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Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions

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Objective. This study compared a motivational intervention based on protection motivation theory (PMT, Rogers, 1975, 1983) with the same motivational intervention augmented by a volitional intervention based on implementation intentions (Gollwitzer, 1993).

Design. The study had a longitudinal design, involving three waves of data collection over a 2-week period, incorporating an experimental manipulation of PMT variables at Time 1 and a volitional, implementation intention intervention at Time 2.

Method. Participants ($N = 248$) were randomly allocated to a control group or one of two intervention groups. Cognitions and exercise behaviour were measured at three time-points over a 2-week period.

Results. The motivational intervention significantly increased threat and coping appraisal and intentions to engage in exercise but did not bring about a significant increase in subsequent exercise behaviour. In contrast, the combined protection motivation theory/implementation intention intervention had a dramatic effect on subsequent exercise behaviour. This volitional intervention did not influence behavioural intention or any other motivational variables.

Conclusions. It is concluded that supplementing PMT with implementation intentions strengthens the ability of the model to explain behaviour. This has implications for health education programmes, which should aim to increase both participants' motivation and their volition.

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Coronary heart disease (CHD) is one of the most significant causes of death in modern industrial societies. Indeed, 44% of all deaths of the UK in 1994 were attributed to cardiovascular disease (British Heart Foundation, 1996). Approximately 300 000 heart attacks are experienced in the UK (British Heart Foundation, 1996) and $1\frac{1}{2}$ million in the USA each year (American Heart Association, 1995). Of these, more than a third will result in death. In a recent review, Miller, Balady, and Fletcher (1997) reported an accumulation of evidence to show that a physically inactive lifestyle doubles the risk of developing CHD. Regular exercise has been shown to prevent CHD by decreasing levels of cholesterol and fat in the bloodstream and by lowering blood pressure. This, in turn, dramatically reduces the primary cause of CHD, atherosclerosis, the build-up of fatty deposits on the artery walls (Bouchard & Despres, 1995). Although atherosclerosis often leads to CHD in middle age, the process occurs throughout life. Thus, to have the best chance of lowering the risk of CHD, preventive habits need to be developed at an early age (Clarkson, Manuck, & Kaplan, 1986). The greatest decrease in exercise participation throughout life occurs during late adolescence (Stephens, Jacobs, & White, 1985). Bauman, Owen, and Rushworth (1990) found that only 25% of Australians under 20 years of age engaged in regular exercise. Makrides, Veinot, Richard, McKee, and Gallivan (1998) found that fewer than half of the students in a Canadian university participated in regular exercise. This suggests that an intervention designed to increase exercise participation among young adults would be of considerable value.

Many researchers and practitioners aiming to develop health education interventions to promote precautionary actions, such as exercise, have turned to social cognitive models of behaviour. One such model, which has been shown to be useful in the prediction of, and intervention in, health-related behaviours, is protection motivation theory (PMT, Rogers, 1975, 1983. For recent literature reviews see Boer & Seydel, 1996; Rogers & Prentice Dunn, 1997. For meta-analytic reviews, see Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orbell, 2000).

The model proposes that protection motivation is the variable that 'arouses, sustains and directs activity' and is operationalized in terms of peoples' *intentions* to perform a recommended precautionary behaviour. Intention is influenced by two processes: threat appraisal and coping appraisal. *Threat appraisal* concerns the evaluation of the components of a fear appeal relevant to an individual's perception of how endangered he or she feels by a threat disease(s). The PMT variables involved in threat appraisal are perceived vulnerability, perceived severity and fear arousal. An individual perceiving the threat to be high will be more likely to be motivated to adopt the recommended protective behaviour. *Coping appraisal* evaluates the components of a fear appeal that are relevant to an individual's assessment of the recommended coping response to the appraised threat. Coping appraisal involves beliefs about response efficacy, self-efficacy and response costs. An individual will be more likely to intend to adopt the recommended coping response if he or she believes that the response will be effective, feels able to perform the recommended behaviour and perceives the behaviour to be low in cost (see Boer & Seydel, 1996; Floyd *et al.*, 2000; Milne *et al.*, 2000; Rogers & Prentice-Dunn, 1997, for more detailed description of the model and its measurement).

Unlike other social cognitive models of health-related behaviour, such as the theory of reasoned action (TRA, Ajzen & Fishbein, 1980) and the theory of planned behaviour (TPB, Ajzen, 1985), PMT has been subjected to several *experimental* tests. Studies have manipulated PMT variables within a fear-arousing communication in order to explore the effects of the intervention on subsequent beliefs, intentions and behaviour. Three

studies have explored the effects of manipulating PMT variables on exercise cognitions, intention and behaviour (Fruin, Pratt, & Owen, 1991; Stanley & Maddux, 1986; Wurtele & Maddux, 1987). Fruin *et al.* and Stanley and Maddux examined cognitions and intentions while Wurtele and Maddux also included a measure of subsequent behaviour. All three interventions were successful in changing PMT cognitions. Self-efficacy was found to predict intention to exercise in all three studies, whereas Stanley and Maddux found that perceived response efficacy also influenced intention to exercise. Perceived vulnerability to heart disease and stroke was the only threat or coping appraisal variable that predicted participation in aerobic exercise (Wurtele & Maddux, 1986). These findings indicate that experimental manipulations are generally very effective in influencing subsequent cognitions and intention. However, in a recent review Milne *et al.* (2000) have shown that their effectiveness in influencing subsequent behaviour is more limited.

Difficulties arise in applying such experimental manipulations to real-world health education intervention programmes. This is because it is not generally practical or ethical in health education settings to provide participants with false information in order to manipulate the levels of a variable (e.g. to tell participants that heart disease is not a serious condition in order to produce 'low' perceived severity). There is also the difficulty that most experimental tests of PMT involve two experimental groups (one receiving, e.g. a 'high' severity communication and the other receiving a 'low' severity communication), but do not include a control condition in which participants receive no information (e.g. Fruin *et al.*, 1991; Maddux & Rogers, 1983; Rippetoe & Rogers, 1987; Wurtele, 1988). Thus, it is unclear how successful the interventions are relative to not receiving the intervention (see, however, Sturges & Rogers, 1996; Tanner, Day, & Crask, 1989). In a real-world health education intervention the effects of providing factual information would be compared with a no information condition.

Three studies have examined the effects on behavioural intentions of a PMT-based health education intervention employing factual information (Boer & Seydel, 1996; Seydel, Taal, & Weigmen, 1990; Steffen, 1990). In these studies, one group received information about the health threat and recommended response and a control group received no information (e.g. Seydel *et al.* showed an experimental group an educational TV film about cancer, while the control group watched a programme about an unrelated topic). These interventions have not been as successful in bringing about cognition or intention change as interventions involving two experimental groups (Milne *et al.*, 2000). To our knowledge, only one factually based health intervention study (Seydel *et al.*, 1990) examined subsequent behaviour. They found that a health education communication, based on PMT variables, had no effect on the behaviour of ordering leaflets about cancer. Thus, research is needed to find the best ways of manipulating PMT variables within a factual health education intervention and to establish the effect of such a health education intervention on subsequent behaviour. The first aim of the present study was to examine the effects of a factual health education intervention based on all PMT variables on subsequent PMT cognitions, intention and behaviour.

Another important issue is that the success of the intervention tends to be measured immediately following the manipulation in PMT intervention studies. Thus, cognitive change is measured when the information is still fresh in the minds of the participants (Wurtele & Maddux, 1987). In real-life health education settings, it is important to establish that the effects of an intervention last over time. The present study is the first to include all PMT variables in a longitudinal health education intervention study (cf. Milne *et al.*, 2000) and to measure the stability of the effects

of the intervention on subsequent changes in cognitions, intention and behaviour in a longitudinal design.

As discussed above, PMT has been found to account well for intention to change behaviour. However, the model's ability to explain subsequent behaviour is more limited (Floyd *et al.*, 2000; Milne *et al.*, 2000). This reflects accumulating evidence to suggest that social cognitive models of health-related behaviour are generally more successful at predicting intention than behaviour (Norman & Conner, 1996). Thus, these accounts can be viewed as adequate accounts of *motivation* (intention). However, motivation to perform a behaviour does not automatically translate into action, and research has recently turned to an investigation of the volitional processes involved in behavioural enactment.

According to Gollwitzer (1993) and Heckhausen (1991), motivation is just the starting point for behavioural performance. They propose a model of action phases which suggests that adopting a behaviour has two distinct stages. The first is a motivational or deliberative phase during which the individual weighs up the costs and benefits of performing the behaviour. This phase parallels the view of intention formation offered by PMT and culminates in the development of a behavioural intention. Unlike PMT, Gollwitzer and Heckhausen (Gollwitzer, 1993; Gollwitzer, Heckhausen, & Steller, 1990; Heckhausen, 1991; Heckhausen & Gollwitzer, 1987) also posit a post-intentional or *volitional* phase during which the individual develops strategies and plans in order to ensure that their intention will be enacted. Thus, the model of action phases suggests that behaviour is most likely when the individual is both motivated to act *and* has developed strategies and plans which promote behavioural enactment. This suggests that a motivational model such as PMT could usefully be supplemented by volitional strategies in order to increase the likelihood of performing health behaviours.

One volitional strategy that has received empirical support over recent years is the concept of implementation intentions (Gollwitzer, 1993, 1996; Gollwitzer & Brandstätter, 1997. For a discussion of implementation intentions in relation to health goals see Gollwitzer & Oettingen, 2000). Gollwitzer (1993) draws a distinction between a *goal intention* (e.g. 'I intend to exercise.') and an *implementation intention*, which is a specific action plan concerning exactly how, when and where an intended goal-directed behaviour will be enacted (e.g. 'I will exercise by doing my step-aerobic video in the living room at 6.00 pm when I get in from work.'). Implementation intentions have been found to dramatically increase the likelihood of performing health behaviours in many experimental studies (for a discussion of the role of implementation intentions in health psychology see Gollwitzer & Oettingen, 2000). The TPB (Ajzen, 1985) to predict behaviour has been found to greatly increase with the addition of an implementation intention intervention. For example, in an earlier study, Orbell, Hodgkins, and Sheeran (1997), we found that 100% of women who formed an implementation intention concerning where and when they would perform breast self-examination subsequently performed the examination compared with just 53% of the control group. Similarly, Sheeran and Orbell (1999) found that participants were less likely to miss taking vitamin supplements if they were induced to form implementation intentions concerning where and when they would take a pill each day. TPB was also found to predict cervical smear screening attendance when augmented with implementation intentions (Sheeran & Orbell, 2000). Other studies have shown implementation intentions to be effective in increasing functional activity following joint replacement surgery (Orbell & Sheeran, 2000) and in increasing healthy eating (Verplanken & Faes, 1999).

According to Gollwitzer (1993, 1996), the formation of implementation intentions serves to delegate control of the behaviour to the environmental cues specified in the implementation intention. Thus, implementation intentions aid performance of behaviour because when the specified conditions are met the environmental cues stimulate automatic activation of behaviour. Thus, the opportunity for action is not missed, even if it presents itself for only a fleeting moment. This view is supported by findings showing that participants are extremely likely to perform the behaviour at the time and in the location they had previously specified in their implementation intentions (e.g. Orbell *et al.*, 1997; Sheeran & Orbell, 1999). The formation of a goal intention on its own is not sufficient to produce this effect (Gollwitzer, 1993; Gollwitzer & Brandstätter, 1997). Moreover, forming an implementation intention will not, on its own, influence behaviour. Implementation intentions must be preceded by a goal intention. This is because implementation intentions work in the service of goal intentions (Gollwitzer, 1993).

As discussed previously, PMT has an advantage over TPB in health research as it has often been implemented in experimental manipulation studies. Thus, the success of implementation intentions in increasing prediction of behaviour within the TPB framework suggests that combining a motivational intervention based on PMT with a volitional intervention based on implementation intentions would be more likely to increase exercise behaviour than a motivational intervention alone. This study adds to the growing literature on the role of implementation intentions in health psychology by assessing their utility within the framework of PMT. It is also the first study to augment a motivational manipulation with an implementation intention intervention.

The specific aims of the study were:

(i) To assess the effect of a motivational intervention employing a health education leaflet which addresses all PMT variables (i.e. perceived vulnerability, perceived severity, fear, response efficacy, self-efficacy and response-costs) on subsequent changes in exercise cognitions, intention and behaviour. The following hypotheses were tested.

> *Hypothesis 1.* The PMT-based motivational intervention will increase perceptions of vulnerability, perceived severity, fear, self-efficacy and response efficacy and reduce perceived response costs.
> *Hypothesis 2.* The motivational intervention will increase intention to engage in at least one 20-minute session of exercise over the following week.
> *Hypothesis 3.* The effects of the motivational intervention on PMT cognitions and intention will remain stable over the three time points of the study.

(ii) To determine whether supplementing a motivational, PMT-based intervention with an implementation intention intervention will improve the likelihood of adopting exercise behaviour. We formed two hypotheses:

> *Hypothesis 4.* The addition of a volitional intervention, forming an implementation intention, to the PMT-based motivational intervention will increase participation in at least one 20-minute session of exercise over the following week.
> *Hypothesis 5.* Participants who form implementation intentions will engage in exercise on the day and at the time and place specified in their implementation intention.

Method

Sample details

The sample comprised undergraduate students at a UK university. Participation was voluntary with course credits offered to those who participated at all three time points. Two hundred and ninety-six questionnaires were distributed at Time 1, of which 273 were completed. Two hundred and fifty participants completed the questionnaires at all three time points. Two participants were eliminated from the sample for medical reasons. The final sample was $N = 248$, a response rate of 84% of the questionnaires distributed at Time 1. *T*-tests were carried out to ensure that participants who dropped out of the study at Time 2 or Time 3 did not differ on previous behaviour, intention and the PMT variables compared with those who completed all three questionnaires. There were no significant differences on any variables, which suggests that the final sample was representative. Seventy-three per cent of the sample were women. The age range was 18–34 years ($M = 20.04$, $SD = 2.23$). Participants were randomly allocated to one of three groups: experimental group 1, who received only the motivational intervention ($N = 93$); experimental group 2, who received both the motivational intervention and the volitional intervention ($N = 79$); and a control group ($N = 76$), who received neither intervention.

Study design and procedure

The study took the form of a longitudinal study, involving three waves of data collection over a 2-week period. The study incorporated an experimental manipulation of PMT variables at Time 1 and a volitional intervention at Time 2. The study was presented to participants as an investigation of young adults' attitudes and behaviour patterns concerning regular exercise. At Time 1 participants were asked to complete background questions concerning their age, gender and exercise behaviour patterns over the previous week, month and year. They were told that an exercise session must be at least 20 minutes long and should be enough to cause a noticeable increase in heart rate, i.e. 'a pounding sensation'. In addition, they were told that an exercise session longer than 20 minutes (e.g. 1 hour of exercise) counts as one session.

The motivational intervention was administered in the Time 1 questionnaire following the background questions. Participants in experimental groups 1 and 2 were asked to read a health education leaflet. The leaflet provided factual information about CHD and the benefits of exercise and was based on PMT variables. The control group were asked to read the opening three paragraphs of a novel.

At Time 1, PMT variables and intention were measured immediately after the motivational intervention. One week later (Time 2), participants were asked how many times they had engaged in at least one 20-minute session of exercise over the last week. All participants then completed the PMT and intention measures a second time. Experimental group 2 was also asked to form an implementation intention regarding when and where they would carry out exercise in the following week. All three groups received the third questionnaire 1 week later (Time 3), which again assessed PMT variables, intention and behaviour. In addition, participants were asked when and where they had engaged in exercise and why they had not exercised if they had intended to do so.

Interventions

Protection motivation theory variables

The PMT constructs were manipulated using a factual health education leaflet containing information about the prevalence and nature of CHD and the effects of exercise on preventing the disease. The leaflet was checked for validity by a hospital consultant in pulmonary function and general medicine. Each PMT variable was manipulated in the leaflet. Participants in experimental groups 1 and 2 were told that: 'The following passage presents a true account of the effect exercise has on reducing the risk of coronary heart disease.'

Perceived severity was manipulated by outlining the painful and debilitating effects of CHD:

> The effects of angina can cause severe pain and distress and lead to the inability to walk for even short distances .... When a coronary artery has become narrowed due to CHD it can more easily become blocked by an obstructing deposit or a blood clot. This causes the heart muscle to become sufficiently short of blood for part of it to die. This is the cause of a heart attack. This is a medical emergency and often proves fatal in severe cases.

Perceived vulnerability was manipulated using two statements to increase the belief that young adults who do not exercise are vulnerable to developing CHD in the future:

> ... the process (atherosclerosis, the process of fatty deposit build-up on the coronary artery wall) occurs throughout life. This means that the arteries are progressively narrowing until they are so narrow that CHD occurs .... If a young adult does not engage in regular exercise atherosclerosis is already causing progressive narrowing of the coronary artery.

Response efficacy was manipulated by explaining the effectiveness of exercise in preventing CHD:

> 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. Regular (at least one 20-minute session a week) vigorous exercise such as sports, swimming, aerobics, dancing, running or walking briskly, has been shown to prevent CHD by decreasing the levels of cholesterol and fat in the bloodstream and lowering blood pressure. Reduced blood levels of fat and cholesterol and lower blood pressure have both been shown to dramatically slow down the build-up of fatty deposits on the artery walls.

Participants were also told that: 'Most young adults who have stuck to a regular exercise program have found it to be very effective in reducing their chances of developing CHD'.

Self-efficacy was manipulated in two ways, first, by suggesting that it would be easy for participants to engage in exercise: 'Most young adults have the cognitive and physical ability to engage in regular exercise. Indeed, the Sports Council hold that anyone can find an exercise that they are able to do'.

Bandura (1991) suggests that the best way to increase an individual's perceived self-efficacy is to provide direct experience. It is not always practical to incorporate direct experience into health education. Another way of inducing experience is by use of imagination.

The following tactic was therefore also used to manipulate self-efficacy: 'If an individual doubted their ability to find an exercise they could do it would be useful to imagine themselves doing a few different exercises and they would soon find one they felt confident in trying'.

Response costs were manipulated by the statement: 'Although adopting a regular exercise does have its costs most young adults find these to be very minor and easily overcome and find that the benefits of a regular exercise programme far outweigh the costs'.

Implementation intentions

Following previous studies (Gollwitzer, 1993; Gollwitzer & Brandstätter, 1997; Orbell *et al.*, 1997) participants in experimental group 2 were asked to form an implementation intention specifying where and when they would engage in exercise over the coming week. The following passage was presented after the measures of PMT variables, intention and behaviour at Time 2:

> Many people find that they intend to take at least one 20-minute session of vigorous exercise but then forget or 'never get around to it'. It has been found that if you form a definite plan of exactly when and where you will carry out an intended behaviour you are more likely to actually do so and less likely to forget or find you don't get round to doing it. It would be useful for you to plan when and where you will exercise in the next week.

They were then asked to complete the following statements:

> During next week I will partake in at least 20 minutes of vigorous exercise on (day or days)_____ at _____ (time of day) at/or in (place)_____.

Measures

Protection motivation theory variables

PMT variables were measured on 7-point Likert scales, comprising belief statements coupled with appropriate response items. Items measuring the PMT constructs and intention were randomized in such a way that patterns of questions were less obvious to the participants (cf. Sheeran & Orbell, 1996). Measures of PMT variables were the same at all three time points (see Appendix 1 for measures of PMT constructs, including intention). In addition to the PMT items, 4 items assessed *previous exercise behaviour* at Time 1: 'How many times did you partake in vigorous exercise for at least 20 minutes over the last month (e.g. sport, swimming, aerobics, dancing, running or walking briskly)?' 'Did you engage in vigorous exercise for at least 20 minutes last week? (yes/no)', 'If so, how many times?' and 'Over the last year I have engaged in vigorous exercise for at least 20 minutes (every week–never)'. These measures were taken prior to the manipulation of PMT variables. There were also two measures of *subsequent behaviour*, taken before the implementation intention intervention at Time 2 and again at Time 3: 'Did you engage in at least one 20-minute session of vigorous exercise last week? (yes/no)' and 'If so, how many sessions did you partake in?'

Other measures

At Time 3 participants were asked when and where they participated in exercise in order to compare actual times and places in which the exercise took place with those specified in their implementation intentions. An open-ended question was also included at Time 3, asking participants 'If you intended to partake in at least one 20-minute session of vigorous exercise last week but did not do so, why not?'

Scale reliabilities

Cronbach's alphas (Cronbach, 1951) were computed in order to check that variables measured by multiple items formed reliable scales. The 2 items measuring perceived severity (αs = .54, .55 and .55, for Times 1–3, respectively) and the 2 items measuring response efficacy (αs = .38, .43 and .58, for Times 1–3, respectively) were not reliable and were included as separate items in subsequent analyses. All other PMT variables and intention formed reliable scales, with αs ranging from .73 to .95. Reliabilities, means and standard deviations for study variables are shown in Table 1.

Table 1. Variables, scale reliabilities, mean and standard deviations for the whole sample

Variables	Time	Items (*N*)	α	Range	*M*	SD
Threat appraisal						
Perceived vulnerability	T1	2	.87	1–7	4.16	1.43
	T2	2	.73	1–7	4.22	1.27
	T3	2	.75	1–7	4.21	1.26
Perceived severity 1 (premature death)	T1	1	—	1–7	5.45	1.73
	T2	1	—	1–7	5.43	1.65
	T3	1	—	1–7	5.48	1.56
Perceived severity 2 (pain)	T1	1	—	1–7	5.75	1.22
	T2	1	—	1–7	5.60	1.25
	T3	1	–	1–7	5.67	1.25
Fear	T1	4	.93	1–7	4.62	1.42
	T2	4	.95	1–7	4.66	1.41
	T3	4	.95	1–7	4.76	1.33
Coping appraisal						
Response efficacy 1 (lessen chances of CHD)	T1	1	—	1–7	5.77	1.23
	T2	1	—	1–7	5.75	1.16
	T3	1	—	1–7	5.73	1.09
Response efficacy 2 (positive effects reduce risk of CHD)	T1	1	—	1–7	5.31	1.70
	T2	1	—	1–7	5.34	1.60
	T3	1	—	1–7	5.50	1.43
Self-efficacy	T1	4	.78	1–7	5.59	1.43
	T2	4	.78	1–7	5.65	1.44
	T3	4	.80	1–7	5.54	1.43
Response costs	T1	4	.73	1–6	2.29	1.19
	T2	4	.76	1–6	2.32	1.22
	T3	4	.76	1–6	2.31	2.31
Intention	T1	2	.82	1–7	5.46	1.76
	T2	2	.80	1–7	5.48	1.68
	T3	2	.85	1–7	5.52	1.75
Behaviour (No. of sessions)	T1	1	—	0–7	1.18	0.69
	T2	1	—	0–7	1.01	0.66
	T3	1	—	0–7	1.11	0.50

Results

Randomization checks

There were no significant differences between the three groups in terms of previous frequency of exercise behaviour over the year ($F(1,247) = 0.26$, n.s.), month ($F(1,247) = 1.13$, n.s.) or week ($F(1,247) = 0.30$, n.s.) prior to the study. There were also no significant differences in age ($F(1,247) = 0.25$, n.s.) or gender ($\chi^2(2) = 1.50$ n.s.). Finally, there were no significant differences in intention or any of the PMT variables between experimental groups 1 and 2 either at Time 1 or at Time 2 (see Table 2). Thus, the volitional intervention was not confounded by differences on intentions or variables influencing intentions.

Descriptive findings

The means and standard deviations for study variables at all three time points are shown in Table 1. Overall, the participants agreed that CHD is a serious disease that could bring about premature death and would cause pain. The participants felt moderately afraid of the disease. However, they did not feel very vulnerable to developing CHD in later life. At lease one 20-minute session of exercise a week was seen as being very effective in reducing the risk of CHD and as being low in cost. Participants generally felt able to carry out one session of exercise per week. The mean intention scores indicate that the participants generally intended to carry out the exercise at each time of assessment. However, only 45% of the overall sample had engaged in a 20-minute session of exercise in the week before the study, whereas 36% reported having exercised at Time 2 and 52% reported having engaged in one session of exercise at Time 3.

Analytic strategy

The main hypotheses were tested by conducting a mixed model MANOVA with one between-subjects factor (3 levels: control, motivational intervention, motivational plus volitional intervention) and one within-subjects factor (3 levels: Time 1, Time 2, Time 3). Means and standard deviations for the three groups at each time point are presented in Table 2.

Effects of the motivational intervention on subsequent cognitions and intention

MANOVA showed a significant effect for experimental condition ($F(1,247) = 4.45$, $p < .001$), time ($F(1,247) = 198.94$, $p < .001$) and for the condition × time interaction ($F(2,245) = 3.21$, $p < .001$). The univariate F values for PMT variables, intention and behaviour frequency showed significant differences between the three groups on all the PMT variables and on intention at Time 1 (see Table 2). Pairwise comparisons of means revealed that the differences were between those participants who received the motivational intervention and those who did not. The motivational intervention produced greatest changes in response efficacy (operationalized as the opinion that at least one 20-minute session of exercise a week would lessen chances of developing CHD) ($F(1,247) = 36.93$, $p < .001$), intention ($F = 22.87$, $p < .001$) and self-efficacy ($F(1,247) = 15.11$, $p < .001$). The smallest change in belief found following the motivational manipulation was for fear ($F(1,247) = 3.85$, $p < .05$). A significant effect of time was obtained for just one of the variables, perceived severity ($F(1,247) = 6.00$, $p < .01$). However, pairwise comparisons failed to show any significant difference in mean scores across the three time points.

Thus, findings show that Hypothesis 1 (the motivational intervention will increase perceived vulnerability, perceived severity, fear, self-efficacy and response efficacy and reduce perceived response cost) was supported. Hypothesis 2 (the motivational intervention will increase intention to engage in at least one 20-minute session of exercise in the following week) was also confirmed. Hypothesis 3 (the effects of the motivational intervention will be stable over time) was also supported with all cognitive changes induced by the health education leaflet on PMT variables and intention remaining stable over the 2-week period (see Table 2).

Effects of the motivational and volitional interventions on subsequent behaviour

The MANOVA revealed a significant condition × time interaction ($F(2,245) = 3.08$, $p < .05$) on the frequency of 20-minute sessions of exercise (see Table 2). We conducted simple effects analyses between groups at each time point and between time points for each group in order to decompose the interaction. Whereas the three groups did not differ on the number of exercise sessions at Time 1 or Time 2, there was a significant difference at Time 3. Pairwise comparisons revealed that experimental group 2 (who received both the motivational and volitional intervention) engaged in more exercise than either experimental group 1 (the motivational intervention only group) or the control group ($p < .01$ for both comparisons). Experimental group 1 and the control group did not differ in their exercise behaviour.

ANOVAs were conducted to examine the effect of time on exercise participation within each group. There was no significant effect of time on exercise behaviour in either experimental group 1 ($F(2,245) = 1.95$, n.s.) or the control group ($F(2,245) = 1.58$, n.s.). However, time was found to have significant effect on behaviour in experimental group 2 ($F(2) = 9.53$, $p < .0001$). Pairwise comparisons revealed that the volitional (implementation intention) intervention was entirely responsible for this effect. Thus, provision of the motivational intervention alone had no significant effects on exercise behaviour. However, our Hypothesis 4, that the addition of a volitional intervention, in the form of an implementation intention, to the PMT-based motivational intervention will increase participation in at least one 20-minute session of exercise, was strongly supported.

In order to further investigate the effects of the motivational and volitional interventions on behaviour, a chi-squared test was employed to compare the percentage of participants in each group who engaged in at least one 20-minute exercise session at each time point (see Fig. 1).

It is interesting to note that among both the control group and the motivational manipulation group exercise participation decreased between Time 2 and Time 3. The implementation intention group showed a slight decrease in participation between Time 1 and Time 2 (38 and 35%, respectively), but at Time 3, following the volitional intervention, exercise participation increased dramatically to 91%. Chi-squared tests showed that there were no significant differences between the three groups in exercise participation at Time 1 ($\chi^2(2) = 3.93$, n.s.) or Time 2 ($\chi^2(2) = 0.89$, n.s.). There was a highly significant difference, due to the increase in exercise behaviour in the implementation intention group, at Time 3 ($\chi^2(2) = 71.28$, $p < .001$). Thirty-eight per cent of the control group, 35% of the motivational intervention only group and 91% of experimental group 2, the motivational plus volitional intervention group, engaged in exercise. Thus, Hypothesis 4 was strongly supported in two analyses.

Table 2. Differences in PMT variables, intention and behaviour means across experimental groups, time and experimental group × time interaction

Variable	Time	Control *M* (SD)[a]	Expt 1 *M* (SD)[a]	Expt 2 *M* (SD)[a]	*F* Condition[b] (experimental group)	*F* Time[b]	*F* Condition × time[c]
Threat appraisal							
Perceived vulnerability	T1	3.80 (1.09)$_x$	4.31 (1.64)$_y$	4.35 (1.41)$_y$	4.86**	0.41 n.s.	0.60 n.s.
	T2	3.87 (1.03)$_x$	4.44 (1.39)$_y$	4.30 (1.29)$_y$			
	T3	3.86 (1.02)$_x$	4.37 (1.44)$_y$	4.36 (1.18)$_y$			
Perceived severity 1 (premature death)	T1	4.75 (1.83)$_x$	5.71 (1.68)$_y$	5.81 (1.49)$_y$	4.55**	6.0**	0.11 n.s.
	T2	4.96 (1.69)$_x$	5.54 (1.65)$_y$	5.75 (1.51)$_y$			
	T3	5.01 (1.60)$_x$	5.70 (1.49)$_y$	5.68 (1.52)$_y$			
Perceived severity 2 (pain)	T1	5.07 (1.44)$_x$	6.08 (0.97)$_y$	6.01 (0.95)$_y$	8.75***	1.06 n.s.	0.23 n.s.
	T2	4.88 (1.37)$_x$	5.92 (1.09)$_y$	5.91 (1.03)$_y$			
	T3	4.93 (1.38)$_x$	5.93 (1.05)$_y$	6.05 (1.01)$_y$			
Fear	T1	4.37 (1.49)$_x$	4.81 (1.30)$_y$	4.63 (1.46)$_y$	3.85*	2.73 n.s.	0.36 n.s.
	T2	4.32 (1.57)$_x$	4.93 (1.19)$_y$	4.68 (1.45)$_y$			
	T3	4.45 (1.48)$_x$	5.01 (1.65)$_y$	4.76 (1.33)$_y$			
Coping appraisal							
Response efficacy 1 (lessen chances of CHD)	T1	5.05 (1.38)$_x$	6.13 (0.91)$_y$	6.04 (1.11)$_y$	36.93***	0.24 n.s.	0.29 n.s.
	T2	4.99 (1.27)$_x$	6.11 (0.76)$_y$	6.08 (1.08)$_y$			
	T3	4.96 (1.24)$_x$	6.05 (0.76)$_y$	6.09 (0.88)$_y$			
Response efficacy 2 (reduce risk of CHD)	T1	4.74 (1.45)$_x$	5.40 (1.93)$_y$	5.77 (1.48)$_y$	10.61***	2.45 n.s.	0.41 n.s.
	T2	4.88 (1.50)$_x$	5.44 (1.80)$_y$	5.67 (1.39)$_y$			
	T3	4.92 (1.44)$_x$	5.66 (1.54)$_y$	5.89 (1.10)$_y$			
Self-efficacy	T1	4.94 (1.61)$_x$	5.89 (1.20)$_y$	5.86 (1.31)$_y$	15.11***	0.41 n.s.	0.46 n.s.
	T2	4.86 (1.60)$_x$	5.83 (1.30)$_y$	5.93 (1.21)$_y$			
	T3	4.86 (1.61)$_x$	5.81 (1.23)$_y$	5.86 (1.23)$_y$			

Response costs	T1	2.68 (1.31)$_x$	2.15 (1.09)$_y$	2.09 (1.10)$_y$	7.15***	0.27 n.s.	1.82 n.s.
	T2	2.71 (1.31)$_x$	2.19 (1.16)$_y$	2.10 (1.13)$_y$			
	T3	2.76 (1.28)$_x$	2.08 (1.06)$_y$	2.17 (1.16)$_y$			
Intention	T1	4.59 (2.01)$_x$	5.92 (1.67)$_y$	6.10 (1.23)$_y$	22.87***	0.33 n.s.	0.31 n.s.
	T2	4.60 (1.97)$_x$	5.91 (1.49)$_y$	6.19 (1.06)$_y$			
	T3	4.59 (2.01)$_x$	5.87 (1.52)$_y$	6.16 (1.20)$_y$			
Behaviour (No. of sessions)	T1	1.18 (1.94)$_x$	1.41 (2.06)$_x$	1.24 (1.88)$_x$	0.80 n.s.	5.13***	3.08*
	T2	0.95 (1.74)$_x$	1.17 (1.74)$_x$	1.01 (1.66)$_x$			
	T3	0.84 (1.54)$_x$	1.01 (1.54)$_x$	1.61 (1.19)$_y$			

Note. Expt 1 = motivational manipulation group, Expt 2 = motivational intervention and implementation intention group.
[a]Means with different subscripts within rows differ significantly at least $p < .05$.
[b]d.f. = 1,247.
[c]d.f. = 2,245.

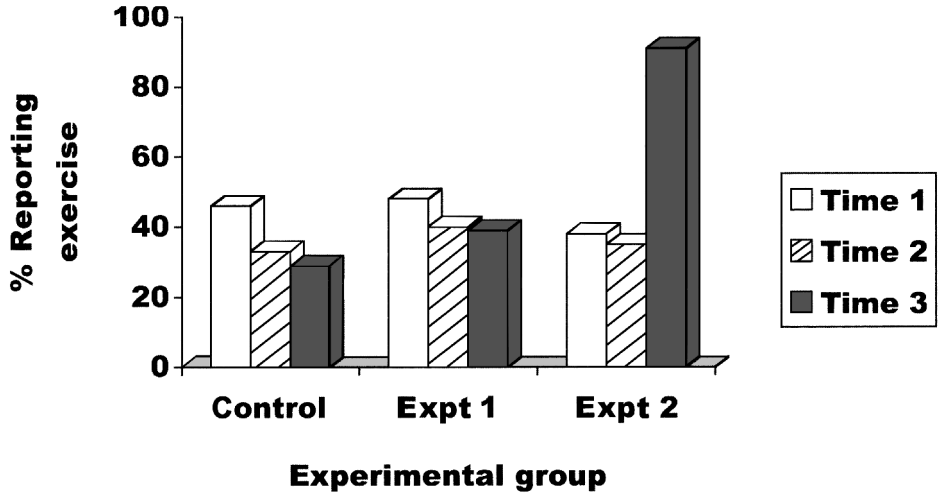

Figure 1. Percentages of exercisers in the three experimental groups at each time point. Control group, no intervention; Expt 1, motivational (PMT) intervention only; Expt 2, motivational (PMT) intervention and volitional (implementation intention) interventions.

Effects of the volitional intervention on intention

Did the volitional intervention change behavioural intentions?

There were no significant differences in intention following the volitional intervention (Time 3 measure of intention) between the participants who received only the motivational intervention (experimental group 1) and those who received both the motivational and volitional intervention (experimental group 2) (see Table 2). This suggests that motivational factors were not responsible for the effects of the implementation intention intervention. Rather, volitional factors must be responsible.

In order to test Hypothesis 5 (participants who form implementation intentions will engage in exercise on the day and at the time and place specified in their implementation intention) the days, times and places specified in participants' implementation intentions were cross-tabulated against the days, times and places in which the exercise was enacted, as shown in Table 3 (cf. Orbell *et al.*, 1997).

All participants in experimental group 2 exercised at the places specified in their implementation intention, whereas 97% exercised at the time specified, and 88% exercised on the day specified. Thus, Hypothesis 5 was supported. These findings support the view that implementation intentions allowed participants to delegate control of behaviour to the environmental cues specified in their implementation intentions and that encountering these cues led to automatic initiation of behaviour (Orbell *et al.*, 1997; Sheeran & Orbell, 1999).

We also analysed the reasons given for failing to exercise at Time 3 among participants who intended to do so in each of the three groups. Implementation intentions result in a strong and easily accessible memory trace of the context for initiating the behaviour (cf. Orbell *et al.*, 1997). Thus, participants who formed implementation intentions should not report forgetting to exercise. Indeed, none of the participants in experimental group 2 did report forgetting to exercise, whereas 19% ($N = 14$) of participants in experimental group 1 and 14% ($N = 6$) of the control group said they

Table 3. Day, time and place specified for exercise behaviour in implementation intentions at Time 2 by time and place of exercise enactment reported at Time 3 ($n = 73$)

Day of enactment	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Day specified in implementation intention							
Monday	8						
Tuesday		23	2	2			
Wednesday	1	2	25	3	1		1
Thursday				13			
Friday			1	1	11	2	
Saturday						8	
Sunday							7

Time specified in implementation intention	Morning	Lunch-time	Afternoon	Evening
Time of enactment				
Morning	32			
Lunch-time	2	14		
Afternoon			21	
Evening				9

Place of enactment	Goodwin sports centre	Goodwin swimming pool	Other swimming pool	Gym	Street	Park	Playing fields	Tennis courts	Team sports pitch	Home
Place specified in implementation intention										
Goodwin sports centre	27									
Goodwin swimming pool		48								
Other swimming pool			4							
Gym				15						
Street					1					
Park						2				
Playing fields							1			
Tennis court								6		
Team sports pitch									9	
Home										6

forgot to exercise ($\chi^2(2) = 14.80$, $p < .001$). However, this was not the reason most often given for failure to exercise. Twenty-six per cent of participants in experimental group 1 ($N = 19$) and 45% ($N = 19$) of the control group said that they were too busy to participate in exercise at Time 3. Only one participant in the implementation intention group gave the same reason for not exercising ($\chi^2(2) = 14.26$, $p < .001$). 'I didn't get round to it' was another popular reason for failing to exercise among participants in experimental group 1 and the control group. Twenty-three per cent

($N = 17$) of intenders in the motivation intervention group and 23% ($N = 10$) in the control group said they did not get round to exercising. No-one in experimental group 1 reported not getting round to exercise ($\chi^2(2) = 14.06$, $p < .001$). Thus, participants who formed implementation intentions were less likely to report: (i) forgetting to exercise, (ii) not having time to exercise, and (iii) not getting round to exercise.

Discussion

This is the first study to include all PMT variables in a longitudinal study incorporating a factual health education intervention (cf. Milne *et al.*, 2000). The intervention produced significant positive changes on all PMT variables and increased intentions to exercise. Previous health education interventions based on PMT variables have been less successful in bringing about cognitive change, especially for threat appraisal variables (e.g. Boer & Seydel, 1996; Seydel *et al.*, 1990; Steffen, 1990).

One explanation for the success of the present study in changing PMT variables is that the health education leaflet and subsequent measures were both salient to the participant group and involved a specific behaviour–'at least one 20-minute session of vigorous exercise over the coming week.' Previous health education studies (Boer & Seydel, 1996; Seydel *et al.*, 1990; Steffen, 1990) provided a general leaflet based on PMT variables about a focal disease and behaviour. It may be the case that the participants did not feel as personally involved in those studies as the present study. Here, the designation 'young people' was used repeatedly to involve readers in the passage, and remind them that the information applied to them personally. It seems likely that health education needs to be specific about the focal behaviour and involve its target group in order to ensure effectiveness (Abraham & Sheeran, 1994).

Our PMT intervention had a significant effect on intention to engage in exercise. This finding is consistent with results from other studies (Boer & Seydel, 1996; Steffen, 1990). However, this motivational intervention had no significant effect on subsequent exercise behaviour. One explanation of these findings might be that, although the motivational intervention bought about a large and highly significant change in intention, it did not produce sufficient change in intention to influence behaviour. A related explanation for the failure of the motivational intervention to change behaviour in the present study was the fact that examinations were approaching at the time of the study and many of the participants who had received the motivational intervention on its own reported that they were 'too busy' to exercise. It may be that the changes in intention bought about by the motivational intervention were not strong enough to influence behaviour in the context of competing goals associated with examination preparation.

Wurtele and Maddux (1987) have acknowledged that PMT manipulations are effective in increasing intention but not in increasing subsequent behaviour. They argue that this may be due to the fact that intentions are measured immediately after the intervention when the information is fresh in the minds of participants. By the time the behavioural measure takes place, the effects of the manipulation may have worn off. To establish whether this explanation for the inefficacy of PMT-based interventions in changing behaviour we measured cognitive changes at three times over the 2-week period of the study: immediately after the manipulation (Time 1), again 1 week later (Time 2) and again 1 week later (Time 3). The effects of the PMT intervention on measures of PMT variables and intention were found to be similar at all time points. This

indicates that the effects of such manipulations can last over time. This undermines Wurtele and Maddux's explanation for the inability of PMT manipulations to influence behaviour. Rather, the present results show that the effects of interventions based on PMT variables, although successful in influencing intention, do not alter behaviour. Thus, PMT manipulations can be seen as motivational interventions. As such, they are very successful and useful for health education interventions in which changing intention is the goal. However, to change behaviour something more is needed.

At Time 2, after completing measures of PMT variables, intention and behaviour, experimental group 2 were asked to form an implementation intention. Implementation intentions were found to have a dramatic effect on increasing subsequent exercise behaviour. Findings showed that implementation intentions increased both the number of exercise sessions engaged in by participants and also the number of participants who engaged in at least one exercise session. These results add further support to the growing body of evidence that implementation intentions are powerful strategies for behavioural enactment (Gollwitzer & Oettingen, 2000). Despite its effect on increasing behaviour the implementation intention intervention had no effect on intentions to exercise or any of the PMT variables. Post hoc tests among the two experimental groups confirmed that making implementation intentions did not affect strength of intention. Thus, the effect of the implementation intention occurred only for behaviour, it did not alter motivation (intention) or the beliefs influencing motivation. This supports Gollwitzer's (1993, 1996) contention that the effects of implementation intentions on behaviour are purely volitional. Both the motivational and the volitional interventions were necessary to change exercise behaviour, supporting the view held by Gollwitzer (1993) and Heckhausen (1991) that motivation and volition are discrete processes.

The present study also confirms previous findings regarding the mechanisms by which implementation intentions influence behaviour. Evidence shows that participants have very good memory for the time and place specified within their implementation intention (e.g. Gollwitzer, 1993, 1996; Orbell *et al.*, 1997; Sheeran & Orbell, 1999). The present study added to this body of evidence. There was a strong correspondence between the times and places specified in the implementation intention and when and where the reported behaviour took place. This adds further support to the conclusion that the situations specified in implementation intentions produce strong memory traces that are readily accessible in memory and lead to automatic activation when the specified cues are encountered (Gollwitzer, 1993, 1996, Orbell *et al.*, 1997).

The present study also supported the view that implementation intentions work by heightening perceptual readiness, ensuring that good action opportunities are not missed (Gollwitzer, 1993, 1996). Twenty-five per cent of those in the control group and 23% of the motivational intervention group reported not having got around to their intended exercise. None of the implementation intention group reported this. Participants who did not make implementation intentions may not have recognized opportunities to act and, hence, did not get around to realizing their intentions to exercise.

It has also been suggested that implementation intentions work by ensuring the goal in question has priority over other competing goals, both at behaviour activation and during behaviour completion (Gollwitzer, 1993, 1996). Findings from the present study are consistent with this hypothesis. Participants had strong competing goals concerned with preparing for examinations. This may explain the decrease in exercise participation among the control group and the motivational intervention group. Forty-seven per cent of intenders in the control group and 24% of intenders in the motivational intervention group reported being too busy to carry out their intentions, whereas only

one participant in the implementation intention group made this report. This provides suggestive evidence that implementation intentions ensured that the goal of exercising gained precedence over other competing goals.

A number of possible criticisms with the present study needs to be addressed. In intervention studies it is possible that experimenter demand may have influenced the results. To help lessen this effect, participants were anonymous to the experimenter and did not know the purpose of the study or that it involved interventions. These considerations should have reduced the influence of experimenter demand. It should also be acknowledged that a longer term study would also have been desirable although it is notable that we obtained highly significant effects over a relatively short time interval and have no grounds for believing that a longer term study would have altered our findings (Sheeran & Orbell, 1999). Finally, a convenience sample of undergraduate students was used. Although many studies in health psychology involve undergraduate students, it must be acknowledged that this is not ideal. There are also some criticisms we would now wish to make concerning our measure of exercise.

Our intervention aimed to increase 'vigorous exercise'. Our description of vigorous exercise can be seen as misleading as activities such as walking, swimming and dancing can be moderate or vigorous, depending on the level of exertion expended by the individual. However, we feel that by adding that the exercise should be enough to cause a noticeable increase in heart rate we came some way towards controlling for this problem. Recommendations for regular exercise to reduce the risk of CHD have recently been clarified as '30 minutes moderate intensity exercise on at least five days a week or three 20-minute sessions of vigorous intensity exercise a week' (Pate *et al.*, 1995). Our intervention differs from this both in terms of intensity and regularity. The implications of these errors are that self-efficacy and response cost measures may have been artificially inflated, thus massaging the success of the PMT intervention. However, this problem in no way invalidates the critical finding that addition of implementation intentions greatly increases the ability of a PMT-based intervention to increase behaviour.

Conclusions

The motivational intervention based on PMT variables had a significant effect in changing beliefs and increasing intention to exercise. These effects were stable over time. While the motivational intervention did not affect subsequent exercise behaviour, the addition of a volitional intervention, an implementation intention, produced a dramatic increase in behaviour. Implementation intentions did not alter intention to exercise, or any other motivational factors. From this we can conclude that the effects of implementation intentions are purely volitional and motivation and volition are separate, discrete processes (e.g. Gollwitzer, 1993, 1996; Heckhausen, 1991). Overall, the results of the present study show that a PMT-based intervention combined with an implementation intention can be a powerful tool for health education programmes. Such a programme should first increase motivation. A volitional intervention should follow when a goal intention has been formed. Future research should test this type of intervention among clinical or general populations and for other health behaviours. The impact of implementation intentions on health-related behaviour has now been well documented. Research should now explore how best to train health professionals and those wishing to modify their behaviour on how best to use implementation intentions for themselves and how to adapt them for different goals.

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Appendix 1

Measures of PMT variables, including intention

Perceived severity

If I were to develop CHD I would suffer a lot of pain (*strongly disagree–strongly agree*). Developing CHD would be unlikely to cause me to die prematurely (*strongly agree–strongly disagree*).

Perceived vulnerability

My chances of developing CHD in the future are (*not at all strong–very strong*). I am unlikely to develop CHD in the future (*strongly disagree–strongly agree*).

Fear

The thought of developing CHD makes me feel (*very frightened–not at all frightened; not at all anxious–very anxious; not at all worried–very worried; very scared–not at all scared*).

Response efficacy

Because of the wide range of positive effects exercising vigorously for at least 20 minutes a week has on the body it is a good way of reducing the risk of developing CHD (*strongly disagree–strongly agree*).

If I were to engage in at least one 20-minute session of vigorous exercise a week I would lessen my chances of developing CHD (*strongly agree–strongly disagree*).

Self-efficacy

I am discouraged from taking at least one 20-minute session of vigorous exercise during the next week because I feel unable to do so (*strongly agree–strongly disagree*).

I feel confident in my ability to partake in at least one 20-minute session of vigorous exercise during the next week (*strongly agree–strongly disagree*).

It would not be difficult for me to take at least one 20-minute session of vigorous exercise during the next week (*strongly agree–strongly disagree*).

Taking at least one 20-minute session of vigorous exercise during the next week would be easy for me (*strongly disagree–strongly agree*).

Response cost

The benefits of taking at least one 20-minute session of vigorous exercise a week outweigh the costs (*strongly agree–strongly disagree*).

Taking at least one 20-minute session of vigorous exercise during the next week would cause me too many problems (*strongly disagree–strongly agree*).

I would be discouraged from taking at least one 20-minute session of vigorous exercise during the next week as it would take too much time (*strongly disagree–strongly agree*).

I would be discouraged from taking at least one 20-minute session of vigorous exercise a week because I would feel silly doing so (*strongly agree–strongly disagree*).

Intention

I intend to partake in at least one 20-minute session of vigorous exercise (e.g. sport, swimming, aerobics, dancing, running or walking briskly) during the next week (*strongly agree–strongly disagree*).

I do not wish to partake in at least one 20-minute session of vigorous exercise during the next week (*strongly agree–strongly disagree*).