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A Case for Theoretical Integration: Combining Constructs From the Theory of Planned Behavior and the Extended Parallel Process Model to Predict Exercise Intentions

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Abstract

The present research investigated whether constructs of the Theory of Planned Behavior (TPB) and the Extended Parallel Process Model can be integrated into a model that can better explain intentions to exercise than the TPB constructs alone. A total of 336 participants completed measures of constructs from both theories and past exercise behavior. Hierarchical regression analyses revealed that attitudes, subjective norms, susceptibility, self-efficacy, and past behavior contributed unique variance to a model that predicted intentions to exercise. This model explained a greater proportion of the variance in exercise intentions than the TPB alone. Relationships between key variables of both models were also highlighted. Implications for theory and practice are discussed.

Keywords

health psychology, applied psychology, psychology, social sciences, Theory of Planned Behavior, Extended Parallel Process Model, theoretical integration, self-efficacy

It is widely acknowledged that regular exercise is associated with significant physiological and psychological benefits (Warburton, Nicol, & Bredin, 2006; Williams, 2001). However, in many westernized countries, less than half the population meet the minimum recommended physical activity requirements to achieve these health benefits (e.g., Australian Institute of Health and Welfare, 2010; Canadian Fitness and Lifestyle Research Institute, 2004; U.S. Department of Health and Human Services, 2003). As such, investigating ways of increasing exercise is a concern within health psychology (e.g., Hagger & Armitage, 2004; Hagger, Chatzisarantis, & Biddle, 2002a; Jones, Sinclair, Rhodes, & Courneya, 2004; Rhodes,& Nasuti,2011). The focus of this research is to identify the socio-cognitive factors that predict exercise intentions and behavior and provide a psychological account of how these factors determine behavior. Advancing theories in this way is important as successful manipulation of these factors via health promotion and communication may be useful in increasing the rates of exercise (Armitage & Conner, 2000).

Several models have been proposed to explain health behaviors. Two prominent models are the Theory of Planned Behavior (TPB; Ajzen, 1985, 1987) and the Extended Parallel Process Model (EPPM; Witte, 1992a). Both these models have been utilized to explain health behavior and intentions to engage in health behavior. Intention refers to the strength of the motivation or desire to engage in a particular behavior (Ajzen, 1991). Embedded in both models is the assumption that an individual's intention to engage in a particular health behavior is a proximal predictor of engagement in that behavior (Ajzen, 1991; Witte, 1994). As such, intentions are often used as the dependent variable of interest rather than actual behavior change (e.g., Abraham, Sheeran, & Henderson, 2011; Armitage & Conner, 2000; Godin & Kok, 1996; Hagger & Armitage, 2004; Hagger et al., 2002a). However, meta-analytic reviews suggest that neither model can explain all or even most of the variance in either behavioral intentions or health behavior change (e.g., Armitage & Conner, 2001; Floyd, Prentice-Dunn, & Rogers, 2000; Hagger et al., 2002a; Milne, Sheeran, & Orbell, 2000; Witte & Allen, 2000).

The literature primarily focuses on testing and utilizing existing theory to predict intentions and health behavior.

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Most often, one theory is selected to guide the choice of explanatory and outcome variables as if the other theories did not exist (Weinstein, 1993). Several researchers have lamented that there is a lack of research comparing competing theories or augmenting existing theories (Noar & Zimmerman, 2005; Ogden, 2003; Weinstein, 1993, 2007; Weinstein & Rothman, 2005; see Conner & Armitage, 1998; Dodge, Stock, & Litt, 2013; Dolman & Chase, 1996; Godin & Kok, 1996; Hagger et al., 2002a; Murray-Johnson et al., 2006, for some notable exceptions). Failing to compare or adjust existing theory means that it fails to naturally evolve, and as such our understanding of the socio-cognitive factors which determine health behavior change (and the mediators of health behavior change) does not improve (Weinstein & Rothman, 2005).

Several researchers have advocated taking a broader approach to predicting health behavior change by utilizing constructs from several theoretical perspectives—namely, theoretical integration (e.g., Hagger, 2009, 2010; Noar & Zimmerman, 2005). Bringing together the constructs with the most research support into a single model may yield a model which can explain a larger proportion of the variance than any single model alone. In many cases, the similarities between models of health behavior outweigh the differences (Hagger, 2009, 2010; Weinstein, 2007). Therefore, to reduce redundancy, only dissimilar models should be integrated. Two models which stand out as being different from one another, while still explaining a large proportion of the variance in health behavior change, are the TPB and EPPM.

Main Theoretical Perspectives

The TPB

According to the TPB (Ajzen, 1985, 1987, 1991), intentions and perceived behavioral control (PBC) are the proximal predictors of behavior. PBC refers to an individual's appraisal of how much control they have over adopting a particular behavior (Ajzen, 1991, 2002). This is determined by the individual considering the relevant resources they have available to them (i.e., requisite skills, social support, disposable income, etc.) and determining whether these are sufficient to overcome any barriers they anticipate in the performance of the behavior. Ajzen argues that if people believe that they will be successful in performing the behavior, they will be more likely to expend greater effort in adopting it (cf. Bandura, 1977, 1982, 1991). PBC is only likely to be an important predictor of behavior when behaviors are somewhat difficult or effortful to perform.

An individual's intentions are determined by their attitudes, subjective norms, and PBC. One's attitude toward a behavior refers to their appraisal (positive or negative) of their performing the behavior. Beliefs contributing to the formation of an attitude include the expected outcomes of engaging in the behavior (behavioral beliefs) and whether or not these outcomes are appraised as favorable or unfavorable (subjective evaluation; Ajzen, 1991). More positive attitudes are generated when expected outcomes are appraised as favorable. Subjective norms refer to the "perceived social pressure to perform or not perform the behaviour" (Ajzen, 1991, p. 188). The beliefs which determine subjective norms are the perceived likelihood that important people in the individual's life (e.g., friends, family members, medical professionals) will approve or disapprove of them engaging in a particular behavior, and their motivation to comply with each important other's wishes. According to the TPB, an individual is most likely to intend to perform health protective behaviors if they believe that (a) the behaviors are associated with favorable outcomes, (b) important others will approve, and (c) they have a high level of control over whether the behavior is adopted.

The TPB has received much research interest and has been found to be useful in explaining a variety of health behaviors including exercise (e.g., Armitage & Conner, 2001; Chatzisarantis, Hagger, Wang, & Thøgersen-Ntoumani, 2009; Godin & Kok, 1996; Hagger et al., 2002a; Hausenblas, Carron, & Mack, 1997; Murnaghan et al., 2010). Meta-analytic reviews have found that, on the whole, TPB explains 39% to 51% of the variance in behavioral intentions and 26% to 34% of the variance in health behavior (Armitage & Conner, 2001; Godin & Kok, 1996; Hagger, Chatzisarantis, & Biddle, 2002b; McEachan, Conner, Taylor, & Lawton, 2011). Therefore, although the TPB explains a large proportion of the variance in intentions and behavior, a significant amount of variance remains unexplained, suggesting that other predictors may exist which could explain this missing variance.

EPPM

The EPPM (Witte, 1992a) was designed to explain responses following exposure to a fear provoking health message—or a fear appeal (Witte, 1992a). Fear appeals generally consist of two elements: an explicit threat to health (e.g., "obesity increases your chances of heart disease") and a recommended response which will alleviate that threat ("exercise for 30 min 5 times per week"). However, many of the principles of the EPPM can be applied outside of a fear appeal context to explain how individuals are likely to respond to a perceived health threat (e.g., Rimal, 2001; Rimal, Böse, Brown, Mkandawire, & Folda, 2009; Rimal, Brown, et al., 2009; Rimal & Real, 2003; Turner, Rimal, Morrison, & Kim, 2006). Witte (1992a) theorized that responses to a health threat are a function of two appraisal processes: threat appraisal and efficacy appraisal (cf. Lazarus & Folkman, 1984). During the threat appraisal, individuals evaluate factors associated with the health threat, including feelings concerning the seriousness of a health threat (severity) and the likelihood of their being affected (susceptibility). The efficacy appraisal evaluates factors associated with a possible

response to the threat including beliefs regarding the effectiveness of the response in reducing the health threat (response-efficacy) and a conviction that they can succeed in adopting the response (self-efficacy; cf. Bandura, 1977).

According to the EPPM, when a health threat is appraised as trivial (low severity) or irrelevant (low susceptibility), no fear is elicited and there is no motivation to respond to the fear appeal or continue to attend to its message. Thus, low threat messages are unlikely to lead to adaptive behavior change, regardless of the efficacy level (Witte, 1992a). However, when a health threat is appraised as harmful and relevant, fear is elicited (e.g., Maddux & Rogers, 1983; Rippetoe & Rogers, 1987; Rogers & Mewborn, 1976; Witte, 1992b, 1994; Witte & Allen, 2000). This fear motivates a consideration of possible responses to the health threat (efficacy appraisal; cf. Lazarus & Folkman, 1984). When a particular response is believed to be effective in alleviating the health threat (high response-efficacy) and easy to perform (high self-efficacy), the individual should become motivated to protect themselves from the health threat. This protection motivation should in turn stimulate acceptance of the response (i.e., adaptive attitude, intention, and behavior change; Witte, 1992a; Witte & Allen, 2000). Therefore, the EPPM predicts that when individuals perceive themselves to be susceptible to a severe health threat, and believe that adopting a particular behavior will be effective in alleviating that health threat, they are likely to hold positive attitudes and intend to adopt that behavior (see Witte, 1992a, for a fuller explication of the predictions of the EPPM).

Meta-analyses reveal that the five key variables (fear, severity, susceptibility, response-efficacy, and self-efficacy) of the EPPM each have positive associations with behavioral intentions and behavior change (Floyd et al., 2000; Milne et al., 2000; Witte & Allen, 2000). However, on the whole, effect sizes range from no effect to moderate (r = .07-.36; Milne et al., 2000). Self-efficacy, response-efficacy, and fear are generally stronger predictors of intentions and behavior than severity or susceptibility (Milne et al., 2000; Witte & Allen, 2000). Research findings suggest that perceptions of threat and efficacy account for 20% to 56% of the variance in intentions and 19% to 46% of the variance in health behavior (e.g., Hodgkins & Orbell, 1998; Maddux & Rogers, 1983; Melamed, Rabinowitz, Feiner, Weisberg, & Ribak, 1996; Plotnikoff & Higginbotham, 1995, 1998, 2002; Plotnikoff, Trinh, Courneya, Karunamuni, & Sigal, 2009; Rogers & Mewborn, 1976; Stanley & Maddux, 1986; Van der Velde & Van der Pligt, 1991). Although these findings are impressive, there is still a large proportion of the variance which is left unexplained by the model. Therefore, other variables may need to be considered if a more complete explanation of health behavior is to be realized.

The Case for Theoretical Integration

The present study aims to investigate the utility of taking a more comprehensive approach to predicting exercise intentions by utilizing constructs from two socio-cognitive models as predictors. The study will investigate whether adding perceived susceptibility, severity, self-efficacy, and response-efficacy to the TPB increases its explanatory power for predicting intentions to exercise. Hagger (2009) identified three arguments in favor of theoretical integration; it can eliminate gaps in theories, reduce redundancy, and increase parsimony. Both the TPB and EPPM contain different explanatory variables (Ajzen, 1985, 1987; Witte, 1992a), but each still explains a significant proportion of the variance in health behavior intentions (e.g., Armitage & Conner, 2001; McEachan et al., 2011; Witte & Allen, 2000). Therefore, it is possible that constructs from the EPPM may be able to fill explanatory gaps in the TPB, and vice versa, highlighting redundancies and unnecessary variables between theories. Therefore, theoretical integration may help streamline health promotion campaigns by identifying the most important variables to manipulate (Hagger, 2009). Other researchers agree that combining social-cognitive models may be a useful next step in the development of health behavior theory (Armitage & Conner, 2000; Fishbein et al., 2001; Maddux, 1993; Plotnikoff, Rhodes, & Trinh, 2009). To date, no research has attempted to combine variables from the TPB and EPPM to explain exercise intentions.

Integrating Ideas From the TPB and EPPM

Theorists have argued that self-efficacy and PBC are conceptually similar (Ajzen, 1985, 1991; Ajzen & Madden, 1986). However, Conner and Armitage (1998) argued that PBC is really a confounded measure of two constructs: one which is akin to self-efficacy (cf. Bandura, 1977, 1982; that is, ease with which the behavior can be adopted) and the other akin to locus of control (cf. Rotter, 1966; that is, whether a person believes that the behavior is under volitional control—perceived controllability). In support of this view, several studies have provided evidence for the conceptual distinction between perceived controllability and self-efficacy (e.g., Armitage & Conner, 1999a, 1999b; Dzewaltowski, Noble, & Shaw, 1990; Terry & O'Leary, 1995). Terry et al. argued that they should each be included as separate variables within the TPB framework. Adding self-efficacy to the TPB has been shown to increase the explanatory power of the model in terms of explaining exercise intentions and behavior (e.g., Hagger et al., 2002b; Povey, Conner, Sparks, James, & Shepherd, 2000; Yordy & Lent, 1993). Therefore, it is predicted that perceptions of self-efficacy and perceived controllability will be conceptually distinct and will each predict exercise intentions.

It has been argued that components of perceived threat within the EPPM (i.e., susceptibility and severity) may be incorporated into the TPB as beliefs contributing to one's attitudes (Maddux, 1993; Rogers & Prentice-Dunn, 1997). Susceptibility may be conceptualized as a perceived outcome of not engaging in the healthy behaviors (i.e., "if I maintain my sedentary lifestyle I may develop heart

disease"). Perceptions of severity could be conceptualized as unfavorable evaluations of developing a health problem (i.e., "heart disease is a serious and life-threatening"; Maddux, 1993). Beliefs about one's susceptibility to a severe illness should lead to more negative attitudes concerning the current unhealthy behavior (cf. Rogers, 1983; Rogers et al., 1997) and as a result more positive attitudes about proposed changes in behavior, especially if these are believed to be effective in alleviating the health risk. Therefore, beliefs about the efficacy of a particular response in alleviating the health risk (i.e., response-efficacy) could also be conceptualized as a behavioral belief concerning that response. It can be safely assumed that this belief would be favorable as it is unlikely that improving one's health would be viewed as unfavorable. This suggests that the EPPM constructs of susceptibility, severity, and response-efficacy may be determinants of attitudes within the TPB. As such, it is predicted that the effect of these variables on intentions will be mediated by attitudes.

Ajzen (1991, 2011) argued that a measure of past behavior may be used to test the sufficiency of the TPB. If the TPB is sufficient, prior behavior (or any other variable) should not add significant unique variance to the model. However, meta-analytic reviews of the TPB consistently suggest that past health behavior is a relatively strong and consistent predictor of both intentions and behavior even after controlling for the effects of attitudes, subjective norms, PBC, and intentions (e.g., Conner & Armitage, 1998; Hagger et al., 2002b; McEachan et al., 2011; Ouellette & Wood, 1998; Sandberg & Conner, 2008). The addition of past behavior to the TPB also significantly attenuates the effects of intentions and PBC on behavior, and the effects of attitudes, subjective norms, and PBC on intentions (McEachan et al., 2011). Therefore, the TPB may not be sufficient to predict intentions and behavior, suggesting that important socio-cognitive predictors may have been left out of the model.

Ouellette and Wood (1998) argued that when a behavior is performed frequently within similar contexts, the performance of that behavior can become automatic or habitual—occurring independent of the conscious deliberation posited by the TPB (cf. Ronis, Yates, & Kirscht, 1989). Therefore, if an individual has made a habit of exercising in the past, they are likely to do so in the future. Ajzen (2002) offered an alternative explanation arguing that the determinants of past behavior are likely to affect future behavior and future intentions. As such, assuming these determinants do not change significantly over time, past behavior will necessarily correlate with intentions. Ajzen suggested that the link between past behavior and intentions is spurious and should be mediated by other predictors of intentions. It is possible that this effect may be due to past exercise raising individual's self-efficacy with respect to exercising in the future. Engaging in exercise demonstrates empirically that one should be able to exercise again (cf. Bandura, 1977, 1982). Therefore, it is predicted that self-efficacy will mediate the effect of past exercise behavior on intentions to exercise.

Taken together, we propose a model in which exercise will be determined by attitudes, subjective norms, self-efficacy, and perceived controllability. Severity, susceptibility, and response-efficacy will have no direct effect on intentions but will exert their influence via attitudes. Past behavior will be used to test the sufficiency of the model and its effect on intentions should be mediated by self-efficacy.

Method

The results reported here are preliminary findings from a larger study investigating the predictors of health behavior change around obesity, diet, and exercise. The present research will report only the results pertaining to the predictors of exercise.

Participants

A total of 336 participants (265 females, 71 males) were recruited for the study. The mean age of participants was 25.28 years (SD = 11.01). Most participants were recruited from the undergraduate psychology program of a university in New South Wales, Australia, via an online advertisement (N = 284), the remaining 52 participants were recruited from the general public via advertisement posters. Undergraduate participants received partial course credit for their participation, whereas the general public participants received no incentives or rewards.

Measures

With the exception of the demographics measure, all measures used in this study have been adapted from those used in previous research testing the TPB (e.g., Chatzisarantis et al., 2009; Fishbein & Ajzen, 2010; Jones et al., 2004; Payne, Jones, & Harris, 2004; Rivis & Sheeran, 2003) and the EPPM (e.g., Cho, 2003; Witte, 1994; Witte, Cameron, McKeon, & Berkowitz, 1996). The phrasing of the items remained similar but was adapted to fit the health context of this study.

All items corresponded to exactly the same specific behavior ("exercising 30 min a day, 5 days per week") over a specific time frame ("the next month") following recommendations from Ajzen (1991). With the exception of the demographics measure (which was presented first) and the attitudes and intentions measures (which were presented last), the items from the remaining scales were presented in random order. All measures except the attitudes measure utilized a 7-point categorical scale anchored by *strongly agree* and *strongly disagree*. The attitudes measure utilized a 7-point semantic differential scale. Items pertaining to each of the measures were summed, then averaged by dividing the total by the number of items, such that each measure was scored out of seven. The experiment was performed online on the university server. The survey program was used to randomize the items.

Demographics/past behavior. Age, sex, and information pertaining to relevant health behaviors (e.g., frequency of exercise, minutes spent exercising per week) were gathered using a demographics measure. Past exercise behavior was determined by asking participants how many exercise sessions they had completed over the past month and what was the average length of these exercise sessions. These values were used to calculate the time (in hours) spent exercising per week. This was used as a measure of past behavior. As a guide, participants were provided with the following definition of exercise: "Exercise is defined as physical activity that is planned, structured, and repetitive for the purpose of conditioning any part of the body or increasing physical fitness."

Attitudes. Participant's attitudes were measured using a four-item semantic differential scale. Participants indicated the extent to which engaging in exercise during the next month would be good/bad, enjoyable/not enjoyable, unwise/wise, and beneficial/not beneficial. The internal consistency for this measure was high ($\alpha = .84$).

Subjective norms. Subjective norms were measured using a two-item scale. Participants indicated the extent to which they believe that important others would "approve" or "recommend" that they engage in exercise during the next month. The internal consistency for this measure was acceptable ($\alpha = .77$).

Perceived controllability. Perceived controllability was measured using a two-item scale. Participants indicated the extent to which they believe that they have control over engaging in exercise during the next month (i.e., "It is mostly up to me [I have control over] whether or not I exercise for at least 30 min per day during the next month"). The internal consistency for this measure was high ($\alpha = .89$).

Susceptibility. Susceptibility was measured using a three-item scale. Participants indicated whether they believed themselves to be "at risk of," "likely to develop," or "possibly affected by" the adverse health effects associated with weight gain. The internal consistency of this scale was high ($\alpha = .96$).

Severity. Severity was measured using a three-item scale. Participants indicated the extent to which they believed that the adverse health effects associated with weight gain are "severe," "serious," and "significant." The internal consistency of this scale was acceptable ($\alpha = .78$).

Self-efficacy. Self-efficacy was measured using a six-item scale. Items included the following: "Exercising for 30 minutes per day 5 days per week during the next month will be easy (difficult, inconvenient [reverse scored]) for me" and "I am able to (I am certain I could, If I wanted to I could easily) exercise for 30 min . . ." The internal consistency for the scale was high ($\alpha = .93$).

Response-efficacy. Response-efficacy was measured using a three-item scale. Participants indicated the extent to which they believe that engaging in exercise "works" and "is effective" in preventing weight-related health problems. The internal consistency for this measure was high ($\alpha = .89$).

Intentions. The dependent variable, intentions, was measured using a two-item scale. Items included the following: "I intend to exercise for at least 30 min per day, 5 days per week during the next month" and "I will exercise . . ." The internal consistency for this measure was high ($\alpha = .88$).

Data Analysis

Principal components analysis was utilized to ascertain whether self-efficacy and perceived controllability were distinct constructs. Pearson's correlations were utilized to investigate the intercorrelations between the psychological variables used in this study. Multiple regression was utilized to investigate the predictors of attitudes. Hierarchical regression analysis was utilized to uncover a significant model of factors that predict exercise intentions. This analysis was performed by entering four different blocks of predictors into a regression equation predicting intentions. Block 1 consisted of the TPB variables (i.e., attitudes, subjective norms, and perceived controllability). Block 2 contained self-efficacy. Block 3 consisted of the remaining variables from the EPPM (i.e., susceptibility, severity, and response-efficacy). Block 4 contained past exercise behavior. Hierarchical regression was also utilized to investigate whether the effect of severity, susceptibility, and response-efficacy on intentions is mediated by attitudes, and whether the effect of past behavior on intentions is mediated by self-efficacy.

Results

Principal Components Analysis

As PBC and self-efficacy are conceptually similar, there was a need to ensure that the items used were indeed representing two separate constructs, rather than one overarching construct. Therefore, a principal components analysis with Varimax rotation was performed on the perceived controllability and self-efficacy items. Kaiser's criterion (eigenvalue > 1) was utilized to determine how many factors to extract. The first factor (rotated: eigenvalue = 4.00, variance explained = 49.95%; unrotated: eigenvalue = 5.13, variance explained = 64.17%) was found to all six of the self-efficacy items loading on it (with factor loadings greater than .5; Kline, 1994). The second factor (rotated: eigenvalue = 2.23, additional variance explained = 27.87%; unrotated: eigenvalue = 1.09, additional variance explained = 13.65%) had

Table 1. Descriptive Statistics and Correlation Matrix for Exercise Intentions and All Measured Predictors.

	M	*SD*	1	2	3	4	5	6	7	8
1. Intentions	4.38	1.91								
2. Attitudes	5.92	1.05	.48**							
3. Subjective norms	4.68	1.05	.31**	.37**						
4. Controllability	5.74	1.37	.34**	.28**	.26**					
5. Susceptibility	2.79	1.83	.02	−.05	.08	−.22**				
6. Severity	5.33	1.41	.02	.11	.20**	−.01	.27**			
7. Self-efficacy	4.47	1.64	.65**	.48**	.33**	.56**	−.19**	.02		
8. Response-efficacy	5.94	1.02	.12*	.27**	.35**	.35**	.03	.21**	.21**	
9. Past behavior[a]	2.61	2.62	.38**	.24**	−.02	.20**	−.16**	.01	.44**	.04

[a]Hours of exercise performed each week.
*$p < .05$. **$p < .01$.

both of the perceived controllability items loading on it. No further factors were extracted (eigenvalues < 1). As predicted, these results indicate that the self-efficacy and perceived controllability items represent distinct constructs. However, the percentage of additional variance explained by the second factor was small, indicating that this factor is relatively weak. Nevertheless both factors were retained to investigate the unique effect of self-efficacy and perceived controllability on intentions. The total variance explained by the two-factor rotated solution was 78.21%. The correlation between the resultant measures of perceived controllability and self-efficacy was $r = .51$.

Descriptive Statistics and Correlations

Descriptive statistics and correlation coefficients for each of the psychological variables are presented in Table 1. Pearson's correlations coefficients revealed a strong positive association between self-efficacy and intentions; moderate positive associations were observed between exercise intentions and attitudes, subjective norms, perceived controllability, and past behavior. Exercise intentions were also weakly associated with response-efficacy. Contrary to predictions, no significant bivariate correlation was found between exercise intentions and susceptibility or severity. As predicted, attitudes were positively associated with response-efficacy, and past behavior was positively associated with self-efficacy. However, contrary to predictions, neither severity nor susceptibility was associated with attitudes. Furthermore, a moderate positive correlation was found between self-efficacy and perceived controllability. Other intercorrelations were generally weak or non-significant. However, moderate positive associations were recorded between attitudes and subjective norms, attitudes and self-efficacy, subjective norms and self-efficacy, subjective norms and response-efficacy, and perceived controllability and response-efficacy.

Prediction of Attitudes

Multiple regression analysis was utilized to investigate the effect of susceptibility, severity, and response-efficacy on attitudes. A significant model which explained 7.29% of the variance in attitudes was found, $F(3, 332) = 9.77$, $p < .001$ (see Table 2). Response-efficacy was the only variable found to explain a significant proportion of the variance in attitudes. Contrary to predictions, the effects of both susceptibility and severity were non-significant.

Predictors of Exercise Intentions

The first step in the hierarchical regression analysis revealed that attitudes, subjective norms, and perceived controllability each contributed to the prediction of exercise intentions, $F(3, 332) = 44.60$, $p < .001$ (see Table 2). Self-efficacy was found to explain a further 16.21% of the variance, $\Delta F(1, 331) = 97.60$, $p < .001$. Following the addition of self-efficacy to the model, the effect of both subjective norms and perceived controllability was attenuated to non-significance. The remaining EPPM predictors explained a further 1.90% of the variance in intentions, $\Delta F(3, 328) = 4.89$, $p < .005$. However, perceived susceptibility was the only variable to explain a significant proportion of the remaining variance. Finally, past exercise behavior was also found to be a significant predictor of intentions, explaining a small proportion of the remaining variance, $\Delta F(1, 327) = 8.95$, $p < .005$. The overall model explained 47.46% of the variance in exercise intentions.

Given the zero-order bivariate relationship between susceptibility and intentions ($r = .02$, $p = .78$), it is possible that susceptibility acted as a suppressor variable. Suppressor variables generally increase the prediction of an outcome variable of interest by increasing the predictive validity of one or more predictor variables (cf. MacKinnon, Krull, & Lockwood, 2000; Pandey & Elliot, 2010; Tzelgov & Henik, 1991). This occurs as the suppressor variable suppresses variance in one or more of the predictor variables, which is irrelevant to the outcome variable. Investigation of the correlation matrix revealed that susceptibility was negatively associated with self-efficacy ($r = -.19$, $p < .001$). Furthermore, a small increase in the beta-weight for self-efficacy was found following the inclusion of susceptibility in the model. MacKinnon et al. demonstrated that suppression and

Table 2. Hierarchical Regression Analysis of the Predictors of Attitudes and Exercise Intentions.

	β	*t*	Adjusted R^2
Attitudes			
Step 1: Susceptibility	−.07	−1.28	.07***
Severity	.07	1.26	
Response-efficacy	.26	4.77***	
Intentions			
Step 1: Attitudes	.38	7.48***	.28***
Subjective norms	.12	2.29*	
Controllability	.20	4.03***	
Step 2: Attitudes	.27	4.46***	.44***
Subjective norms	.07	1.56	
Controllability	−.03	−0.52	
Self-efficacy	.52	9.88***	
Step 3: Attitudes	.22	4.77***	.46**
Subjective norms	.08	1.61	
Controllability	.02	0.42	
Self-efficacy	.54	10.16***	
Susceptibility	.14	3.34**	
Severity	−.05	−1.25	
Response-efficacy	−.08	−1.69	
Step 4: Attitudes	.22	4.52***	.47**
Subjective norms	.10	2.18*	
Controllability	.03	0.53	
Self-efficacy	.47	8.36***	
Susceptibility	.15	3.57***	
Severity	−.06	−1.40	
Response-efficacy	−.08	−1.67	
Past exercise behavior	.14	2.99**	

*p< .05. **p< .01. ***p< .001.

mediation are mathematically equivalent. As such, tests of mediation, such as the Sobel test, can also be applied to identifying suppressor effects (Preacher & Hayes, 2004). A Sobel test revealed that the inclusion of susceptibility in a model regressing intentions from self-efficacy significantly increased the predictive validity of self-efficacy ($Z = -2.44$, p< .05). This indicates that susceptibility acted as a suppressor variable within the regression equation, suppressing variance in self-efficacy, which was irrelevant to intentions (classical suppression; Horst, 1941; Pandey &Elliot, 2010; Tzelgov & Henik, 1991). These findings suggest that exercise intentions are not associated with the shared variance between self-efficacy and susceptibility.

Mediation Analyses

It was predicted that attitudes would mediate the relationship between response-efficacy and intentions, susceptibility and intentions, and severity and intentions. Following Baron and Kenny (1986), variables were only entered as potential mediators when (a) the predictor was correlated with the mediator (attitudes), (b) the predictor was correlated with the dependent variable (intentions), and (c) the mediator was correlated with the dependent variable. Investigations of correlation matrix revealed that attitudes qualified as a mediator for the effect of response-efficacy on intentions. Both susceptibility and severity did not correlate with intentions. This suggests that neither susceptibility nor severity exert any direct or indirect effect on intentions.

Attitudes were found to fully mediate the effect of response-efficacy on intentions to lose weight. Response-efficacy was found to be a predictor of intentions in the first step of a hierarchical linear regression analysis (β = .15, p< .01). However, following the addition of attitudes into the equation, the effect of response-efficacy was attenuated to non-significance (β = .07, p = .20). A Sobel test of mediation revealed that the indirect effect of response-efficacy on intentions was significant ($Z = 3.68$, p< .001; cf. Preacher & Hayes, 2004). These findings support the prediction that attitudes will mediate the effect of response-efficacy on intentions.

A similar analysis was performed to investigate whether self-efficacy mediated the relationship between past exercise behavior and intentions. Investigation of the correlation matrix revealed that self-efficacy qualified as a mediator. Hierarchical regression analysis revealed that adding self-efficacy to a model regressing exercise intentions from past exercise behavior attenuated the effect of past exercise behavior to non-significance—β reduced from .26 (p< .001) to .02 (p = .63), $Z = 6.62$, p< .001. These findings support the prediction that the effect of past behavior on intentions will be mediated by self-efficacy.

Discussion

The current study aimed to investigate whether there is utility in combining constructs from the TPB and EPPM to predict exercise intentions. Results suggested that although the TPB is a useful model for predicting exercise intentions, the addition of variables from the EPPM increased its explanatory power. The identified integrated model suggested that individuals are most likely to intend to exercise when they believe that engaging in exercise will lead to desirable outcomes, believe that others will approve of their exercising, believe that they are able to exercise effectively, and believe that they are susceptible to weight-related illnesses. The identified model closely resembles the structure of the TPB, the only differences being that only the self-efficacy component of PBC was an important predictor and perceived susceptibility explained additional variance. The proportion of the variance explained by the model is comparable with that found in meta-analytic reviews of TPB research relating to health behaviors (e.g., Godin & Kok, 1996; Hagger et al., 2002; McEachan et al., 2011). The addition of susceptibility and past behavior only added a further 3%, suggesting that these variables are far less important predictors of exercise intentions than attitudes and self-efficacy.

Self-Efficacy and Perceived Controllability

The results of this study lend further support for the separation of the PBC construct into two component parts: self-efficacy and perceived controllability. These findings are consistent with a large number of studies, which have provided evidence for the conceptual distinction between self-efficacy and perceived controllability (e.g., Armitage & Conner, 1999a, 1999b; Hagger & Chatzisarantis, 2005; Povey et al., 2000; Terry & O'Leary, 1995; White, Terry, & Hogg, 1994). Although there is evidence to suggest that both self-efficacy and PBC may contribute unique variance to models of health behavior intentions (e.g., Hagger et al., 2002; Yordy & Lent, 1993), this finding was not borne out in the current study. In the present study, the effect of perceived controllability on intentions was attenuated to non-significance following the addition of self-efficacy to the model. However, these results echo other previous findings which suggest that self-efficacy is a stronger predictor of intentions than perceived controllability (e.g., Povey et al., 2000; Sparks, Guthrie, & Shepherd, 1997; Terry & O'Leary, 1995). These findings suggest that individual's belief that they are capable of engaging in exercise is a more important predictor of exercise intentions than their belief that they have control over whether they engage in exercise.

Attitudes

Attitudes were found to be a predictor of intentions lending support to the predictions of the TPB. Attitudes are consistently a strong predictor of intentions in TPB research (cf. Godin & Kok, 1996; Hagger et al., 2002; McEachan et al., 2011). As predicted, response-efficacy was found to be a significant predictor of attitudes. However, contrary to predictions susceptibility and severity were non-significant predictors. These results support previous findings in the literature, suggesting that perceptions of efficacy (but not threat) are associated with more positive attitudes concerning health behaviors (e.g., Ruiter, Verplanken, Kok, & Werrij, 2003; Witte, 1992b, 1994). Attitudes were also found to fully mediate the effect of response-efficacy on intentions. According to the EPPM, individual's perceptions of response-efficacy can be manipulated through health messages highlighting the effectiveness of certain responses (e.g., Cho, 2003; Witte, 1992b, 1994; Witte & Allen, 2000). Therefore, a health message may increase perceptions of response-efficacy with respect to a recommended response, which determines one's attitudes concerning that response, which in turn determines intentions and behavior. This mediation model is consistent with the results of this study and the predictions of both the TPB and EPPM. As such, it may be possible to apply the TPB to the prediction of health message responsiveness. Investigating this possibility would be an interesting venture for future research.

Other predictors of exercise intentions included subjective norms, susceptibility, and past behavior. Importantly, these variables were much weaker predictors of intentions. Several researchers have noted that subjective norms are often a weaker predictor of intention than either attitudes or PBC as evidenced by effect sizes in meta-analytic reviews and regression weights (e.g., Ajzen, 1991; Armitage & Conner, 2001; Conner & Armitage, 1998; Hagger et al., 2002; Hausenblas et al., 1997; McEachan et al., 2011; Rivis & Sheeran, 2003). Findings also suggest that perceptions of threat are weaker predictors of exercise intentions than efficacy perceptions (e.g., Lippke & Plotnikoff, 2009; Plotnikoff & Higginbotham, 1995; Plotnikoff & Trinh, 2010; Plotnikoff, Rhodes, & Trinh, 2009; Plotnikoff, Trinh, et al., 2009). Furthermore, susceptibility was identified as a suppressor variable increasing the predictive validity of self-efficacy. This suggests that the positive effect of self-efficacy on intentions is not at all attributable to the finding that those with high self-efficacy tend to report lower susceptibility. The effect of susceptibility was significant because it removed variance in self-efficacy which was unrelated to exercise intentions; rather than susceptibility exerting any direct impact on intentions.

Past exercise behavior was also found to be a predictor of exercise intentions. However, it only added a very small amount of the residual variance in intentions after controlling for the effect of the other psychological variables. Nevertheless, this suggests that the current model may be inadequate and other psychosocial constructs may need to be considered to optimize the prediction of exercise intentions (cf. Ajzen, 1991, 2011). However, the results of this study suggest that the effect of past exercise behavior on intentions is mediated by self-efficacy. This finding supports Ajzen's (2002) contention that the effect of past behavior on future intentions is spurious and should be mediated by other predictors of intentions. The results of the present study suggest that engaging in exercise in the past increases one's belief that they could continue to exercise in the future, which in turn predicts intentions to exercise.

It is important to note that variables from both the TPB and EPPM contributed to the model. Furthermore, several of the psychological variables from both models either did not predict exercise intentions (susceptibility and severity) or did not contribute unique variance to its prediction (perceived controllability, response-efficacy). This suggests that neither model provides a complete or optimal account of exercise intentions. Despite a large number of variables being used as predictors, a relatively simple five-factor model of intentions emerged. This suggests that theoretical integration can be used to identify variables that are weakly or spuriously associated with an outcome variable of interest (cf. Hagger, 2009, 2010). The results of this study further suggest that theoretical integration can be utilized to develop our understanding of the relations between constructs from separate models. With the large number of extant models being applied to health behavior, many of which making very similar or identical predictions, it is important to identify and understand

connections between these models. This allows for identification of general cross-theoretical principles of predicting health behavior (Maddux, 1993; Noar & Zimmerman, 2005). This is desirable as it serves to simplify and reconcile the health behavior literature as a whole (cf. Hagger, 2009; Maddux, 1993). Reconciliation of the health behavior literature may be achieved through further research, which employs theoretical integration (cf. Hagger, 2009, 2010).

A limitation of the present research is the use of intentions as the primary outcome measure in lieu of a specific measure of behavior. Although many socio-cognitive models (including TPB and EPPM) assume that intentions are the proximal predictor of behavior, this assumption has often been called into question (e.g., Rhodes & Dickau, 2012; Rhodes, Plotnikoff, & Courneya, 2008; Sheeran, 2002). In a review of the relevant literature, Sheeran found that intentions explained, on average, only 28% of the variance in behavior. This suggests that individuals self-reported intentions do not necessarily translate into behavior. Future research could employ a longitudinal design to ascertain the extent to which intention predicts subsequent behavior within an integrated model.

Conclusion

The present study suggests that exercise intentions can be predicted by attitudes, subjective norms, self-efficacy, and past behavior. Several other psychological variables that have been shown to be robust predictors of behavioral intentions in previous research were investigated but did not contribute unique variance to the model. Furthermore, an interesting relationship between response-efficacy and attitudes was uncovered, which suggests that the TPB may be applied to the prediction of responses to health messages. Taken together, these findings suggest that theoretical integration can highlight variables that are weakly or spuriously associated with health behavior intentions. Furthermore, it can develop our understanding of how constructs from different theoretical models can be combined to predict intentions. The authors advocate using theoretical integration as a methodology to improve understanding of the determinants of health behavior.

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