)	4.02*	.42	.01–.83
Self-efficacy ($\alpha = .85$)	4.97 (1.44)	4.69 (1.74)	1.67	.29	−.15–.72
Fear ($\alpha = .95$)	5.06 (1.32)	4.63 (1.44)	5.21*	.44	.06–.81
Perceived severity ($\alpha = .08$)					
Item 1	5.69 (1.82)	5.06 (1.87)	6.07*	.63	.13–1.13
Item 2	5.77 (1.28)	5.46 (1.38)	2.88	.31	−.05–.68
Perceived Vulnerability ($\alpha = .73$)	3.93 (1.15)	3.55 (1.23)	5.28*	.38	.05–.71
Response efficacy ($\alpha = .71$)	6.16 (.90)	5.62 (1.13)	14.68**	.54	.26–.82
Response costs ($\alpha = .38$)					
Item 1	5.72 (1.27)	5.32 (1.48)	4.25*	.39	.02–.77
Item 2	5.18 (1.58)	5.25 (1.60)	.09	.07	−.50–.37

*$p < .05$; **$p < .0005$; $CI_{95} = 95\%$ confidence interval.
[a] Two participants did not complete some of the items assessing Protection Motivation Theory variables.

manipulations was more effective in reducing saturated fat than manipulating either alone. Standard implementation intentions were ineffective without the protection motivation manipulation. The study also tested a new form of implementation intentions in which participants provided the reasons for their intention. This new variant of implementation intentions had a small, albeit significant, effect on reducing saturated fat intake. Its effects on saturated fat intake did not vary as a function of the protection motivation manipulation.

The interaction between protection motivation and standard implementation intentions is generally consistent with existing theoretical and empirical evidence. The Model of Action Phases (Gollwitzer, 1990), for example, suggests that targeting both motivational and volitional aspects of goal-striving, the latter through implementation intentions, should be a particularly effective means to change behaviour. It is also congruent with evidence that manipulating intentions does not necessarily equate to behaviour change (e.g., Webb & Sheeran, 2006). The finding supports correlational data demonstrating an interaction between intentions and planning whereby intentions are more predictive of behaviour when an individual has formed a concrete plan of action or implementation intention (e.g., Norman & Conner, 2005). It is also in line with experimental work that has manipulated both motivation and implementation intentions (e.g., Prestwich et al., 2003). The study reported here is the first attempt to focus on combining implementation intentions with motivational manipulations for the *reduction* of unhealthy behaviour rather than the promotion of desired behaviours. Failing to adopt such a combined approach might explain the weak effects of implementation intentions in previous diet studies (e.g., Armitage, 2004; Bamberg, 2002).

The research also presented initial evidence that reasoning implementation intentions can be successful in changing behaviour. They make salient one's reasons for (not) performing a particular action in a specific context rather than their behaviour (e.g., avoiding unhealthy foods) directly. Reasoning implementation intentions were significantly more efficacious in reducing the proportion of food energy derived from saturated fat than having no implementation intentions, and their impact was not moderated by the protection motivation message. Explanations for the added effect of reasoning might entail generating motivation, or cueing intentions, within critical situations (e.g., when people are at risk of purchasing high-fat foods). People should become less likely to forget their intention and/or for it to be re-prioritized behind competing goals. Dealing with issues related to forgetting or goal conflict should enhance the relationship between intentions and behaviour (Sheeran, Milne, et al., 2005).

While the reductions in the proportion of *saturated* fat intake were rather modest in the reasoning implementation intentions groups (the difference was approximately .5–.8% in absolute terms, and >1% relative to the control groups that were not asked to form implementation intentions), this figure should be put into context. A 1% reduction in the proportion of food intake from fats, when applied at a population level, could result in 10,000 lives saved in the US alone (c.f. Armitage & Conner, 2001).

It is not known at this stage, however, how easily this intervention can be employed for public health benefits as participants in our study were required to complete

Table 3
Pre- and Post-intervention primary outcome means (SD)

Variable	Time	Standard II + protection motivation	Reasoning II + protection motivation	Protection motivation only	Standard II	Reasoning II	Full control
		n = 29	n = 32	n = 31	n = 25	n = 29	n = 28
Percentage of food	T1	14.60 (2.89)	14.46 (3.23)	14.57 (2.89)	15.01 (4.20)	15.95 (3.52)	15.27 (3.00)
Energy from saturated fat	T2	12.39 (2.82)	13.95 (3.52)	14.98 (3.21)	15.37 (4.40)	15.14 (4.28)	15.76 (3.89)

Note: II = Implementation intention.

Table 4
ANCOVA *F*-values (df) comparing the proportion of food energy derived from saturated fat at follow-up across implementation intention and protection motivation message conditions (controlling for proportion of food energy derived from saturated fat at baseline)

	Protection motivation message	Implementation intention type	Protection motivation message × implementation intention type
1. Proportion of food energy from saturated fat (S-II vs. R-II vs. No II)	5.72* (1, 167)	4.40* (2, 167)	4.41** (2, 167)
2. Proportion of food energy from saturated fat (S-II vs. No II)	9.24** (1, 108)	8.74** (1, 108)	6.73* (1, 108)
3. Proportion of food energy from saturated fat (R-II vs. No II)	.04 (1, 115)	4.42* (1, 115)	.05 (1, 115)
4. Proportion of food energy from saturated fat (S-II vs. R-II)	7.30** (1, 110)	.50 (1, 110)	7.19** (1, 110)

Note: $^{*}p < .05$; $^{**}p < .01$; S-II = Standard Implementation Intentions; R-II = Reasoning Implementation Intention; No II = No Implementation Intention Manipulation.

measures of cognitions (and received some sort of incentive- entry into a prize draw or course credit). The measurement and incentive effects (e.g., Greenwald, Carnot, Beach, & Young, 1987) could contribute (interactively) to the intervention effect, although it does not undermine that there were additional benefits of the interventions over the control group. Furthermore, given the size of the statistical effects obtained by the reasoning implementation intention conditions, and that this represents the first test of the strategy, additional research is needed to establish their efficacy and to further examine whether its success varies depending on whether they are combined with a motivational intervention or not. There are other reasons why the findings from this research should be treated with some degree of caution.

First, the study relied on self-reports (though valid) of food intake and objective indices might be preferable. Second, although we included both student and non-student participants, and none of the effects were moderated by whether the participant was a student or not, the true generalisability of the interventions is not known. Related to this, there are potential shortcomings of these interventions. It is unknown whether these effects still occur for individuals who have strong cravings for foods that are high in saturated fat (or for addictive behaviours). In addition, exerting self-control in relation to one's food consumption might have negative consequences for other behaviours that require self-control (such as avoiding smoking) as self-control can be viewed as a limited resource (Baumeister, Bratlavsky, Muraven, & Tice, 1998). Finally, the study was powered to detect significant effects rather than to make strong conclusions regarding null effects. Consequently, the non-significant effects reported in this study (e.g., the lack of difference in the proportion of energy derived from saturated fat between standard and reasoning implementation intentions overall) should be treated with caution.

In summary, the study provides further evidence that standard implementation intention interventions should be paired with motivational techniques in order to maximise their efficacy. Participants asked to form standard implementation intentions targeted directly at behaviour change were successful in reducing the proportion of food energy derived from saturated fat only when they also read the protection motivation message. It also provides initial evidence that alternative implementation intentions targeting motivation can be similarly effective but their impact might not be dependent on the baseline strength of one's intentions.

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