Cancer prevention as a source of exercise motivation: an experimental test using protection motivation theory

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Abstract  The present study examined whether cancer prevention is a meaningful source of exercise motivation using Protection Motivation Theory (PMT). Participants were 427 undergraduate students randomly assigned to read one of 16 persuasive communications that independently manipulated perceived vulnerability (PV), perceived severity (PS), response efficacy (RE) and self-efficacy (SE). A factorial ANOVA indicated a significant main effect for PS and a significant interaction between PS and RE. The interaction was such that individuals who were led to believe that colon cancer was a severe disease (high PS) were more motivated to exercise if they also believed that exercise was effective (high RE) as opposed to ineffective (low RE) in reducing their risk of colon cancer. Conversely, individuals led to believe that colon cancer was not a very severe disease (low PS) were not differentially motivated to exercise based on their RE beliefs. It was concluded that cancer prevention may be a meaningful source of exercise motivation but that further research is required to determine the replicability and generalizability of these results.

Over the past decade, mounting evidence has indicated that exercise may reduce cancer risk (Colditz, et al. 1996). This research is important because it links a modifiable lifestyle factor to cancer risk. An important practical question, however, is whether documenting such a relationship will have any impact on exercise motivation. To date, no research has examined this question for any type of cancer or within any theoretical framework. In the present study, we examined colon cancer prevention as a source of exercise motivation using Rogers’ (Rogers & Prentice-Dunn, 1997) protection motivation theory (PMT).

Colon cancer was selected because it has the strongest and most consistent evidence for a protective effect from exercise (Colditz et al., 1996) and because it has the third highest incidence rate for both sexes (American Cancer Society, 2000). Moreover, colon cancer accounts for 10% of all cancer deaths and has many quality of life issues that surround the disease and its treatments. Rogers’ (Rogers & Prentice-Dunn, 1997) PMT was selected as the guiding theoretical framework because it was developed specifically to explain health behaviour motivation from a disease prevention perspective.

PMT proposes that protection motivation (PM), defined as the person’s desire or willingness to perform the health behaviour, is determined by perceived vulnerability (PV),
perceived severity (PS), response efficacy (RE) and self-efficacy (SE). PV reflects the person’s judgement of the likelihood of developing the health condition, whereas PS is a judgement of the severity of the consequences of developing the health condition. These two constructs may be combined additively to form a person’s threat appraisal. RE is based on the belief that the recommended coping response is effective in reducing the risk and/or mitigating the effects of the health condition, whereas SE reflects the belief that one can successfully perform the coping response. RE and SE may be combined additively to produce the person’s coping appraisal.

In the present study, we manipulated each of the four independent PMT constructs using written persuasive communications and determined their effect on the dependent variable of PM. Consistent with PMT, we hypothesized main effects for each of the four social cognitive constructs as well as a possible interaction between constructs from the different appraisal processes (i.e. threat and coping).

Method

Participants

Participants were 427 undergraduate psychology students who averaged 2.1 moderate (SD = 1.8) and 2.2 strenuous (SD = 1.8) exercise sessions per week. Mean age was 19.7 years (SD = 4.0) and 73% were female.

Design and procedures

The experimental design was a $2 \times 2 \times 2 \times 2$ between-subjects factorial design with two levels (low versus high) each of PV, PS, RE and SE. Participants were randomly assigned to read one of the resulting 16 persuasive communications and then asked to complete an anonymous questionnaire assessing the four independent constructs (i.e. PV, PS, RE and SE) and the dependent variable (i.e. PM), in that order. Following the session, participants were debriefed about the purpose of the study and provided accurate information concerning exercise and colon cancer.

Stimulus materials

Each persuasive communication was approximately 415 words, with the key manipulations for each of the PMT constructs as follows. For PV, the manipulation was for risk which was presented as either 1 in 200 (low PV) or 1 in 9 (high PV). For PS, colon cancer was characterized by either limited treatment problems and an 80% five-year relative survival rate (low PS) or by major treatment problems (e.g. colostomy) and a 20% five-year relative survival rate (high PS). For RE, the manipulation was the risk reduction associated with exercise which was described as either 10% and inconsistent (low RE) or 60% and consistent (high RE). SE was manipulated by describing the amount of exercise necessary to reduce colon cancer risk as either five–six days per week for one hour at high intensity (low SE) or as two–three days per week for 20 minutes at moderate intensity (high SE).

Instruments

PV ($\alpha = 0.86$), PS ($\alpha = 0.87$) and RE ($\alpha = 0.77$) were each measured by three seven-point items (1 = strongly disagree to 7 = strongly agree) commonly used in the PMT literature.
Table 1. Descriptive statistics and correlations among protection motivation theory constructs

<table>
<thead>
<tr>
<th></th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Protection motivation</td>
<td>0.21**</td>
<td>0.21**</td>
<td>0.47**</td>
<td>0.17**</td>
<td>4.31</td>
<td>1.36</td>
</tr>
<tr>
<td>2. Perceived vulnerability</td>
<td>0.14*</td>
<td>0.01</td>
<td>-0.31**</td>
<td>2.94</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>3. Perceived severity</td>
<td>0.16*</td>
<td>-0.07</td>
<td>5.20</td>
<td>1.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Response efficacy</td>
<td>0.31**</td>
<td>5.48</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Self-efficacy</td>
<td></td>
<td>5.03</td>
<td>1.52</td>
<td></td>
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</tr>
</tbody>
</table>

*p < 0.01; **p < 0.001.

Sample items were: ‘Personally, I feel vulnerable to developing colon cancer at some point in my life’ (PV), ‘I feel colon cancer would be a very serious illness for me to develop’ (PS) and ‘I feel that physical exercise would help me personally to reduce my risk of colon cancer’ (RE). SE (α = 0.84) was measured by three seven-point items often used by Ajzen (1991) to assess perceived behavioural control, which is conceptually similar to self-efficacy. A sample item was: ‘If I wanted to, I could easily do the type and amount of physical exercise necessary to reduce my risk of colon cancer’. PM (α = 0.87) was assessed by three seven-point items drawn from the PMT literature. A sample item was: ‘Would you seriously consider starting an exercise programme designed to reduce your risk of colon cancer?’ (1 = not at all, to 7 = very seriously).

Results

Descriptive statistics and zero-order correlations among PMT constructs are presented in Table 1. Pearson correlations indicated that each independent construct had a significant relationship with PM. Multiple regression analysis revealed that the four measured social cognitive constructs explained 29% of the variance in PM [F(4, 422) = 42.80, p < 0.001], with all four constructs making significant unique contributions as follows: RE (β = 0.41, T = 9.38, p < 0.001); PV (β = 0.22, T = 5.07, p < 0.001); PS (β = 0.12, T = 2.85, p < 0.01); and SE (β = 0.12, T = 2.62, p < 0.01).

Manipulation checks

Multivariate analyses of variance (MANOVAs) were conducted to examine the effectiveness of the persuasive communications in manipulating each of the four independent constructs. The results revealed that PS and SE were manipulated quite effectively, whereas RE was manipulated weakly and PV not at all (Table 2).

Hypotheses testing

The hypotheses were tested using a 2 × 2 × 2 × 2 analysis of variance (ANOVA), with two levels (low and high) for each of the four independent constructs and PM as the dependent variable. This analysis revealed a significant main effect for PS [F(1, 411) = 4.02, p < 0.046], with individuals in the high PS condition reporting higher PM (M = 4.44, SD = 1.30) than individuals in the low PS condition (M = 4.18, SD = 1.41). This main effect was overridden, however, by a two-way interaction between PS and RE [F(1, 411) = 4.12, p < 0.043] presented in Figure 1. Essentially, the interaction showed that in the low RE condition there was no difference in PM between the low (M = 4.32, SD = 1.42) and high (M = 4.33,
Table 2. Manipulation check results for protection motivation theory constructs under low and high experimental conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Low</th>
<th>High</th>
<th>$F(1,425)$</th>
<th>$p$</th>
<th>$\omega^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived vulnerability</td>
<td>2.83</td>
<td>3.04</td>
<td>3.29</td>
<td>&lt; 0.070</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td>(1.16)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Perceived severity</td>
<td>4.24</td>
<td>6.15</td>
<td>275.00</td>
<td>&lt; 0.001</td>
<td>0.393</td>
</tr>
<tr>
<td></td>
<td>(1.38)</td>
<td>(0.97)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response efficacy</td>
<td>5.35</td>
<td>5.61</td>
<td>8.26</td>
<td>&lt; 0.004</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.99)</td>
<td>(0.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>4.19</td>
<td>5.86</td>
<td>184.41</td>
<td>&lt; 0.001</td>
<td>0.303</td>
</tr>
<tr>
<td></td>
<td>(1.44)</td>
<td>(1.07)</td>
<td></td>
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SD = 1.30) PS conditions. However, in the high RE condition PM was significantly higher [$t(210) = 2.87, \ p < 0.003$] in the high PS ($M = 4.56, SD = 1.30$) than in the low PS ($M = 4.03, SD = 1.38$) condition.

**Discussion**

The present study appears to provide some preliminary support for the idea that cancer prevention may be a meaningful source of exercise motivation. More specifically, persuasive communications developed for the present study were effective in manipulating PS and RE which, in turn, interacted to influence PM. Specifically, individuals who were led to believe that colon cancer was a very severe disease (i.e. high PS) were more motivated to exercise if they were also led to believe that exercise was very effective (i.e. high RE) rather than minimally effective (i.e. low RE) in reducing their risk of colon cancer. Conversely, individuals led to believe that colon cancer was not a very severe disease (i.e. low PS) were not differentially motivated to exercise based on their beliefs concerning the effectiveness or

![Fig. 1. Significant interaction effect of perceived severity and response efficacy on protection motivation.](image-url)
ineffectiveness of exercise in reducing colon cancer risk. This finding is consistent with PMT, which suggests that individuals who perceive a threat will be more motivated to change their behaviour if they believe the coping strategy being offered to them is effective in reducing the threat (Rogers & Prentice-Dunn, 1997).

We might have found even stronger results if we were more effective in manipulating RE and PV. The failure to strongly manipulate RE was unfortunate because it had the strongest relationship with PM ($r = 0.47$) and, thus, the greatest potential to produce an effect. The main difference in the persuasive communications of the low and high RE conditions was that low RE participants were told that the risk reduction was about 10%, whereas the high RE participants were told it was about 60%. Both conditions reported a mean RE score of about 5.5 on a seven-point scale, indicating that the weak manipulation most likely resulted from an ineffective low RE condition. In retrospect, perhaps even a 10% reduction in colon cancer risk is viewed as meaningful. From a practical perspective, this finding is encouraging because it indicates that documenting even modest reductions in cancer risk from exercise may generate high RE and motivate exercise behaviour change.

Our failure to manipulate PV is perplexing and does not allow us to comment on its potential role in cancer prevention and exercise motivation. Participants in the low PV condition were told that the risk is 1 in 200 and that the disease mainly affects older people. Participants in the high PV condition were told the risk is 1 in 9 regardless of their demographic characteristics. The mean of both groups was about 3.0 on the seven-point PV scale, indicating that the failure likely resulted from an ineffective high PV condition. It appears that even a 1 in 9 lifetime risk is still considered a low risk, at least for healthy young people. Weinstein (1993) has noted that strong manipulations of PV are needed to overcome an optimistic bias held by most individuals, but especially young adults. Clearly, instilling perceptions of vulnerability to cancer in young people is a major challenge for cancer prevention practitioners.

The failure to find a main effect for SE on PM is surprising given the effective manipulation of SE. This lack of a main effect most likely resulted from the weak correlation between SE and PM in the present study ($r = 0.17$). It is likely that SE would have had a much stronger relationship with PM if the sample were not active young people or the dependent variable went beyond motivation to actual behaviour. Concerning this latter point, some theorists have suggested a stage approach to health behaviour change that usually has intention or decision to act as one of the early stages (Prochaska & Velicer, 1997; Weinstein, 1988). PMT constructs such as PS are theorized to be most relevant for these early stage transitions (Courneya, 1995). In the present study, the majority of participants would be considered in the later stages of change because of their high level of exercise. This means that we examined colon cancer prevention as a motive to exercise in a sample that were already exercising. This fact probably worked against our hypotheses but perhaps makes our findings stronger because of the positive findings. Future research is needed, however, to determine if cancer prevention is effective for motivating non-exercisers to seriously consider exercising, those seriously considering exercising to decide to start, and those currently exercising to continue.

Although the present findings are promising, there are a number of limitations in this study that should be considered when interpreting the findings, applying the results and planning future research. First, the findings are not generalizable beyond active, healthy young undergraduate students or colon cancer. Second, we failed to manipulate PV and only weakly manipulated RE. Third, we only measured motivation as the outcome and not actual behaviour. Despite these limitations, however, the present study provides the first evidence that cancer prevention may be a meaningful source of exercise motivation. Thus, the
potential for increasing exercise motivation through documenting a link between exercise and cancer risk seems promising. More research is needed, however, before any definitive conclusions can be drawn.

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References


