1 General background

Protection motivation theory (PMT) was developed by Rogers (1975) as a framework for understanding the impact of fear appeals. A revision of PMT (Rogers 1983) extended the theory to provide a more general account of the impact of persuasive communications, with an emphasis on the cognitive processes that mediate behaviour change. Subsequent research on PMT has typically taken two forms: first, PMT has been used as a framework to develop and evaluate persuasive communications; and second, PMT has been used as a social cognition model to predict health behaviour.

The origins of PMT lie in early work on the persuasive impact of fear appeals that focused on the conditions under which fear appeals may influence attitudes and behaviour. A central question of this work was whether fear appeals could, in themselves, influence attitudes and behaviour, or whether their effects were more indirect. The Yale Programme of Research on Communication and Attitude Change (Hovland et al. 1953) provided a systematic study of the ways in which, and the conditions under which, fear appeals may be effective in changing attitudes and behaviour. The research was based on the fear-drive model which proposed that fear acts as a driving force that motivates trial and error behaviour. If a communication evokes fear, then the recipient will be motivated to reduce this unpleasant emotional state. If the communication also contains behavioural advice, following this advice is one way to reduce the threat. If following the behavioural advice leads to a reduction of fear, then the behavioural response will be reinforced and the probability of performing the behaviour in the future is enhanced. However, if following the behavioural advice does not lead to a reduction of fear, or if the communication does not contain behavioural advice, alternative maladaptive coping responses, such
as avoidance or denial, may be used as means for reducing the level of aroused fear.

The fear-drive model proposed a non-monotonic relationship between fear arousal and the probability of following recommended behavioural advice (i.e. acceptance). In particular, Janis (1967) argued that as well as motivating the recipient to find ways to reduce the danger (i.e. facilitation), fear may also lead to a more critical evaluation of the recommended advice (i.e. interference). As fear increases (from zero level), facilitation is assumed to increase at a faster rate than interference. However, above a certain (optimal) level, the interfering effects of fear are assumed to increase faster than the facilitating effects. As a result, an inverted U-shaped relationship is predicted between fear arousal and acceptance of a recommended action. However, in a review of early studies (between 1953 and 1980) on the effectiveness of fear appeals, Sutton (1982) found little evidence for the hypothesized inverted U-shaped relationship. Instead, strong evidence was found for a positive linear relationship between fear arousal and acceptance. In addition, Sutton (1982) reported that the perceived effectiveness of the recommended action had an independent effect on acceptance.

PMT was developed by Rogers (1975) to provide conceptual clarity to work on fear appeals. In particular, Rogers (1975) sought to identify the key variables in fear appeals as well as their cognitive mediational effects. PMT was based on the work of Hovland et al. (1953) who proposed that there are three main stimulus variables in a fear appeal: (a) the magnitude of noxiousness or severity of an event, (b) the probability of the event occurrence if no protective behaviour is adopted or existing behaviour modified, and (c) the efficacy of a recommended coping response to reduce or eliminate the noxious event. Rogers (1975) included these variables in the original formulation of PMT and further proposed that each stimulus variable initiates a corresponding cognitive mediational process. Thus the magnitude of noxiousness of an event initiates perceptions of severity, the probability that the event will occur initiates perceptions of vulnerability, and the availability of an effective coping response initiates perceptions of response efficacy. In other words, the impact of the stimulus variables in a fear appeal is mediated by perceived severity, vulnerability and response efficacy. These perceptions, in turn, influence protection motivation (i.e. intention to follow the behavioural advice). Protection motivation is seen to be the proximal determinant of protective behaviour as it ‘arouses, sustains, and directs activity’ (Rogers 1975: 94).

Rogers (1983) subsequently revised PMT to provide a more general theory of persuasive communication and underlying cognitive mediating processes. In particular, the revised version of PMT includes a broader range of factors that initiate cognitive processes. In addition to persuasive communications, other stimulus variables or sources of information were included such as observational learning, past experience and personality. PMT was also expanded to incorporate additional cognitive mediating processes, including perceptions of the rewards of maladaptive responses, self-efficacy and response costs, that were organized into two independent
cognitive mediating processes focusing on threat appraisal and coping appraisal.

PMT therefore has similarities with Leventhal’s (1970) parallel response model which distinguishes between two independent control processes that are initiated by a fear appeal. The first, fear control, focuses on attempts to reduce the emotional threat (e.g. avoidance) while the second, danger control, focuses on attempts to reduce the threatened danger (e.g. following behavioural advice). The parallel response model is important in that it proposes that protection motivation results from danger control processes (i.e. cognitive responses) rather than from fear control processes (i.e. emotional responses). A similar distinction is made by Lazarus (1991) between primary appraisal processes that focus on the nature of the threat, and secondary appraisal processes that focus on the coping responses available to the individual.

2 Description of the model

PMT outlines the cognitive responses resulting from fear appeals (see Figure 3.1). Rogers (1983) proposed that various environmental (e.g. fear appeals) and intrapersonal (e.g. personality) sources of information can initiate two independent appraisal processes: threat appraisal and coping appraisal.

Threat appraisal focuses on the source of the threat and factors that increase or decrease the probability of maladaptive responses (e.g. avoidance, denial, wishful thinking). Individuals’ perceptions of the severity of, and their vulnerability to, the threat are seen to inhibit maladaptive responses. In relation to smoking, for example, smokers may consider the seriousness of lung cancer and their chances of developing the disease in the future. Fear is an additional, intervening variable, between perceptions of severity and vulnerability and the level of appraised threat. Thus, greater levels of fear will be aroused if an individual perceives him or herself to be vulnerable to a serious health threat and this will increase an individual’s motivation to engage in protective behaviour. While perceptions of severity and vulnerability serve to inhibit maladaptive responses, there may be a number of intrinsic (e.g. pleasure) and extrinsic (e.g. social approval) rewards that increase the likelihood of maladaptive responses. For example, smokers may believe that smoking helps to regulate weight or that it facilitates interaction in social settings.

Coping appraisal focuses on the coping responses available to the individual to deal with the threat and factors that increase or decrease the probability of an adaptive response, such as following behavioural advice. Both the belief that the recommended behaviour will be effective in reducing the threat (i.e. response efficacy) and the belief that one is capable of performing the recommended behaviour (i.e. self-efficacy) increase the probability of an adaptive response. For example, smokers may consider the extent to which quitting smoking would reduce their chances of developing lung cancer in the future and whether they are capable of doing so. While perceptions of response efficacy and self-efficacy serve to increase
Figure 3.1 A schematic representation of the cognitive mediating processes of protection motivation theory
the probability of an adaptive response, there may be a number of response costs or barriers (e.g. availability of resources) that inhibit performance of the adaptive behaviour. For example, smokers may believe that quitting smoking may lead to increased craving.

Protection motivation (i.e. intention to perform a recommended behaviour) results from the two appraisal processes and is a positive function of perceptions of severity, vulnerability, response efficacy and self-efficacy, and a negative function of perceptions of the rewards associated with maladaptive responses and the response costs of the adaptive behaviour. For protection motivation to be elicited, perceptions of severity and vulnerability should outweigh the rewards associated with maladaptive responses. In addition, perceptions of response efficacy and self-efficacy should outweigh the response costs of the adaptive behaviour. However, most applications of PMT simply consider the additive effects of these variables on protection motivation. Protection motivation, which is typically equated with behavioural intention, is seen to direct and sustain protective behaviour. Protection motivation therefore operates as a mediating variable between the threat and coping appraisal processes and protective behaviour.

In the original version of PMT, perceived severity, vulnerability and response efficacy were hypothesized to combine in a multiplicative fashion to elicit protection motivation. This multiplicative function was proposed as it was assumed that protection motivation would not be elicited if the value of any of these three components was zero. Despite the intuitive appeal of such a combinational rule, empirical support for this multiplicative function has been lacking and, in the revised version of PMT, Rogers (1983) proposed a simpler additive model. Most applications of PMT only consider the main effects of perceptions of severity, vulnerability, response efficacy, self-efficacy and response costs. The rewards associated with maladaptive responses are rarely considered as 'the conceptual distinction between the reward value of a risk behaviour and cost of a preventative measure may not be clear' (Abraham et al. 1994: 271). For example, the reward of 'increased sexual pleasure' associated with unprotected sex could be rephrased as a response cost associated with condom use (i.e. 'reduced sexual pleasure'). The following review of research on PMT therefore examines the predictive utility of the five main components of the model (i.e. perceptions of severity, vulnerability, response efficacy, self-efficacy, response costs).

3 Summary of research

PMT provides a framework for understanding the effects of fear appeals and the social cognitive variables underlying health protective behaviour. Tests of PMT have typically taken two forms. First, the main components of PMT are manipulated in persuasive communications and their effects on protection motivation and behaviour evaluated. Second, PMT is used as a social cognition model to predict health behaviour. Research on PMT has
been subjected to a number of narrative reviews (Boer and Seydel 1997; Rogers and Prentice-Dunn 1997; Conner and Norman 1998) as well as twmeta-analyses (Floyd et al. 2000; Milne et al. 2000) which are described below.

3.1 Meta-analyses

Floyd et al. (2000) conducted a meta-analysis of 65 studies. Studies we included in the meta-analysis provided they measured at least one PM component and included intention and/or behaviour as a dependent variable. Sixteen of the studies measured only one PM component, where 49 contained multiple PMT components. In addition, 27 of the studies measured intention, 22 only measured behaviour, and 16 measured both intention and behaviour. The results of the meta-analysis are presented in Table 3.1, combined across the different dependent variables. Floyd et al. (2000) reported $d$, (sample weighted standardized mean differences) as an estimate of the effect size for each component. Cohen (1992) suggests that $d$, values of 0.20, 0.50 and 0.80 represent small, medium and large effect sizes, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Floyd et al. (2000)$^a$</th>
<th>Milne et al. (2000)$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intention and behaviour</td>
<td>Intention</td>
</tr>
<tr>
<td>Severity</td>
<td>0.39***</td>
<td>0.10***</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>0.41***</td>
<td>0.16***</td>
</tr>
<tr>
<td>Response efficacy</td>
<td>0.54***</td>
<td>0.29***</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.88***</td>
<td>0.33***</td>
</tr>
<tr>
<td>Response costs</td>
<td>-0.52***</td>
<td>-0.34***</td>
</tr>
<tr>
<td>Protection motivation</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note:* $^a$ Reported coefficients are $d$, = sample weighted standardized mean differences.  
$^b$ Reported coefficients are $r_s$ = sample weighted average correlations. ** $p < 0.01$.  
*** $p < 0.001$.

As can be seen from Table 3.1, significant effects were found for all PM components. The effect sizes for the threat appraisal variables (i.e. perceived severity and vulnerability) were in the small to medium range. In contrast, the effect sizes for the coping appraisal variables (i.e. perceived response efficacy, self-efficacy and response costs) were in the medium to large range. Self-efficacy was found to have the largest effect size. More detailed analyses were conducted to examine the performance of PMT different kinds of behaviours. For example, a distinction was made between initiation behaviours (i.e. beginning an adaptive behaviour such as...
self-examination) and cessation behaviours (i.e. stopping a maladaptive behaviour such as smoking). The threat appraisal variables were found to have similar effect sizes for each type of behaviour, whereas the coping appraisal variables were found to have larger effect sizes for cessation behaviours than for initiation behaviours. Floyd et al. (2000) also examined the performance of PMT in relation to the prediction of intention versus behaviour. Both the threat and coping appraisal variables were found to have larger effect sizes when intention was the dependent variable compared to when behaviour was the dependent variable. Overall, the results of the Floyd et al. (2000) meta-analysis suggest that coping appraisal variables, and especially self-efficacy, provide the strongest predictions of protection motivation (i.e. intention) and behaviour.

This pattern of results was, to a large extent, replicated in a more detailed meta-analysis of PMT studies conducted by Milne et al. (2000). Milne et al. (2000) employed stricter inclusion criteria so that only empirical applications of PMT to health-related intentions, concurrent behaviour or future behaviour were included in the meta-analysis. Only 12 studies, with 13 independent samples, were deemed suitable for inclusion in the meta-analysis. Most of these studies were concerned with the prediction of intention, while a minority of studies focused on the prediction of concurrent or future behaviour. The results of this meta-analysis are also presented in Table 3.1. Milne et al. (2000) reported $r_p$ (sample weighted average correlations) as an estimate of the effect size for each component of PMT in relation to intention, concurrent behaviour and future behaviour. Cohen (1992) suggests that $r_p$ values of 0.10, 0.30 and 0.50 represent small, medium and large effect sizes, respectively.

Considering first the prediction of intention, significant effects were found for all PMT components. Small effect sizes were found for the threat appraisal variables (i.e. perceived severity and vulnerability), whereas the effect sizes for the coping appraisal variables (i.e. perceived response efficacy, self-efficacy and response costs) were in the medium to large range. Response costs had the largest effect size, followed by self-efficacy. Milne et al. (2000) also reported fail-safe N (FSN) values that indicate the number of null findings that would be required to make a calculated effect non-significant. Interestingly, with the exception of self-efficacy, all the FSN values fell well short of Rosenthal's (1991) tolerance level of $5k + 10$, suggesting the calculated effects are not robust and that they could be easily reduced to non-significance by unretrieved or future null results. A similar pattern of results was found for the prediction of concurrent behaviour. Again, all effects were significant with small effect sizes for the threat appraisal variables and small to medium effect sizes for the coping appraisal variables. Self-efficacy was found to have the largest effect size and was the only variable close to Rosenthal's (1991) tolerance level. In addition, Milne et al. (2000) calculated the effect size for the correlation between protection motivation and concurrent behaviour which was found to be large and robust. Finally, a small number of studies examined the relationship between PMT and future behaviour. Only perceived vulnerability, self-efficacy,
response costs and protection motivation were found to have significant
effects, although these were somewhat attenuated in comparison to the
effect sizes calculated for the prediction of intention and concurrent
behaviour. In addition, only the correlation between protection motivation
and future behaviour approached robustness, as indicated by the FSN
value. However, the fact that the FSN values fell short of Rosenthal's
(1991) tolerance level is most likely a consequence of the modest number of
prospective PMT studies.

Overall, the results of the meta-analyses conducted by Floyd et al. (2000)
and Milne et al. (2000) indicate that the coping appraisal variables provide
stronger predictions of protection motivation and behaviour than do threat
appraisal variables. The threat appraisal variables (i.e., perceived severity
and vulnerability) are typically found to have small effects sizes, whereas
the coping appraisal variables (i.e., perceived response efficacy, self-efficacy
and response costs) are typically found to have medium effects sizes. In
addition, protection motivation is typically found to be a strong predictor
of concurrent and, to a lesser extent, future behaviour. It is notable that all
of the PMT variables provide stronger predictions of intention and concur-
tent behaviour than of future behaviour. Moreover, many of the rela-
tionships, while significant, appear not to be robust, indicating the need for
further replication.

The meta-analyses reported by Floyd et al. (2000) and Milne et al. (2000)
were based on the results of studies employing a wide range of methodol-
gies. In particular, they included both experimental studies, in which the
PMT components were manipulated and their effects evaluated, and cor-
relational studies in which PMT was used as a social cognition model to
predict health behaviour. As a result, it is difficult to tease out the predictive
power of PMT as a social cognition model of health behaviour versus its
utility as a framework for developing and evaluating interventions. The
following narrative review of PMT studies therefore focuses solely on its
use as a social cognition model to predict a range of health-related
behaviours (see Table 3.2). Experimental studies that have sought to test
PMT by manipulating its components are considered in Section 7.

3.2 Health behaviour

PMT has been used to predict a range of health-promoting (e.g., exercise
and diet) and health-compromising (e.g., smoking and alcohol consump-
tion) behaviours. In relation to exercise and dietary behaviour, only a small
number of studies have employed PMT, and these have tended to use cross-
sectional designs. For example, Plotnikoff and Higginbottom (1998)
applied PMT to the prediction of exercise and dietary intentions and
behaviour among a group of patients who had recently experienced a
myocardial infarction or angina. In a path analysis, self-efficacy was the
only PMT variable to emerge as a significant predictor of exercise intentions
(although fear also had a weak effect on intention). Intention, in turn, was
the only significant predictor of exercise behaviour. Similarly, self-efficacy
Table 3.2  Illustrative applications of protection motivation theory

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>Greening (1997)</td>
</tr>
<tr>
<td>Binge drinking</td>
<td>Ben-Ahron et al. (1995); Murgraff et al. (1999)</td>
</tr>
<tr>
<td>Sexual behaviours</td>
<td>Abraham et al. (1994); Aspinwall et al. (1991); Bengel et al. (1996);</td>
</tr>
<tr>
<td></td>
<td>Eppright et al. (1994); Greening et al. (2001); Sheeran and Orbell (1996); Van der Velde and Van der Pligt (1991)</td>
</tr>
<tr>
<td>Screening behaviours</td>
<td>Boer and Seydel (1995); Hodgkins and Orbell (1998); Orbell and Sheeran (1998); Seydel et al. (1990)</td>
</tr>
<tr>
<td>Treatment adherence</td>
<td>Bennett et al. (1998); Flynn et al. (1995); Norman et al. (2003); Palardy et al. (1998); Rudman et al. (1999); Taylor and May (1996)</td>
</tr>
</tbody>
</table>

was the only significant predictor of intentions to follow a low-fat diet. Intention was predictive of engaging in a low-fat diet, along with perceived vulnerability and fear. Plotnikoff and Higginbottom (1995, 2002) have also conducted PMT studies on exercise and dietary behaviour with randomly selected community samples drawn from areas of Australia with high incidence rates of cardiovascular disease. Considering exercise, Plotnikoff and Higginbottom (2002) found self-efficacy to be the strongest predictor of exercise intentions, although weak effects were also found for perceived severity and perceived vulnerability (negative relationship). Intention was again predictive of exercise behaviour, along with self-efficacy and perceived vulnerability (negative relationship). In relation to dietary behaviour, Plotnikoff and Higginbottom (1995) found that self-efficacy and response efficacy were strong predictors of intentions to follow a low-fat diet. Intention, in turn, was predictive of dietary behaviour along with self-efficacy. However, it should be noted that the above studies were cross-sectional in design and used stage-based measures of behaviour that may be confounded with intention (see Sutton, Chapter 6 in this volume).

There have been relatively few tests of PMT in relation to the prediction of health-compromising behaviours. For example, Murgraff et al. (1999) used PMT to examine students’ binge drinking behaviour over a two-week period. Perceived severity and self-efficacy were predictive of intentions to drink within safe limits. The PMT variables were unable to predict drinking behaviour at two-week follow-up, although it should be noted that Murgraff et al. (1999) also included a measure of past behaviour in their regression analyses which may have masked the influence of the PMT variables. In support of this interpretation, a number of baseline PMT measures (i.e. perceived vulnerability, rewards, self-efficacy and intention) had significant correlations with drinking behaviour at two-week follow-up. In an earlier cross-sectional study, Ben-Ahron et al. (1995) examined the ability of PMT to discriminate between students classified as binge and
non-binge drinkers. This study is noteworthy in that it also contained measures of the intrinsic and extrinsic rewards associated with binge drinking. All of the PMT constructs, with the exception of response efficacy (of drinking within safe daily limits), were found to discriminate between binge and non-binge drinkers, although a negative relationship was found for perceived severity. Considering smoking behaviour, Greening (1997) reported that PMT was predictive of concurrent smoking behaviour in a sample of adolescents. Smokers were more likely to downplay the health risks associated with smoking (i.e. perceived severity) and the response efficacy of not smoking, although they were also more likely to acknowledge greater personal vulnerability to smoking-related diseases.

3.3 Sexual behaviours

PMT has also been applied to the prediction of AIDS-risk reducing intentions and behaviour, although there have been few prospective applications of the model. Aspinwall et al. (1991) examined the predictive utility of PMT in relation to a number of AIDS-risk reducing behaviours in a sample of gay men. Self-efficacy and perceived vulnerability were predictive of reductions in the number of sexual partners over a six-month follow-up period. Self-efficacy was also predictive of reductions in the number of anonymous sexual partners, and response costs (i.e. barriers to change) were predictive of unprotected anal receptive intercourse over the same time period. Greening et al. (2001) examined the predictive utility of PMT over a one-year period in a sample of sexually active rural African American female adolescents. PMT was found to be predictive of condom use at one-year follow-up, although only self-efficacy emerged as a significant predictor after controlling for baseline condom use. Moreover, contrary to predictions, low levels of self-efficacy were predictive of condom use. A closer inspection of the study, however, reveals a lack of correspondence between the measurement of self-efficacy, which focused on preventing a pregnancy and using contraceptives, and the dependent variable (i.e. condom use). In addition, the sample size (n = 61) meant that the cases-to-independent variables ratio was low for a regression analysis. Finally, the study did not report the simple bivariate correlation between self-efficacy and condom use. As a result, the negative relationship between self-efficacy and condom use found in the regression analysis may have been the result of a suppressor effect, given the strong effect observed for past behaviour.

Other studies have examined the ability of PMT to predict AIDS-risk reducing behaviour using cross-sectional designs. Bengel et al. (1996) found that self-efficacy was related to more frequent condom use and fewer sexual partners among a sample of male and female heterosexuals. However, perceived vulnerability was related to more frequent condom use, as well as a higher number of sexual partners. Similar results have been reported by Eppright et al. (1994), who found that perceptions of vulnerability were related to the performance of what they termed adaptive (i.e. being abstinent, avoiding sharing bodily fluids, using condoms) and maladaptive
(i.e. reducing partners, being careful about selecting infection-free partners) behaviours. The coping appraisal variables they considered (i.e. self-efficacy and response-efficacy) were non-significant predictors, although it should be noted that there was a lack of correspondence between these measures and the dependent variables.

Other PMT studies have focused solely on the prediction of AIDS-risk related intentions. For example, Van der Velde and Van der Pligt (1991) examined the predictors of AIDS-risk related intentions among heterosexual men and women and homosexual men with multiple partners. Considering the results for the heterosexual sample, perceived vulnerability, response efficacy and self-efficacy were all found to have direct positive effects on condom use intentions. In addition, perceived severity had an indirect effect on condom use intentions through a measure of fear. Similar results were found among the homosexual sample with perceived severity, response efficacy and self-efficacy having positive direct effects on safe sex intentions. However, a negative relationship was found between perceived vulnerability and safe sex intentions. Abraham et al. (1994) found that self-efficacy and response costs were predictive of condom use intentions among a sample of male and female adolescents. Similar findings have been reported by Sheeran and Orbell (1996) in a sample undergraduate students. However, Abraham et al. (1994) also found a negative relationship between perceived vulnerability and intentions to limit the number of sexual partners.

Taken together, the above results suggest that PMT is a useful framework for understanding AIDS-risk reduction intentions and behaviour. Self-efficacy consistently emerges as the most important predictor, with response efficacy, response costs and perceived severity also emerging as significant predictors in some studies. However, a conflicting pattern of results has been found for the vulnerability component, such that in some studies perceived vulnerability has a positive relationship with AIDS-risk reduction intentions and behaviour, whereas in other studies the relationship is negative. Similar conclusions have been reached by Farin (1994) in a meta-analysis of PMT and HIV-protective behaviour. Self-efficacy and response efficacy emerged as the best predictors of HIV-protective behaviour, although they could only explain 2.2 per cent and 1.8 per cent of the variance in such behaviour. Perceived severity was a weaker predictor, and a conflicting pattern of results was found for perceived vulnerability.

3.4 Cancer-related preventive behaviour

A number of studies have applied PMT to the prediction of cancer-related preventive behaviour, and many of these studies have employed prospective designs. For example, Orbell and Sheeran (1998) reported a prospective study in which PMT measures were used to predict uptake of cervical cancer screening among a sample of never-screened women. Perceived vulnerability, response efficacy (obtaining peace of mind), response costs (perceived potential negative emotional reactions to the test procedure) and
self-efficacy were predictive of screening intentions. Intention was, in turn, predictive of actual uptake of screening at one year follow-up, along with perceived vulnerability and response efficacy (belief that any abnormalities would be curable). Boer and Seydel (1996) also used a prospective design to examine the predictors of attendance at breast cancer screening by mammography. Response efficacy and self-efficacy were predictive of screening intentions. However, the PMT measures were unable to predict attendance at screening at two-year follow-up. Hodgkins and Orbell (1998) examined the predictive utility of PMT in relation to breast self-examination (BSE) in a sample of young women (17- to 40-year-olds) over a one-month period. In a path analysis, only self-efficacy was related to BSE intentions. Intention was, in turn, found to be predictive of BSE performance at one-month follow-up. Finally, Seydel et al. (1990) examined PMT in relation to a number of cancer-related preventive behaviours in a cross-sectional study. Response efficacy and self-efficacy were found to be predictive of intentions to attend cervical cancer screening and to perform BSE. In addition, perceived severity was also predictive of BSE intentions. Considering the prediction of concurrent behaviour, response efficacy and self-efficacy were predictive of BSE performance, while perceived vulnerability, perceived severity and self-efficacy were predictive of recent uptake of cervical cancer screening.

Overall, the above results suggest that PMT is a useful framework for predicting cancer-related preventive behaviour. Self-efficacy and response efficacy consistently emerge as key predictors, although there is evidence to suggest that threat appraisals (i.e. perceived severity and perceived vulnerability) are also important for the prediction of cancer-related preventive behaviour. One of the strengths of PMT work in this area is the number of prospective studies.

3.5 Medical adherence behaviour

A number of studies have applied PMT to the issue of adherence to medical regimens. For example, Bennett et al. (1998) found that the perceived chronicity and perceived severity of asthma were significant predictors of self-reported adherence to corticosteroid medication among a general practice sample of asthma patients. Palardy et al. (1998) employed PMT to examine the predictors of self-report adherence to self-care activities among a sample of adolescents with insulin-dependent diabetes mellitus. Perceived severity and response costs emerged as significant predictors of self-report adherence, over and above the influence of the quality of the child–parent relationship and disease severity. Rudman et al. (1999) examined renal transplant patients’ adherence to a self-monitoring regimen and found that perceived threat, self-efficacy and response costs were predictive of self-monitoring intentions and that self-efficacy and perceived threat were predictive of concurrent adherence behaviour. In a prospective study, Taylor and May (1996) applied PMT to the prediction of compliance to a physiotherapist’s treatment recommendations (e.g. application of compression,
hot/cold therapy, stretching and strengthening exercises) in a sports injury clinic. Patients completed a PMT questionnaire at the end of their initial appointment and treatment compliance was assessed at the second appointment (3–10 days later). Bivariate analyses revealed that the four main components of PMT were each able to predict compliance, although in a regression analysis only perceived severity and self-efficacy emerged as significant predictors. Unfortunately, the study did not assess intention.

A couple of studies have used PMT as a framework to predict actions taken by one individual (e.g. a parent) to protect another person’s health (e.g. their child). For example, Flynn et al. (1995) examined parental adherence to physical therapy recommendations for children with muscular dystrophy. Self-efficacy and response efficacy were found to be predictive of adherence intentions, whereas self-efficacy was the sole predictor of adherence. Norman et al. (2003) used a prospective design to examine parents’ adherence to eye patching recommendations for children with amblyopia. Perceived vulnerability, response efficacy and self-efficacy were predictive of adherence intentions, whereas perceived vulnerability and response costs were predictive of adherence behaviour at two-month follow-up. Interestingly, intention was unrelated to adherence behaviour at follow-up.

Overall, the above studies suggest that PMT can be usefully employed to predict adherence to medical regimens. Both threat appraisal (i.e. perceived severity and perceived vulnerability) and coping appraisal (i.e. response costs and self-efficacy) variables have been found to be predictive of adherence intentions and behaviour, although it is interesting to note that response efficacy has only emerged as a significant predictor of adherence intentions. Despite some encouraging results, work in this area has suffered from two major shortcomings. First, self-report, rather than objective, measures have typically been used to assess adherence behaviour. Second, most PMT studies of adherence behaviour have been cross-sectional in design.

4 Developments

Four main areas for the future development of PMT as a social cognition model of health behaviour are outlined below. First, the role of emotion, and particularly fear, in the model is considered. Second, the ability of PMT variables to predict maladaptive coping responses and the extent to which such responses may impede protection motivation is examined. Third, the sufficiency of the model is assessed through a consideration of the impact of past behaviour on health-protective intentions and behaviour. Fourth, problems associated with interpreting correlations with perceived vulnerability are highlighted.

4.1 Role of emotion

Tanner et al. (1991) have questioned the extent to which PMT recognizes the importance of emotional responses to fear appeals. In particular, they
argue that Rogers (1975) views fear as an insignificant by-product of the threat appraisal process that has no impact on ongoing appraisal and coping processes. However, Tanner et al. (1991) argue that fear aroused may increase an individual’s motivation to act in a health protective manner. For example, Plotnikoff and Higginbottom (1995) found that a measure of fear arousal (i.e., ‘... how frightened you feel when you think about the possibility of having a heart attack’) had a significant, though weak, effect on intention to follow a low-fat diet among an ‘at risk’ community sample. Similarly, Van der Velde and Van der Pligt (1991) found that fear had a direct effect on condom use intentions among a sample of multiple-partner heterosexuals. In contrast, other studies have found non-significant relationships between fear and BSE (Hodgkins and Orbel 1998) and condom use (Abraham et al. 1994) intentions. In their meta-analysis, Milne et al. (2000) reported significant average correlation between fear and intention ($r_s = 0.20$) and concurrent behaviour ($r_s = 0.26$) and a non-significant average correlation between fear and future behaviour ($r_s = -0.04$). The effect sizes were significant but in the small to medium range, and associated fail-safe N values were well short of recommended tolerance levels indicating the effects not to be robust.

Tanner et al. (1991) also argued that an emotional response, such as fear may act as a source of feedback to heighten the processing of threat and coping information. Thus, Lazarus and Folkman (1984: 227) state that ‘when information is appraised for our well-being, it becomes “ho information”...’ and may increase attention to, and comprehension of information related to the threat. Consistent with this position, Tanner et al. (1991) found that students exposed to a high-threat essay that contained coping response information acquired more knowledge than those exposed to a low-threat essay that contained coping response information. Tanner et al. (1991) therefore argue that the appraisal processes outlined in PMT should be viewed as sequential or ordered, such that coping appraisal processes are only activated when threat appraisal results in fear.

4.2 Maladaptive coping responses

In addition to assessing the ability of PMT to predict health-protective intentions and behaviour (i.e. adaptive coping responses) it is also possible to apply the model to the prediction of maladaptive coping responses. Thus, when individuals perceive a threat to their well-being in the absence of an effective coping response, they may engage in activities that reduce the fear associated with the threat without dealing with the threat itself. Such strategies may be termed maladaptive coping responses (Rippeete and Rogers 1987) and include strategies such as denial and avoidance. Thus, high levels of perceived vulnerability and severity and low levels of response efficacy and self-efficacy would be expected to be related to the adoption of maladaptive coping responses. A number of studies have examined the (concurrent) relationships between PMT variables and maladaptive coping responses.
Ben-Ahron et al. (1995) considered a number of maladaptive coping responses in relation to binge drinking. These included avoidance (e.g., not thinking about the adverse consequences of binge drinking), wishful thinking (e.g., hoping that medical breakthroughs will nullify the need for behaviour change), fatalism (e.g., believing that the adverse consequences are due to fate rather than personal action) and religious faith (e.g., trusting that God will provide protection). A number of significant relationships between PMT variables and maladaptive coping responses were identified using path analysis. Thus, avoidance was predicted by perceived severity and self-efficacy (negative relationship), while the use of religious faith as a coping strategy was predicted by response efficacy and self-efficacy (negative relationships). Abraham et al. (1994) examined a range of maladaptive coping responses in response to the threat of HIV/AIDS among a sample of adolescents. Path analysis revealed negative relationships between response efficacy and wishful thinking, and between self-efficacy and both wishful thinking and denial. In addition, response costs associated with condom use were found to be predictive of denial, fatalism and irrational fear. Similarly, Hodgkins and Orbell (1998) found that the response costs associated with BSE were predictive of the use of avoidance as a coping strategy.

The above studies indicate that PMT can be usefully employed to predict maladaptive, as well as adaptive, coping responses. Future research may therefore seek to confirm these initial findings. In addition, Tanner et al. (1991) have argued that engaging in maladaptive coping responses may impede protection motivation and the adoption of actions to deal with the threat. Thus, Ben-Ahron et al. (1995) found that avoidance and religious faith were significant (negative) predictors of intentions to drink within safe limits. Similarly, both denial (Abraham et al. 1994) and defensive avoidance (Van der Velde and Van der Ploeg 1991) have been found to be significant (negative) predictors of condom use intentions. Finally, Hodgkins and Orbell (1998) reported that avoidance had a negative correlation with BSE at one-month follow-up, although this effect became non-significant in a subsequent regression analysis controlling for PMT variables.

4.3 Sufficiency of PMT

Few PMT studies have examined the impact of past behaviour on health-protective intentions and behaviour. This is despite the fact that work on other social cognition models, such as the theory of planned behaviour (Ajzen 1988), has indicated that past behaviour is a strong predictor of future behaviour (Conner and Armitage 1998). Ouellette and Wood (1998) argue that strong past behaviour–future behaviour relations can be explained in two ways. First, past behaviour may affect future behaviour indirectly through its influence on intention (i.e. a conscious response). Past behaviour should shape individuals’ beliefs about the behaviour which in turn influence their intentions and subsequent behaviour. Thus, the effects of past behaviour should be mediated by PMT variables in line with Rogers’ (1983) view of prior experience (i.e. past behaviour) as an intrapersonal
source of information that may initiate the cognitive appraisal processes outlined in PMT. Second, past behaviour may affect future behaviour directly through the automatic repetition of established routines (i.e. an habitual response). As Triandis (1977) argues, repeated performance of a behaviour may result in the behaviour coming under the influence of automatic processes that typify habitual processes (Eagly and Chaiken 1993).

Past behaviour is typically found to have a direct effect on future behaviour that is not fully mediated by social cognitive variables (see Ouellette and Wood 1998), consistent with the view that the impact of past behaviour on future behaviour reflects the involvement of habitual processes. However, Ajzen (1991) argues that when past behaviour is found to have a direct effect on future behaviour this simply indicates that a model is not sufficient. Assuming that the determinants of a behaviour are stable over time, then the correlation between past behaviour and future can be taken as an indication of the ceiling of a model’s predictive validity. If a model is sufficient (i.e. it contains all the important determinants of behaviour), then the addition of past behaviour should not explain additional variance.

PMT studies that have assessed past behaviour typically find that it has a strong and unmediated impact on future behaviour. For example, Hodgkins and Orbell (1998) found that past BSE performance was the sole predictor of BSE at one-month follow-up. Moreover, when past behaviour was entered into the regression equation, the previously significant beta weights for intention and response efficacy became non-significant. Similar results have been reported by Murgraff et al. (1999) in relation to students’ binge-drinking behaviour. In a regression analysis, past drinking behaviour emerged as the sole predictor of binge drinking at two-week follow-up. Finally, Norman et al. (2003) found that past behaviour was the strongest predictor of parents’ adherence to eye patching recommendations for children with amblyopia at two-month follow-up. However, the response costs associated with patching also emerged as a significant predictor in the regression analysis indicating that the effect of past behaviour was partially mediated by PMT. Past behaviour has also been found to have a direct effect on intention in a number of PMT studies focusing on AIDS risk-reduction behaviour (Van der Velde and Van der Pligt 1991; Abraham et al. 1994) and BSE (Hodgkins and Orbell 1998). The above results suggest that PMT is not a sufficient model of health behaviour and that it would benefit from the inclusion of further variables, particularly in relation to the prediction of behaviour (see Sheeran et al., Chapter 7 in this volume; Sutton, Chapter 6 in this volume).

4.4 Perceived vulnerability

Meta-analyses of PMT studies have found perceived vulnerability to be a relatively weak predictor of intention, concurrent behaviour and future behaviour (Floyd et al. 2000; Milne et al. 2000). Moreover, the narrative review of PMT studies presented above reveals a mixed pattern of results.
According to PMT, perceived vulnerability should be positively related to health-protective intentions and behaviour. However, a number of studies have reported significant negative correlations between perceived vulnerability and intentions to exercise (Plotnikoff and Higginbottom 2002), drink within safe limits (Ben-Ahron et al. 1995), use condoms (Van der Velde and Van der Pligt 1991), limit the number of sexual partners (Abraham et al. 1994) and participate in cancer screening programmes (Seydel et al. 1990). Similar negative correlations have also been reported with concurrent behaviour in relation to binge drinking (Ben-Ahron et al. 1995), eating a low-fat diet (Plotnikoff and Higginbottom 1998) and participating in cervical cancer screening (Seydel et al. 1990). In contrast, when significant, perceived vulnerability is typically found to have a positive relationship with future protective behaviour (e.g. Aspinwall et al. 1991; Orbell and Sheeran 1998; Norman et al. 2003).

When perceived vulnerability has been found to have a negative relationship with health-protective intentions and concurrent measures of behaviour, this has usually been explained by referring to 'defensive avoidance' styles of coping (e.g. Seydel et al. 1990). Thus, individuals who feel particularly vulnerable to a health threat may experience high levels of anxiety and thereby engage in various maladaptive coping responses to deal with the anxiety associated with threat (e.g. denial, avoidance). However, as reviewed above, few studies have examined the relationships between PMT constructs and maladaptive coping strategies and, as a result, little evidence exists to support this interpretation of the negative correlations between perceived vulnerability and health-protective intentions and behaviour.

An alternative explanation for the negative findings has been put forward by Weinstein and Nicolich (1993) who suggest that the results of many cross-sectional studies may have been misinterpreted. In particular they argue that, to the extent to which people use their current behaviour to make vulnerability judgements, a negative correlation is to be expected between perceived vulnerability and concurrent protective behaviour. Thus, for example, individuals who engage in high levels of exercise may infer that they are unlikely to develop cardiovascular disease in the future. However, Mlne et al.'s (2000) meta-analysis provides evidence against such a position given that a significant, but weak, positive correlation was found between perceived vulnerability and concurrent behaviour. In line with PMT, those currently engaging in a health-protective behaviour may be doing so because they believe themselves to be at risk. Unfortunately, it is difficult to tease apart these two rival positions as it is possible that some individuals may base their risk judgements on their current behaviour whereas others may or may not engage in a behaviour on the basis of their risk perceptions. Clearly, if these opposing two processes are operating in different sub-samples then any correlation between perceived vulnerability and concurrent protective behaviour, positive or negative, is likely to be attenuated.

Weinstein and Nicolich (1993) put forward similar arguments when considering the relationship between perceived vulnerability and intention.
According to PMT, individuals who feel vulnerable to a health threat should be more likely to intend to engage in a protective behaviour (i.e. a positive correlation), although it is also possible to argue that individuals who intend to engage in a health-protective behaviour may feel less vulnerable to a health threat (i.e. a positive correlation). However, as before, it is difficult to disentangle whether perceptions of vulnerability drive health-protective intentions or whether these intentions are used to infer perceptions of vulnerability. The significant positive correlation found between perceived vulnerability and intention in the Milne et al. (2000) meta-analysis would suggest that perceptions of vulnerability determine health-protective intentions, in line with PMT. However, given the relatively small size of the correlation it is possible that perceptions of vulnerability only determine health-protective intentions in some situations and/or among some individuals.

When considering the prediction of future behaviour, Weinstein and Nicolich (1993) only argue for the possibility of a positive relationship between perceived vulnerability and protective behaviour, as has been found in relation to reductions in the number of sexual partners (Aspinwall et al. 1991), the uptake of cervical cancer screening (Orbell and Sheeran 1998) and treatment adherence (Norman et al. 2003). In addition, Milne et al. (2000) reported a small, but significant, positive correlation between perceived vulnerability and future behaviour in their meta-analysis. These results are encouraging in that they suggest that perceptions of vulnerability may determine future protective behaviour. However, both Aspinwall et al. (1991) and Norman et al. (2003) reported that the significant effect of perceived vulnerability on future behaviour disappeared when past behaviour was included in the regression equation. This suggests that the apparent link between perceived risk and longitudinal changes in behavior is actually explained by the covariability of a sense of risk and behavior at [time] t" (Joseph et al. 1987: 242).

Finally, Van der Velde and Hooykaas (1996) have advocated the use of conditional measures of perceived vulnerability when testing relationships between perceived vulnerability and health-protective intentions and behaviour. In PMT studies, perceived vulnerability is typically measured by asking respondents to estimate the chances that an event will occur in the future (e.g. "How likely is it that you will become infected with the AIDS virus in the next two years?"). Such questions provide unconditional measures of perceived vulnerability as respondents can take into account an unspecified range of factors when providing their estimates. In contrast, conditional measures of perceived vulnerability ask respondents to estimate the chances that an event will occur in the future if preventive action is, or is not, taken (e.g. "How likely is it that you will become infected with the AIDS virus in the next two years, if you don't use condoms?"). Van der Velde and Hooykaas (1996) argue that conditional measures of perceived vulnerability more closely resemble the perceived vulnerability construct as developed in PMT, as respondents estimate their vulnerability if no preventive action is taken. Conditional measures may also help to disentangle
the nature of the relationship between perceived vulnerability and health-protective intentions and behaviour in cross-sectional studies. For example, Van der Velde and Hooykaas (1996) reported that a conditional measure of perceived vulnerability (for not using condoms) had a significant positive correlation with condom use intentions among STD clinic attendees (with private partners only and with prostitution partners) in line with PMT predictions. In contrast, an unconditional measure of perceived vulnerability was found to have a significant negative correlation with condom use intentions among attendees with prostitution partners and a non-significant, positive, correlation among attendees with private partners only.

5 Operationalization of the model

In this section the various steps required to develop measures of the main PMT constructs are outlined. These steps broadly mirror the recommendations made by DeVellis (1991) for the development of reliable and valid scales. Most of the PMT studies reviewed in this chapter report few details on the development of PMT measures, although there are a number of exceptions that are highlighted below.

The first stage in the development of a PMT questionnaire is to determine the content of the items to be used in the questionnaire and this can be achieved in one of two ways. First, it is possible to conduct a literature review of previous PMT studies on the health behaviour of interest to identify whether there are any previous, published or unpublished, instruments that could be used. The second, and in many ways preferred, alternative is to develop the questionnaire items specifically for the planned study. The first step in this process is to generate an item pool to cover the PMT constructs. This is ideally achieved by conducting semi-structured interviews with a sample drawn from the target population (e.g. 20 to 30 members) to determine the salient beliefs about the health threat and health behaviour under consideration.

Only a small number of PMT studies have followed such an approach when developing PMT measures. Norman et al. (2003) conducted pilot interviews with 20 parents of children who had been prescribed an eye patch for the treatment of amblyopia in their study on treatment adherence. The semi-structured interviews were based around PMT and consisted of initial open-ended questions followed by further prompts and probes in order to generate ideas for the wording and content of the item pool. Example questions are given in Table 3.3 (from Searle et al. 2000). Plotnikoff and Higginbottom (1995, 1998, 2002) conducted pilot interviews to generate item pools in their studies on exercise and dietary behaviour in response to the threat of cardiovascular disease. In addition, they also conducted focus group discussions in order to supplement information from the interviews. Rather than conduct interviews, an alternative approach is to conduct an elicitation study. Hodgkins and Orbell (1998) administered a short questionnaire to a sample of 40 women to ascertain salient cognitions about breast cancer and performing BSE. The
questionnaire consisted of a series of questions reflecting the main components of PMT. For example, in relation to perceptions of severity, the women were asked, 'In what way would you consider contracting breast cancer would affect your life?'. The most frequently mentioned (i.e. modal) beliefs for each of the model's constructs were included in the PMT questionnaire used in the main study. A similar approach was also followed by Orbell and Sheeran (1998) in their study on cervical cancer screening. Having generated an item pool, the items can be reviewed to ensure that each of the PMT constructs is adequately covered and that the items appear to reflect the specific PMT constructs under consideration (i.e. have face/content validity). One way of achieving this is to give the items to experts to judge.

Table 3.3 Example interview questions from Searle et al. (2000)

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td><strong>Severity</strong></td>
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<tr>
<td>In your opinion, what are the potential consequences of your child's visual impairment?</td>
</tr>
<tr>
<td><strong>Vulnerability</strong></td>
</tr>
<tr>
<td>What are your thoughts about how your child's visual impairment will change over time?</td>
</tr>
<tr>
<td><strong>Response efficacy</strong></td>
</tr>
<tr>
<td>What are the benefits/advantages of wearing a patch?</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
</tr>
<tr>
<td>As a parent, to what extent do you feel that you can carry out the treatment requirements?</td>
</tr>
<tr>
<td><strong>Response costs</strong></td>
</tr>
<tr>
<td>What are the things/factors that hinder or prevent your child from wearing the patch?</td>
</tr>
<tr>
<td><strong>Rewards of maladaptive response</strong></td>
</tr>
<tr>
<td>Are there any benefits/advantages of not wearing a patch?</td>
</tr>
</tbody>
</table>

The next stage in the development of a PMT questionnaire is to administer the questionnaire items to a development, or pilot, sample. A pilot stage allows an opportunity to check respondents' comprehension of the items and to detect any potential difficulties that are likely to occur when respondents complete the questionnaire in the main study. In addition, a number of reliability and validity checks can be conducted at this stage. For example, the individual items can be assessed to ensure that they produce a good range of scores and are not excessively skewed. These items can then be combined to form scales to measure each of the model's constructs. The internal reliability of the scales is typically assessed using Cronbach's (1951) coefficient alpha. It is also possible to assess the test-retest reliability of the scales by administering the questionnaire to the same sample (or a sub-sample) at a second time point, usually one or two weeks
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later. Initial analyses can also be conducted to examine how the scales relate to each other and to other variables (e.g. age, gender, risk status, etc.) in order to assess their construct validity. Finally, factor analyses can be conducted to ensure that the items load onto factors in line with the structure of PMT, thereby providing evidence for the factorial validity of the scales (Comrey 1988). Researchers typically employ exploratory factor analysis to investigate the factor structure (i.e. latent constructs) underlying the questionnaire items, although a more appropriate procedure is to conduct confirmatory factor analysis.

There are only a few PMT studies that have included a pilot study when developing PMT measures. Plotnikoff and Higginbottom (2002) reported that they conducted a pilot test of their questionnaire with 95 people from the target population. In addition, 46 respondents were interviewed to establish that respondents were able to comprehend the questionnaire instructions and response formats. A similar procedure was followed in earlier studies by Plotnikoff and Higginbottom (1995, 1998). Taylor and May (1996) conducted a pilot study with 267 patients with a wide range of sports injuries. Respondents completed a PMT questionnaire which was factor analysed to ensure that items loaded onto factors in line with the four main PMT constructs. Reliable scales were subsequently constructed to measure each of these constructs. Murgrait et al. (1999) followed a similar approach when developing a PMT questionnaire in relation to binge drinking among students. One hundred and ninety-six students completed a pilot questionnaire which was analysed in three stages. First, the means and standard deviations of individual items were calculated to ensure that each had an adequate spread of responses. Second, scales to measure each of the PMT constructs were constructed and the item-total correlations were examined in order to delete items that reduced a scale's internal reliability. Third, the remaining items were subjected to a principal components analysis and, in the main, were found to load onto factors in line with the structure of PMT.

Some PMT studies that do not include a pilot study will conduct a factor analysis of the questionnaire items used in the main study. For example, Norman et al. (2003) reported that all PMT items were factor analysed in order to aid the development of reliable measures of the main constructs. Plotnikoff and Higginbottom (1995) factor analysed the vulnerability, response efficacy, self-efficacy and protection-motivation items, while Plotnikoff and Higginbottom (1998, 2002) factor analysed only the response efficacy, self-efficacy and protection-motivation items. Other studies have reported factor analyses of items measuring specific constructs. For example, Abraham et al. (1994) conducted separate factor analyses on items measuring perceptions of vulnerability and response costs. The vulnerability items were found to load onto two factors, reflecting perceptions of vulnerability to the AIDS virus at a personal and at a group level. Items measuring response costs associated with condom use were also found to load onto two factors focusing on pleasure loss and reputation concerns. Sheeran and Orbell (1996) factor analysed items measuring the response
costs of using condoms and the rewards of not using condoms, but found that they were unidimensional. Finally, Orbell and Sheeran (1998) conducted a factor analysis of items assessing various expectancies associated with cervical cancer screening and identified three factors focusing on response efficacy, response costs and the possibility of finding abnormal cells and/or another health problem.

The above studies indicate that when PMT items are subjected to a factor analysis, they tend to load onto factors in line with the structure of PMT (e.g. Taylor and May 1996; Murgraff et al. 1999; Norman et al. 2003). However, few studies have reported such analyses. Instead, items measuring specific PMT constructs are sometimes factor analysed to determine whether or not they are unidimensional in nature (e.g. Abraham et al. 1994; Sheeran and Orbell 1996; Orbell and Sheeran 1998). In addition, when conducted, the factor analyses are typically exploratory in nature. Given the problems associated with exploratory factor analysis and the fact that researchers are able to specify, a priori, which items should load onto which factors, there is a strong case for the routine use of confirmatory factor analysis. It is clear that there is a need for future studies to report such factor analyses of PMT items to demonstrate that they load onto factors in line with the structure of PMT. At present, most studies only report the internal reliability (i.e. alpha coefficients) of scales used to measure PMT variables.

A range of items have been used to measure each of the PMT constructs in applications of the model. Considering perceived severity, many studies have measured this construct with single items (e.g. Orbell and Sheeran 1998; Plotnikoff and Higginbottom 1998). When multi-item scales are used these are often found to have poor internal reliability (e.g. Abraham et al. 1994; Boer and Seydel 1995; Taylor and May 1996), although there are some notable exceptions (e.g. Sheeran and Orbell 1996; Norman et al. 2003). The perceived severity items will typically focus on the physical severity of the health threat (e.g. ‘How serious a health problem is a heart attack?’; Plotnikoff and Higginbottom 2002). However, other aspects of the seriousness of the health threat have been considered including the potential impact on psychological well-being (e.g. ‘Even if I was infected by HIV, I would still lead a happy life’; Sheeran and Orbell 1996) and involvement in normal activities (e.g. ‘I see this injury as a serious threat to my sport/exercise involvement’; Taylor and May 1996).

Perceived vulnerability has, in the main, been assessed using multi-item scales with good levels of internal reliability. The perceived vulnerability items tend to focus on the individual’s chances of experiencing the health threat at some point in the future (e.g. ‘My chances of developing breast cancer in the future are … very low/very high’; Hodgkins and Orbell 1998). Some studies ask respondents to consider their vulnerability on the basis of their current and past behaviour (e.g. ‘Considering my present and past behaviour my chances of getting health problems from binge drinking are very high’; Murgraff et al. 1999). Such a wording is consistent with Weinstein and Nicolić’s (1993) argument that people may use their
current behaviour to inform vulnerability judgements. An alternative approach is to ask respondents to provide vulnerability ratings if a recommended behaviour is not performed (e.g. 'If left untreated, what are the chances that your child’s visual impairment will affect his/her reading ability?'; Norman et al. 2003). As Van der Velde and Hooykaas (1996) have argued, such a conditional measure of perceived vulnerability may provide a more accurate assessment of the perceived vulnerability construct as outlined in PMT. Finally, some perceived vulnerability items appear to be confounded with fear or worry (e.g. ‘How worried are you about the possibility of catching AIDS?’; Epripfie et al. 1994).

Many PMT studies have used reliable multi-item measures to assess response efficacy, although a number of studies have employed single item measures (e.g. Epripfie et al. 1994; Greening 1997; Murgraft et al. 1999). Response efficacy items typically focus on the effectiveness of the behaviour to reduce the health threat (e.g. ‘Regular exercise will reduce my chances of having a heart attack’; Plotnikoff and Higginbottom 2002). However, it is also possible to focus on other positive outcomes of performing the behaviour, especially in relation to psychological well-being (e.g. ‘The test will give me peace of mind’; Orbell and Sheeran 1998). Often, the perceived effectiveness of a behaviour is rated in general terms (e.g. ‘Using a condom is effective in preventing a man passing the AIDS virus to a woman’; Abraham et al. 1994), rather than in relation to the individual performing the behaviour (e.g. ‘The rehabilitation programme designed for me will ensure my complete recovery from this injury’; Taylor and May 1996).

Self-efficacy is typically assessed with multi-item scales with good levels of internal reliability in PMT studies. The self-efficacy items tend to focus on individuals’ overall levels of confidence or perceived ability to perform the behaviour (e.g. ‘I am capable of starting and continuing drinking at safe levels’; Murgraft et al. 1999), or on their perceptions of the ease or difficulty of performing the behaviour (e.g. ‘I would find it easy to suggest using a condom to a new partner’; Abraham et al. 1994). Some studies ask respondents to rate their confidence that they can perform a behaviour when faced with specific obstacles (e.g. ‘Choose mainly low-fat foods when you feel too lazy to prepare a meal’; Plotnikoff and Higginbottom 1998). Alternatively, respondents may be asked to indicate the extent to which specific obstacles may prevent them from performing the behaviour (e.g. Boer and Seydel 1995; Orbell and Sheeran 1998).

Response costs have been measured in fewer PMT studies, although they tend to be assessed with reliable multi-item scales. The items typically focus on various negative aspects of performing the behaviour (e.g. ‘The test will make me feel anxious’; Orbell and Sheeran 1998). The rewards associated with maladaptive responses are rarely assessed. As Abraham et al. (1994) argue, any reward associated with not performing the recommended behaviour (e.g. ‘Sex would be more exciting without a condom’) can be rephrased as a response cost of performing the recommended behaviour (i.e. ‘Sex would be less exciting with a condom’). In support of such a position, Sheeran and Orbell (1996) found only one factor underlying items
measuring various response costs of using condoms and rewards of not using condoms. Nonetheless, Murgraaff et al. (1999) were able to construct a rewards scale in relation to binge drinking (e.g. 'I sometimes drink beyond safe daily limits as a relaxation strategy').

Finally, protection motivation is typically equated with intention to perform a behaviour in PMT studies. Studies have therefore employed a mixture of single-item and reliable multi-item measures that ask respondents to indicate whether they intend to, plan to, are likely to, or are willing to engage in a behaviour (e.g. 'Do you plan to follow a low-fat diet for at least the next six months?'; Plominoff and Higginton 1998). Often respondents are asked to indicate their intention to perform a behaviour either at some point in the future (e.g. 'In the future I will use dental floss regularly'; Sheeran and Orbell 1996) or without a time frame (e.g. 'I intend to drink within safe limits as a regular habit'; Murgraaff et al. 1999). In only a few PMT studies are respondents asked to indicate their intention to perform a behaviour within a specified timeframe (e.g. 'I intend to carry out BSE in the next month'; Hodgkins and Orbell 1998).

In summary, many PMT studies have employed multi-item scales, with adequate levels of internal reliability, to measure the model's constructs. However, there are a number of general comments that can be made on the way in which the PMT constructs have been operationalized. First, few studies report having conducted an elicitation, or pilot, study in order to identify the salient beliefs about the health threat and health behaviour under consideration in the target population. Second, factor analyses of PMT items demonstrating that they load onto factors in line with the structure of PMT are rarely reported. Future studies should therefore ensure that these two activities are conducted in order to ensure the construction of reliable multi-item measures. This, in turn, is likely to increase the statistical power of subsequent analyses (Lipsey 1990). Third, the measurement of the perceived vulnerability construct would be improved by the use of conditional vulnerability measures that ask respondents to indicate their vulnerability if a recommended behaviour is not followed (c.f. Van der Velde and Hooykaas 1996). Fourth, many items that have been used to measure the coping appraisal variables and protection motivation have failed to specify an appropriate time frame. As a result, measures of cognitions and future behaviour may have a low level of correspondence which is likely to attenuate the size of subsequent correlations (Fishbein and Ajzen 1975). Finally, PMT has considerable overlap with other social cognition models of health behaviour reviewed in this book. For example, measures of perceived severity and vulnerability are also included in the health belief model, while intention is a key variable in the theory of planned behaviour and self-efficacy is the cornerstone of social cognitive theory. Recommendations for the measurement of these variables are therefore also outlined in other chapters (Abraham and Sheeran, Chapter 2 in this volume; Conner and Sparks, Chapter 5 in this volume; Luszczynska and Schwarzer, Chapter 4 in this volume).
6 Application of the model

In this section an application of PMT to the prediction of exercise intentions and behaviour is described. Regular exercise has been linked to a range of physical and mental health benefits. For example, the physical health benefits include reduced risk for coronary heart disease (Powell et al. 1987), stroke (Paffenbarger and Hyde 1984) and hypertension (Siscovick et al. 1985) as well as increased metabolism of carbohydrates (Lennon et al. 1983) and fats (Rosenthal et al. 1983). Considering the mental health benefits, regular exercise has been linked to reduced levels of anxiety (Singer 1992), reduced life stress (Brown 1991), positive mood states (Folkins and Sime 1981) and enhanced satisfaction with physical shape (King et al. 1989). Given the various health benefits, regular exercise has been advocated as a key component of a healthy lifestyle (DoH 1992). However, a significant proportion of the UK population continue to lead a sedentary lifestyle. For example, the 1986 General Household Survey indicated that only one in three men and one in five women participated in any sport or recreational activity (OPCS, 1989). As a result, there is a clear need for research on the proximal, social cognitive, determinants of exercise behaviour. PMT may provide an appropriate framework for identifying these determinants.

To date, there have been few applications of PMT to the prediction of exercise behaviour (see Section 3 above). Plotnikoff and Higginbottom (1998) applied PMT to predict the exercise intentions and behaviour of a sample of cardiac patients. Self-efficacy was found to be the strongest predictor of exercise intentions (along with a weak effect for fear). Intention, in turn, was the only significant predictor of exercise behaviour. Plotnikoff and Higginbottom (2002) conducted a similar study with a sample of people drawn from ‘at-risk’ communities in Australia. Self-efficacy was again found to be the strongest predictor of exercise intentions, with weak effects also reported for perceived severity and perceived vulnerability (negative relationship). Intention was a significant predictor of exercise behaviour along with self-efficacy and perceived vulnerability (negative relationship). However, the above studies have two important methodological limitations; first, they employed cross-sectional designs and, second, exercise behaviour was measured using a stage-based measure that may be confounded with intention.

The present study reports an application of PMT to the prediction of exercise intentions and behaviour over a one-week period among a sample of undergraduates. The data are drawn from a previous study reporting the impact of a PMT-based health education intervention (Milne et al. 2002). Only data from those participants in the control arm of the study are presented below.

6.1 Respondents and procedure

The present sample comprises 76 undergraduate students at a UK university. The age range of the sample was 18–28 years (M = 19.92,
SD = 1.76) and included 19 males and 57 females. Respondents completed a PMT questionnaire at time 1 and were followed up one week later when they reported on their exercise behaviour over the past week.

6.2 Measures

All PMT items were measured on seven-point Likert response scales, consisting of belief statements followed by appropriate response categories. Scales to measure each of the PMT constructs were constructed by averaging across items. The following PMT constructs were assessed.

Threat appraisal measures
Perceived severity was assessed using six items focusing on the physical and psychological severity of experiencing developing coronary heart disease (e.g. 'If I were to develop CHD I would suffer a lot of pain'; alpha = 0.62). Perceived vulnerability to coronary heart disease was measured with two items (e.g. 'I am unlikely to develop CHD in the future'; alpha = 0.76). Four items were used to measure fear (e.g. 'The thought of developing CHD makes me feel very frightened—not at all frightened'; alpha = 0.93).

Coping appraisal measures
Response efficacy was assessed using two items focusing on the effectiveness of regular exercise to reduce the risk of developing coronary heart disease. However, it was not possible to combine these two items into a reliable scale. As a result, a single item measure of response efficacy was used which was chosen on the basis of stronger correlations with exercise intentions and behaviour (i.e. 'If I were to engage in at least one 20-minute session of vigorous exercise a week I would lessen my chance of developing CHD'). Self-efficacy was measured with four items (e.g. 'I feel confident in my ability to partake in at least one 20-minute session of vigorous exercise during the next week'; alpha = 0.83). Two items were used to measure response costs (e.g. 'Taking at least one 20-minute session of vigorous exercise during the next week would cause me too many problems'; alpha = 0.74).

Exercise intentions and behaviour
Protection motivation, as assessed by intention to exercise over the next week, was measured using two items (e.g. 'I intend to partake in at least one 20-minute session of vigorous exercise during the next week'; alpha = 0.83). Time 1 exercise behaviour was measured using a single item that asked respondents to indicate how many times they had engaged in vigorous exercise over the previous week. The same item was used to measure time 2 exercise behaviour at one-week follow-up.

6.3 Results

The means, standard deviations and intercorrelations between the main study variables are presented in Table 3.4. All PMT variables were found to
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<tr>
<td>Severity</td>
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<tr>
<td>2</td>
<td></td>
<td>0.44***</td>
<td></td>
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<tr>
<td>Vulnerability</td>
<td>0.36**</td>
<td>0.34**</td>
<td>0.26*</td>
<td>-0.22</td>
<td>0.25*</td>
<td>0.36**</td>
<td>0.15</td>
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<td>3</td>
<td></td>
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<tr>
<td>Fear</td>
<td>0.36**</td>
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<td>Response efficacy</td>
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<td></td>
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<td>Self-efficacy</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Response costs</td>
<td>0.44**</td>
<td>-0.35**</td>
<td>0.23*</td>
<td>-0.30**</td>
<td>0.41***</td>
<td>0.18</td>
<td>0.16</td>
<td></td>
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<td>7</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Time 1 Exercise</td>
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<tr>
<td>Time 2 Exercise</td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean: 4.91 3.79 4.38 5.05 4.94 2.68 4.59 1.18 0.95
SD: 0.97 1.09 1.49 1.38 1.61 1.31 2.01 1.94 1.74

Note: *p < 0.05, **p < 0.01, ***p < 0.001. N = 76.
have significant correlations with exercise intentions, in line with expectations. It is noteworthy that the coping appraisal variables tended to have stronger correlations with intention than did the threat appraisal variables. Intention, in turn, was found to have the strongest correlation with exercise behaviour at time 2. In addition, two of the coping appraisal variables, self-efficacy and response costs, were also found to have significant correlations with time 2 exercise behaviour. Finally, past exercise behaviour had strong correlations with both exercise intentions and time 2 exercise behaviour.

A hierarchical regression analysis was performed to assess the ability of PMT to predict exercise intentions (see Table 3.5). The PMT variables were entered at the first step and were able to explain 53 per cent of the variance in exercise intentions, \( R^2 = 0.53, F(6,69) = 13.08, p < 0.001 \). Only self-efficacy emerged as a significant independent predictor. When past behaviour was entered at the second step it was found to produce a significant increment in the amount of variance explained, \( R^2 \) change = 0.06, \( F(1,69) = 9.67, p < 0.01 \). The effect of self-efficacy was reduced to non-significance and past behaviour was the sole significant predictor in the final regression model which explained 59 per cent of the variance in exercise intentions, \( R^2 = 0.59, F(7,68) = 14.00, p < 0.001 \).

A similar hierarchical regression analysis was performed to assess the ability of PMT to predict exercise behaviour at one-week follow-up (see Table 3.6). Intention (i.e. protection motivation) was entered at the first step and was able to explain 31 per cent of the variance in time 2 exercise behaviour, \( R^2 = 0.31, F(1,74) = 32.93, p < 0.001 \). The addition of the PMT variables failed to produce a significant increment in the amount of variance explained, \( R^2 \) change = 0.09, \( F(6,68) = 1.72, \) ns. At this stage, the variables in the model were able to explain 40 per cent of the variance in exercise behaviour, \( R^2 = 0.40, F(7,68) = 6.45, p < 0.001 \), with intention emerging as the only significant independent predictor. Entering past behaviour at the final step produced a significant increment in the amount of variance explained, \( R^2 \) change = 0.08, \( F(1,67) = 10.49, p < 0.01 \). Past behaviour was the only significant predictor in the final regression model which explained 48 per cent of the variance in exercise behaviour, \( R^2 = 0.48, F(8,67) = 7.73, p < 0.001 \).

### 6.4 Discussion

PMT was found to be highly predictive of both exercise intentions and behaviour. Considering the prediction of exercise intentions, the PMT variables explained 53 per cent of the variance with self-efficacy emerging as the sole significant predictor. The PMT variables were also able to explain 40 per cent of the variance in exercise behaviour at one-week follow-up. It is interesting to note that intention was the sole predictor of time 2 exercise suggesting, in line with the theoretical structure of PMT, that intention acts as mediator variable between the threat and coping appraisal variables and protective behaviour. The present results are consistent with previous cross-sectional PMT-exercise applications that have found self-efficacy to be the
Table 3.5 Regression analysis predicting exercise intentions

<table>
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<th>Step</th>
<th>Variable</th>
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<th>Beta</th>
</tr>
</thead>
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<tr>
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<td>-0.15</td>
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<tr>
<td></td>
<td>Vulnerability</td>
<td>0.18</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Fear</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Response efficacy</td>
<td>0.14</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>0.39**</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Response costs</td>
<td>-0.23</td>
<td>-0.23</td>
</tr>
<tr>
<td></td>
<td>Time 1 exercise</td>
<td></td>
<td>0.31**</td>
</tr>
</tbody>
</table>

R² = 0.53***
R² change = 0.06**

Note: **p < 0.01, *** p < 0.001. N = 76.

Table 3.6 Regression analysis predicting time 2 exercise behaviour

<table>
<thead>
<tr>
<th>Step</th>
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<th>Beta</th>
<th>Beta</th>
<th>Beta</th>
</tr>
</thead>
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<td>Severity</td>
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<td>-0.06</td>
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<tr>
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<td>Vulnerability</td>
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<td>-0.13</td>
<td></td>
</tr>
<tr>
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<td>Fear</td>
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<td>-0.06</td>
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</tr>
<tr>
<td></td>
<td>Response efficacy</td>
<td>-0.04</td>
<td>-0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>0.22</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Response costs</td>
<td>-0.13</td>
<td>-0.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time 1 exercise</td>
<td></td>
<td>0.39**</td>
<td></td>
</tr>
</tbody>
</table>

R² = 0.31***
R² change = 0.09
R² change = 0.08**

Note: **p < 0.01, *** p < 0.001. N = 76.

strongest predictor of exercise intentions which, in turn, have been found to be the strongest predictor of exercise behaviour (Plotnikoff and Higginsbottom, 1998, 2002). The present results are also broadly in line with metaanalyses of PMT (Floyd et al. 2000; Milne et al. 2002) that have reported that coping appraisal variables tend to have stronger correlations with intentions and behaviour than do threat appraisal variables.

The addition of past behaviour produced significant increments in the amounts of variance explained in both exercise intentions and behaviour. In both cases the effects of PMT variables were reduced to non-significance and past behaviour emerged as the sole predictor. Similar results have been found in other applications of PMT to BSE (Hodgkins and Orbell 1998), binge drinking (Murgraff et al. 1999), condom use (Abraham et al. 1994) and treatment adherence (Norman et al. 2003). Such findings question the
sufficiency of PMT as a model of health behaviour (Ajzen 1991) and highlight the need to consider additional predictors of health-protective intentions and behaviour. However, it is also possible that a strong relationship between past and future behaviour, especially for repeated behaviours such as exercise, may reflect the operation of habitual responses (Ouellette and Wood 1998).

There are a number of study limitations which mean that the present results should be interpreted with some caution. First, the sample size was relatively small. This is likely to have reduced the statistical power of the regression analyses given the number of independent predictors (see Cohen 1992). It is notable that perceived vulnerability and response costs were marginally significant (i.e. p < 0.10) in the regression analysis predicting exercise intentions. Second, it was not possible to construct a reliable measure of response efficacy which may have attenuated the predictive power of this construct in the regression analyses. Third, the study only examined exercise behaviour over a brief time interval (i.e. one week). The ability of PMT to predict exercise behaviour over longer time periods remains to be demonstrated. Fourth, it is possible to question the generalizability of the present results given the nature of the sample (i.e. undergraduate students). Finally, exercise behaviour was assessed using a single-item, self-report measure of the number of times participants engaged in vigorous exercise over the previous week. While such a measure ensured a high level of correspondence with the PMT measures, it would also be useful to employ more reliable/valid measures of physical activity such as the Stanford 7-Day Recall Questionnaire (Sallis et al. 1985) in future studies.

Despite these criticisms, the present results are of practical importance. In particular, they suggest that attempts to increase exercise behaviour should first focus on enhancing feelings of self-efficacy. As discussed later in this chapter, Bandura (1986) has outlined various sources of self-efficacy that could be targeted in an intervention. Enhancing self-efficacy is likely to lead to stronger intentions which, in the present study, were found to be predictive of exercise behaviour. Encouragingly, there are a number of PMT-based intervention studies that have reported significant effects for self-efficacy manipulations on exercise intentions (e.g. Stanley and Maddux 1986; Wurtele and Maddux 1987; Fruin et al. 1992). However, similar effects have not been reported in relation to exercise behaviour (e.g. Wurtele and Maddux 1987; Milne et al. 2002). Taken together, these results suggest that while enhancing self-efficacy may lead to increased motivation to exercise, other volitional strategies such as the formation of implementation intentions (Gollwitzer 1999; Sheeran et al., Chapter 7 in this volume) may be required to translate strong intentions into action. For example, Milne et al. (2002) reported a PMT-based intervention that was found to have a significant impact on exercise intentions. However, the intervention was found to have little effect on exercise behaviour at one-week follow-up with 35 per cent of participants in the intervention group having exercised versus 38 per cent in the control group. It was only when
the PMT intervention was combined with a volitional intervention, instructing participants to form an implementation intention specifying when and where they would exercise during the next week, that a significant impact on behaviour was observed, with 91 per cent having exercised at one-week follow-up. Moreover, it appears that this effect was not due solely to the volitional intervention. In another study on testicular self-examination (TSE), Milne and Sheeran (2002) reported that an implementation intention intervention alone had little impact on behaviour (21 per cent performance at one-month follow-up) compared to a PMT intervention (28 per cent) or a control condition (18 per cent). However, combining the PMT and implementation intention interventions had a dramatic impact on TSE performance (62 per cent).

7 Intervention studies

PMT has been tested extensively in experimental settings. PMT developed out of early work on fear appeals that sought to identify the conditions under which persuasive communications may produce attitude and behaviour change (Rogers 1975, 1983). PMT identifies the key variables that need to be targeted to change health behaviour and numerous studies have attempted to manipulate PMT constructs to produce such change. As Milne et al. (2000) note, it is possible to distinguish between two types of PMT intervention studies: (a) 'health education' interventions that are broadly based on PMT and (b) experimental manipulations of specific PMT variables.

7.1 Designing PMT interventions

In health education interventions, the intervention group receives information about a health threat and recommended action whereas the control group receives information on an unrelated topic or receives no information. The health education intervention typically provides general factual information on the health threat and an appropriate coping response, based on PMT constructs. For example, in an intervention to encourage participation in mammography screening (Boer and Seydel 1995), women in the intervention group were sent a PMT-based leaflet entitled Breast Examination that described the relative high vulnerability of older women to breast cancer and the high response efficacy of mammography screening. Feelings of self-efficacy towards participating in the screening programme were encouraged by explaining that mammography is a straightforward procedure with little discomfort. Three days after receiving the leaflet the women received a PMT questionnaire. Women in the control group received no information, simply receiving the PMT questionnaire.

Other studies have directly manipulated specific PMT variables. In these studies participants typically read a persuasive communication in which specific PMT variables have been independently manipulated prior to their measurement in a PMT questionnaire. Most of these studies seek to
manipulate specific PMT variables through the presentation of information designed to produce high versus low levels of the targeted construct. For example, participants in one condition may receive information designed to increase perceptions of vulnerability whereas participants in the other condition may receive information designed to decrease perceived vulnerability. A good example of such a study is provided by Pruin et al. (1992). Participants were presented with material about exercise in which a number of PMT variables (i.e. response efficacy, response costs, self-efficacy) were independently manipulated resulting in a $2 \times 2 \times 2$ between-subjects factorial design with two levels (high vs low) for each factor. After reading the information, participants completed a PMT questionnaire. Other studies seek to manipulate specific PMT variables in order to encourage only health protective behaviour (i.e. present vs absent). For example, Wurtele and Maddux (1987) presented essays to sedentary female undergraduates that recommended beginning a regular exercise programme. The essays were designed so that perceptions of vulnerability, severity, response efficacy and self-efficacy were independently manipulated, such that the specific manipulation was either present or absent (rather than presenting high versus low versions for each variable). After reading the essays, participants completed a PMT questionnaire.

Specific PMT constructs have been manipulated in a variety of ways in intervention studies. Considering threat appraisal variables, Stainback and Rogers (1983) manipulated the perceived severity of excessive drinking by arguing that it may cause either severe injury (i.e. high severity) or minor irritation (i.e. low severity) to internal organs. In a study designed to increase dietary intake of calcium among female students, Wurtele (1988) manipulated perceptions of vulnerability to osteoporosis. The high vulnerability essay ‘presented recent findings on the incidence of bone loss in young women along with several reasons why young women may be at risk for osteoporosis’ (p. 630). The essay concluded by stating that there was a high probability that the reader would develop some form of osteoporosis. In contrast, the low vulnerability essay argued that ‘osteoporosis is primarily a disease of older women and presented several reasons why young women are at low risk for this condition’ (p. 630). The essay concluded by stating that the reader’s risk for developing osteoporosis was low.

Many studies have combined the perceived severity and vulnerability components so that the potential threat of an illness or disease is manipulated. For example, Rippeteo and Rogers (1987) manipulated the perceived threat of breast cancer by presenting women with either a high- or low-threat essay. The high-threat essay described ‘breast cancer in graphic detail, contained vivid descriptions of radical chemotherapy side effects and a radical mastectomy and emphasized college-age women’s vulnerability to breast cancer because of stress and diets with increased fat’ (p. 599). In contrast, the low-threat essay described ‘breast cancer as a less severe disease with few physical or emotional consequences. It also emphasized the rarity of the disease among college-age women and college-age women’s decreased vulnerability to the illness’ (p. 599).
Considering coping appraisal variables, response efficacy has been manipulated in essays that argue that there is an effective method to prevent or treat a disease or that there is no such method. For example, Fruin et al. (1992) presented high school students with essays on cardiovascular disease and exercise. The high response efficacy essay emphasized the effectiveness of regular exercise in reducing their risk of developing cardiovascular disease. In contrast, the low response efficacy essay stated that ‘Many people do not believe that regular exercise is effective in preventing cardiovascular disease’ (p. 60). To manipulate self-efficacy it is necessary to argue that the individual either has or lacks the ability to perform the recommended coping response. Rippetoe and Rogers (1987) therefore provided information that emphasized a woman’s ability to perform breast self-examination and to incorporate it into her health routine, in the high self-efficacy essay. In contrast, the low self-efficacy essay highlighted the difficulty of performing a good breast self-examination and accurately detecting a lump. Finally, only one study has attempted to manipulate response costs directly (Fruin et al. 1992). In the high response costs essay the possible negative side effects of engaging in regular exercise were highlighted, whereas the low response costs essay stated that any negative side effects are ‘quite minor and easily overcome’ (p. 60).

7.2 Meta-analysis of PMT intervention studies

Milne et al. (2000) assessed the impact of PMT interventions through a meta-analysis of cognition changes following experimental manipulations of specific PMT variables (see Table 3.7). Milne et al. (2000) reported $r_s$ (sample weighted average correlations) as an estimate of the relevant effect sizes rather than $d_s$ (sample weighted standardized mean differences) that is a more common measure of effect size in experimental studies. Their meta-analysis consisted of eight studies that included specific manipulations of PMT constructs and considered the effects of the manipulations on corresponding PMT cognitions. As shown in Table 3.7, manipulations of the threat appraisal variables led to significant changes in corresponding perceptions of severity and vulnerability. The effect sizes are large according to Cohen’s (1992) guidelines. The effect sizes for manipulations of response efficacy and self-efficacy, though smaller, were significant and in the medium to large range. Only manipulations of response costs were unable to produce a significant effect, although it should be noted that only one study (Fruin et al. 1992) attempted directly to manipulate perceptions of response costs. Furthermore, for all the significant effect sizes with the exception of self-efficacy, the fail-safe $N$ values fell well above recommended tolerance levels, indicating the effects to be robust. It is noteworthy that the experimental manipulations tend to be more successful at changing threat than coping appraisal cognitions.

There were too few PMT-based health education intervention studies to be able to conduct a meaningful meta-analysis. Milne et al. (2000) therefore conducted a vote count of the percentage of times the interventions
produced significant changes in PMT cognitions. The health education interventions were unable to produce significant changes in perceptions of severity and vulnerability (0 per cent significance ratios), although there was some evidence of an impact of such interventions on response efficacy (50 per cent significance ratio) and self-efficacy (100 per cent significance ratio). These findings can be contrasted with a similar vote count conducted for experimental manipulations of specific PMT variables which revealed 100 per cent significance ratios for manipulations of the four main PMT constructs. However, it is clear that there are too few studies at this stage to make any reliable conclusions on the effectiveness of PMT-based health education interventions to change threat and coping appraisal cognitions.

It is important to highlight that the analyses conducted by Milne et al. (2000) only considered the impact of PMT interventions on changes in threat and coping appraisals. Of more importance is the impact of such interventions on protection motivation (i.e. intention) and behaviour. In the following narrative review of PMT intervention studies the impact of manipulating specific PMT variables, as well as health education interventions, on a range of health-protective intentions and behaviours is considered (see Table 3.8).

### 7.3 Narrative review of PMT intervention studies

Considering the impact of manipulating specific PMT variables, the largest number of studies have focused on exercise. For example, Courneya and Hellsten (2001) presented students with essays that manipulated each of the four main PMT constructs. Only the perceived severity manipulation was found to have a significant effect on exercise intentions. However, most other studies have reported significant effects for self-efficacy manipulations on exercise intentions (Stanley and Maddux 1986; Wurtele and Maddux 1987; Fruin et al. 1992), and significant effects have also been reported for perceived vulnerability (Wurtele and Maddux 1987) and response efficacy (Stanley and Maddux 1986) manipulations. A number of experimental studies have also focused on safe sex intentions in response to the threat of
Table 3.8  Examples of intervention studies based on protection motivation theory

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>Courneya and Hellsten (2001); Pruin et al. (1992); Milne et al. (2002)<em>; Stanley and Maddux (1986); Wurtle and Maddux (1987)</em></td>
</tr>
<tr>
<td>Smoking</td>
<td>Maddux and Rogers (1983)</td>
</tr>
<tr>
<td>Alcohol-related</td>
<td>Stainback and Rogers (1983)</td>
</tr>
<tr>
<td>Sexual behaviours</td>
<td>Kyes (1995); Tanner et al. (1989, 1991); Yzer et al. (1998)</td>
</tr>
<tr>
<td>Breast self-examination</td>
<td>Rippetoe and Rogers (1987)</td>
</tr>
<tr>
<td>Testicular self-examination</td>
<td>Milne and Sheeran (2002)<em>; Steffen (1990)</em></td>
</tr>
<tr>
<td>Mammography</td>
<td>Boer and Seydel (1996)*</td>
</tr>
<tr>
<td>Dental behaviours</td>
<td>Beck and Lund (1981)*</td>
</tr>
</tbody>
</table>

Note: All the above studies report experimental manipulations of specific PMT constructs with the exception of those marked with * which are 'health education' interventions. All studies examined the impact of the manipulations/interventions on intentions. Only those marked with * also examined the impact on behaviour.

Sexually transmitted diseases (STDs) or AIDS. For example, Yzer et al. (1998) presented female undergraduate students with newspaper articles that manipulated perceptions of vulnerability to AIDS and self-efficacy to engage in safe sex practice, although only the self-efficacy manipulation was found to have a significant effect on safe sex intentions. Tanner et al. (1989) also found a self-efficacy manipulation to have a significant effect on condom use intentions. In contrast, manipulating other PMT constructs has been found to have little effect on safe sex intentions (e.g. Kyes 1993).

Only a small number of experimental studies have focused on other health behaviours. For example, Maddux and Rogers (1983) manipulated the four main PMT constructs and found that response efficacy and self-efficacy had significant effects on intentions to quit smoking among a sample of student smokers. Rippetoe and Rogers (1987) manipulated threat of breast cancer as well as response efficacy and self-efficacy in relation to performing BSE. All three manipulations were found to impact on BSE intentions. In relation to the threat of osteoporosis, Wurtele (1988) found that a perceived vulnerability manipulation had significant effects on women's intentions (to take calcium supplements, to increase dietary intake of calcium and to pick up a free calcium supplement) and their behaviour (in terms of their dietary intake of calcium and picking up a free calcium supplement) assessed at two-week follow-up. The response efficacy manipulation was only found to have a significant effect on intentions to take calcium supplements. Beck and Lund (1981) manipulated beliefs about the severity of, and patients' vulnerability to, periodontal disease. Only the severity manipulation was found to have an effect on intentions to use disclosing tablets and, at four-week follow-up, dental flossing behaviour. Finally, Stainback and Rogers (1983) presented high- versus low-threat
information to high school students which was found to influence intentions to remain abstinent and not to drink and drive.

There have been relatively few PMT-based health education interventions reported in the literature. Steffen (1990) evaluated a leaflet on testicular self-examination (TSE) among a sample of male undergraduates. The leaflet, that focused on the prevalence and symptoms of testicular cancer as well as the efficacy of TSE and how to perform it, was found to increase intentions to perform TSE, compared to the control group. Similar results have been reported by Milne and Sheeran (2002) who found that a PMT-based leaflet had a significant effect on intentions to perform TSE, although this effect did not translate into increased performance of TSE at one-month and one-year follow-up. Boer and Seydel (1995) found that a PMT-based leaflet to encourage participation in mammography screening for breast cancer among a community sample of older women increased screening intentions. Unfortunately, it was not possible to assess the impact of the leaflet on the uptake of mammography screening as attendance was extremely high in both the intervention and control groups. Finally, Milne et al. (2002) assessed the impact of a PMT-based health education intervention on exercise intentions and behaviour. The intervention was found to have a significant effect on intention that remained over a two-week follow-up period. However, the intervention had no effect on exercise behaviour.

7.4 Summary and discussion

Although experimental tests of PMT have taken two forms, the majority of studies have assessed the effect of independently manipulating specific PMT variables rather than evaluating the impact of PMT-based health education interventions. These studies have shown that manipulations of specific PMT variables have been successful in producing changes in corresponding cognitions (Milne et al. 2000). Interestingly, larger effect sizes are typically found for manipulations of perceived severity and perceived vulnerability than for manipulations of response efficacy and self-efficacy, thereby indicating that attempts to change threat appraisals have been more successful than those to change coping appraisals. However, when the effects of manipulating specific PMT variables on health-related intentions are considered, manipulations of self-efficacy are typically more effective than manipulations of other PMT constructs. In terms of motivating people to engage in health behaviour, these results suggest that interventions should attempt to change perceptions of self-efficacy, even though such perceptions are difficult to change. Bandura (1991) has outlined four main sources of self-efficacy that could be targeted in interventions. First, feelings of self-efficacy can be enhanced through personal mastery experience. For example, a behaviour may be split into a series of sub-goals so that mastery of each is achieved in turn. Second, self-efficacy may be enhanced through observing others successfully perform the behaviour (i.e. vicarious experience). Third, standard persuasive techniques can be employed to enhance
self-efficacy, as has been attempted in most PMT intervention studies. Fourth, an individual's physiological state may be used as a source of information, such that an individual may infer that high levels of anxiety or arousal indicate that he/she is not capable of performing a recommended action. This may be particularly pertinent when processing high-threat information. As a result, relaxation techniques may be usefully employed to help maintain feelings of self-efficacy.

PMT intervention studies typically assess cognitions immediately after participants have read a persuasive communication, thereby only assessing the immediate impact of PMT interventions. As a result, if the effects of interventions diminish over time, these studies are likely to overestimate their impact. Follow-up assessments of PMT variables are rarely conducted to assess the longer term impact of interventions. To date, only two studies have sought to manipulate and measure PMT variables at a separate time points. Boer and Seydel (1995) sent a PMT-based leaflet to women in the intervention group to encourage attendance at mammography screening. Women in the control group received no leaflet. Three days later all women were sent a PMT questionnaire. Women in the intervention group were found to have stronger perceptions of response efficacy and self-efficacy and stronger intentions to attend screening. Milne et al. (2002) developed a PMT-based intervention to increase exercise. PMT variables were assessed immediately after the intervention and again at one- and two-week follow-up. The intervention was found to have significant effects on all PMT variables assessed immediately afterwards and at both follow-up points. Such findings are encouraging as they suggest that cognition changes following PMT interventions may be relatively stable over time. However, it is clear that further work is required to assess the longer term impact of PMT interventions. Moreover, few studies have assessed the impact of PMT interventions on subsequent behaviour. Some encouraging results have been reported in the literature (e.g. Beck and Lund 1981; Wurtele 1988), although other studies have failed to report significant effects (e.g. Wurtele and Maddux 1987; Milne and Sheeran 2002; Milne et al. 2002). Such findings are disappointing as they suggest that PMT interventions may have a limited impact on behaviour, despite evidence that points to their utility in changing health-protective cognitions and intentions.

Few studies have tested whether the effects of PMT interventions are mediated by PMT variables. Some studies have reported correlations between manipulated PMT variables and intention (e.g. Stanley and Maddux 1986; Courneya and Hellsten 2001), but have failed to report full mediational analyses (cf. Baron and Kenny 1986). A notable exception is the Rippetoe and Rogers (1987) study that assessed the impact of manipulating threat, response efficacy and self-efficacy on BSE intentions. The manipulations were found to have significant effects on corresponding cognitions and BSE intentions, although path analysis provided support for a mediational model as no direct effects were found for the PMT manipulations on BSE intentions; instead, the effects were mediated by corresponding PMT variables. For example, the effect of the self-efficacy
manipulation was fully mediated by the self-efficacy measure which was a significant predictor of intention. Such findings are encouraging in that they suggest that PMT interventions influence health-protective intentions through changing PMT variables, thereby providing strong support for the model.

In addition to assessing the impact of PMT interventions on health-protective intentions and behaviour (i.e. adaptive coping responses), it is also possible to assess their impact on maladaptive coping responses. Thus, according to PMT, individuals may engage in various strategies in order to reduce the fear associated with the threat without dealing with the threat itself. Such responses can be termed maladaptive coping responses (Rippetoe and Rogers 1987). Only a few studies have examined the impact of PMT manipulations on maladaptive coping responses (e.g. Rippetoe and Rogers 1987; Fruin et al. 1992; Yzer et al. 1998). The most thorough investigation has been conducted by Rippetoe and Rogers (1987) who examined the impact of threat, response efficacy and self-efficacy manipulations in relation to breast cancer and BSE. Both adaptive (i.e. BSE intentions, rational problem solving) and maladaptive (i.e. avoidance, wishful thinking, religious faith, fatalism, hopelessness) coping responses were assessed. The threat manipulation increased the likelihood of both adaptive and maladaptive coping responses, consistent with the idea that threat appraisal is a necessary, but not sufficient, condition for protection motivation. In contrast, the coping appraisal manipulations were found to have significant effects on specific coping responses. For example, women who read the high self-efficacy essay were more likely to engage in adaptive responses (i.e. BSE intentions, rational problem solving), whereas those who read the low self-efficacy essay were more likely to feel hopeless. Using path analysis, Rippetoe and Rogers (1987) also found that the manipulated PMT variables were able to mediate the impact of the PMT manipulations on maladaptive coping responses. For example, the effect of the self-efficacy manipulation on hopelessness was mediated by changes in self-efficacy.

Finally, Milne et al. (2002) have highlighted various practical and ethical considerations that should be considered when developing PMT-based intervention studies. First, Milne et al. (2002) note that while there is good evidence that experimental manipulations of specific PMT variables are able to change corresponding cognitions and intentions, applying such manipulations to real-world health education intervention programmes may be difficult. It is not generally ethical to manipulate specific variables in a high versus low level in health education settings as doing so would involve providing some individuals with false information (e.g. incorrectly providing information to some individuals that they are at low or high risk of developing a serious disease). One possible solution to this problem is either to provide or not to provide information on the specific PMT variables (i.e. present vs absent), as has been done in some experimental PMT studies (e.g. Yzer et al. 1998). Second, Milne et al. (2002) note that most experimental PMT studies do not have a control group who receive no information (see Rippetoe and Rogers 1987 for an exception). As a result, it
is difficult to assess the impact of the different interventions relative to not receiving an intervention. Milne et al. (2002) therefore suggest that when applying PMT to real-world health education intervention programmes it may be more appropriate to test the impact of a PMT health education intervention (relative to a control group) in which all PMT components are addressed in a single intervention. However, the disadvantage of such an approach is that it is not possible to assess the relative impact of different components of the intervention. Such interventions are therefore likely to provide only limited information for the future theoretical development of PMT.

8 Future directions

PMT includes many of the key social cognitive determinants of health behaviour reviewed in this book. It shares a number of similarities with the health belief model (Rosenstock 1974; Abraham and Sheeran, Chapter 2 in this volume). For example, the health belief model includes perceived vulnerability and severity as well as the perceived benefits of, and barriers to, performing a health-protective action which are analogous to the response efficacy and response costs constructs of PMT. However, PMT also includes self-efficacy and protection motivation (i.e. intention) which have been found to be among the most powerful predictors of health behaviour and are included in the theory of planned behaviour (Ajzen 1988; Conner and Sparks, Chapter 5 in this volume). In addition, PMT posits that protection motivation acts as a mediating variable between the threat and coping appraisal variables and health behaviour, again in line with the theory of planned behaviour. Given that PMT includes a range of threat and coping appraisal variables that have been found to be important in other models, it is not surprising that PMT has been found to be a useful model for predicting health-protective intentions and behaviour, with meta-analyses reporting significant effects for all PMT variables (Floyd et al. 2000; Milne et al. 2000). However, it is worth noting that many of the significant relationships identified in the meta-analyses appear not to be robust and would therefore benefit from further replication. In addition, there are a number of issues that need to be addressed in future research.

There is a clear need for more prospective tests of PMT. This would assist the future theoretical development of PMT in three important ways. First, the use of prospective designs would provide an opportunity to examine the proposed mediating role of protection motivation (i.e. intention) in more detail. According to PMT, the threat and coping appraisal variables should act through (i.e. be mediated by) intention. Meta-analyses (Floyd et al. 2000; Milne et al. 2000) indicate that the threat and coping appraisal variables provide only weak predictions of future behaviour, whereas intention has been found to be a consistent, and moderately strong, predictor of future behaviour. This pattern of results is consistent with a mediational hypothesis, although it needs to be formally tested in prospective studies in which intention is entered into a regression equation
after the threat and coping appraisal variables when predicting future behaviour (cf. Baron and Kenny 1986). Second, the use of prospective designs would provide a more appropriate test of the relationship between perceived vulnerability and health-protective behaviour. As Weinstein and Nicolich (1993) argue, in cross-sectional studies it is unclear whether a positive or negative correlation should be expected between perceived vulnerability and health-protective behaviour. Prospective designs, coupled with the use of conditional measures of perceived vulnerability (Van der Velde and Hooykaas 1996), are required to disentangle the relationship between perceived vulnerability and health-protective behaviour. Third, the use of prospective designs would allow an opportunity to assess the sufficiency of the model in more detail. Measures of past behaviour should be included which, if PMT is a sufficient model of health-protective intentions and behaviour, should not add to the variance explained by the model's constructs (cf. Ajzen 1991).

Future tests of PMT should also focus on maladaptive coping responses. Thus, in the absence of an effective coping response, individuals may engage in activities to reduce the fear associated with a health threat without dealing with the threat itself (Rippetoe and Rogers 1987). A few studies have reported significant correlations between PMT constructs and various maladaptive coping responses, such as avoidance, denial and wishful thinking (e.g. Abraham et al. 1994; Ben-Ahron et al. 1995; Hodgkins and Orbell 1998). Engaging in maladaptive coping responses may also interfere with protection motivation, as has been noted in some studies (e.g. Van der Velde and Van der Pligt 1991; Abraham et al. 1994; Ben-Ahron et al. 1995). However, these initial findings require replication.

One of the strengths of PMT is that it has been subjected to numerous experimental tests. The majority of these studies have sought to assess the impact of manipulating specific PMT variables. Milne et al.'s (2000) meta-analysis of cognition changes following experimental manipulations of specific PMT variables found large effect sizes for the threat appraisal variables and medium to large effect sizes for the coping appraisal variables. It is interesting to note that Milne et al.'s (2000) meta-analysis indicates that self-efficacy manipulations have the weakest impact on corresponding cognitions, whereas the narrative review of experimental studies presented earlier in this chapter suggests that self-efficacy manipulations have the most consistent impact on health-protective intentions. Future work may therefore consider additional ways of manipulating self-efficacy (cf. Bandura 1991), especially given that self-efficacy is the strongest PMT predictor of health-protective intentions.

Despite some encouraging results, there are a number of issues that future experimental tests of PMT need to address. Most experimental tests measure cognitions and intentions immediately after respondents have been exposed to an experimental manipulation. As such, these studies only assess the immediate impact of manipulating PMT variables (for exceptions, see Boer and Seydel 1995; Milne et al. 2002). Future experimental studies should therefore assess the longer term impact of manipulating PMT
variables. In addition, few studies have assessed the impact of PMT manipulations on subsequent behaviour (for exceptions see Beck and Lund 1981; Wurtele and Maddux 1987; Wurtele 1988; Milhe et al. 2002) and this issue also needs more attention in future work. In addition, when experimental manipulations of PMT variables have been found to impact on health-protective intentions and behaviour, few studies have tested whether their effects are mediated by PMT variables (see Rippetoe and Rogers 1987). Thus, there is a clear need for mediational analyses to assess the extent to which PMT manipulations have their impact through changing corresponding PMT variables. Finally, experimental studies should also examine the impact of manipulating specific PMT variables on maladaptive coping responses.

In conclusion, PMT has received strong support from correlational studies that have used PMT as a social cognition model to predict health behaviour and, to a lesser extent, from experimental studies that have manipulated specific PMT variables. Moreover, given its sound theoretical foundation and its overlap with other social cognition models, PMT is likely to continue to be an important model of health behaviour. In addition, as outlined above, there are various issues that require attention in future studies and these are likely to stimulate further research on PMT.

References


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Protection Motivation Theory


Protection Motivation Theory


