An application of the health belief model to the prediction of breast self-examination in a national sample of women with a family history of breast cancer

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Abstract

Women with a family history of breast cancer (N=833) completed questionnaires that assessed the main constructs of the health belief model (HBM), self-efficacy, behavioral intention and past behavior in relation to breast self-examination (BSE). Regression analyses revealed that intentions to perform BSE were predicted by perceived benefits, perceived emotional barriers, perceived skill barriers, self-efficacy and past behavior. At 9-month follow-up, BSE performance was predicted by perceived benefits, self-efficacy and past behavior. The results provide strong support for the inclusion of self-efficacy in the HBM. However, the significant effects for past behavior indicate that the HBM is not a sufficient model of BSE intentions or behavior and that it may benefit from further development. The practical implications of the results are outlined.

Key words: Health belief model, breast self-examination, breast cancer, family history

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Breast cancer is one of the leading causes of death among women (Heiman, Bradley & Hellman, 1998). One in twelve women in the UK will develop breast cancer during her lifetime (Steel, Cohen & Porter, 1992), and women who have a first-degree relative with breast cancer are 2.3 times more likely to develop the disease (Sattin, Rubin & Webster, 1985). Early detection methods, such as mammography, clinical breast examination and breast self-examination, continue to play an important role in the reduction of deaths from breast cancer in the absence of primary prevention strategies (Strax, 1984). Breast self-examination (BSE) provides a relatively simple, low cost method of early detection that can be performed more frequently than mammography or clinical breast examination. Monthly BSE has been reported to be effective in detecting the early symptoms of breast cancer (Hill, White, Jolley & Mapperson, 1998) which, in turn, greatly reduces mortality from breast cancer (American Cancer Society, 1982). However, despite the risk of breast cancer and the efficacy of monthly BSE many women do not perform BSE on a regular basis (Friedman, Nelson, Webb, Hoffman & Baer, 1994; Murray & McMillan, 1993), even those with a family history of breast cancer (Algana, Morokoff, Bevett & Reddy, 1987; Kash, Holland, Halper & Miller, 1992; Stefanek & Wilcox, 1991).

Against this backdrop, it is imperative to gain an understanding of the psychosocial predictors of BSE among women with an elevated risk of breast cancer. The present study therefore considers the utility of the health belief model (HBM) (Becker, 1974) as a framework for predicting BSE in a national sample of women with a family history of breast cancer. The HBM outlines four psychological dimensions that are believed to be important in the prediction of an individual's decision to perform a health-protective behavior: perceived

susceptibility, perceived severity, perceived benefits and perceived barriers. According to the HBM when individuals are faced with a potential threat to their health they consider their susceptibility to, and the severity of, the health threat. For example, those women who perceive themselves to be susceptible to breast cancer and believe it to be a serious disease will be motivated to take action against the health threat. Which action is pursued is seen to be a function of a cost-benefit analysis of the perceived benefits of, and perceived barriers to, different actions. For example, women who believe that performing BSE has many benefits and few barriers are more likely to engage in regular BSE. In addition, the HBM proposes that the above considerations require a "cue to action" (e.g., physical symptom, health education leaflet), although most applications of the HBM focus on the relationships between the four main dimensions and health behavior.

Reviews of research with the HBM across a wide range of health behaviors indicates that the four dimensions are able to provide consistent, though weak, predictions of health behavior (see Harrison, Mullen & Green, 1992; Janz & Becker, 1984; Sheeran & Abraham, 1996). For example, a meta-analysis conducted by Harrision, Mullen and Green (1992) indicated that while the HBM variables are significant predictors of health behavior, the amounts of variance explained by each of the four dimensions is relatively small. The largest effect size was found for the perceived barriers dimension ($\underline{r}_{+}$=-.21), followed by perceived susceptibility ($\underline{r}_{+}$=.15), perceived benefits ($\underline{r}_{+}$=.13) and perceived severity ($\underline{r}_{+}$=.08). A number of studies have applied the HBM to the prediction of BSE. These have shown perceived barriers to be the strongest predictor of BSE (e.g., Calnan & Rutter, 1986; Champion, 1987, 1988, 1990; Fung, 1998). Significant relationships have also been reported for perceived benefits (e.g, Calnan & Rutter, 1986; Champion, 1990; Hallal, 1982) and perceived susceptibility (e.g., Calnan & Rutter, 1986; Champion, 1987, 1988, 1990; Hallal, 1982; Massey, 1986), although non-significant findings are typically reported for perceived severity

(e.g., Murray & McMillan, 1993; Owens, Daly, Heron & Lemster, 1987; Ronis & Harel, 1989; Rutledge & Davis, 1988).

The majority of applications of the HBM, especially those related to BSE, have been cross-sectional in design (although Champion (1990) is a notable exception). The lack of prospective studies means that it is difficult to infer causal relationships between health beliefs and BSE. In addition, few studies have assessed the influence of past behavior in the HBM which is surprising given past behavior is typically found to be the strongest predictor of future behavior when added to other models of health behavior such as the theory of planned behavior (Ajzen, 1988). Thus, past behavior usually explains variance over and above the influence of psychosocial variables (see Ajzen, 1991; Conner & Armitage, 1998; Ouellette & Wood, 1998). When past behavior has been considered in applications of the HBM to BSE, it has been found to be the strongest predictor of BSE (e.g., Calnan & Rutter, 1986; Champion, 1990). Some researchers have suggested that past behavior should be considered as an additional independent predictor variable (e.g., Bentler & Speckart, 1979), although Ajzen (1987) has argued that it is more appropriate to use past behavior as a means for testing the sufficiency of a model. Thus, if the addition of past behavior in a regression analysis produces a significant increment in the amount of variance explained then this can be taken as evidence that the model is not sufficient and that further psychosocial variables may need to be included in the model. Interestingly, Calnan and Rutter (1986) noted that the addition of past behavior produced a marked increment in the amount of variance explained in BSE when entered after the HBM variables. This suggests that the HBM may be usefully extended when considering the prediction of BSE.

A number of additional variables have been considered in relation to the HBM (see Sheeran & Abraham, 1996), including self-efficacy and behavioral intention. Rosenstock, Strecher and Becker (1988) argued that a conceptual distinction can be made between feelings

of confidence in one's ability to perform a behavior (i.e., self-efficacy) and the perception of barriers towards the behavior. Moreover, self-efficacy has a strong theoretical basis in Bandura's (1977) social cognitive theory and has been found to be one of the strongest predictors of health behavior (see Schwarzer & Fuchs, 1996). In addition, a number of studies have reported significant relationships between self-efficacy and BSE such that those women who report confidence in their ability to perform BSE are more likely to do so on a monthly basis (e.g., Alagna et al., 1987; Alagna & Reddy, 1984; Chalmers & Luker, 1996; Hallal, 1982; Murray & McMillan, 1993; Stefanek & Wilcox, 1991). Thus, there is a strong case for expanding the HBM to consider feelings of self-efficacy. In addition, a number of researchers have suggested that behavioral intention should be considered as a mediating variable between the HBM dimensions and behavior (e.g., Calnan, 1984; King, 1982; Norman, 1995), as is the case in a number of other models of health behavior such as protection motivation theory (Rogers, 1983) and the theory of reasoned action (Ajzen & Fishbein, 1980). Moreover, meta-analyses have indicated that behavioral intention provides a moderate to strong prediction of behavior (e.g., Sheppard, Hartwick & Warshaw, 1988; Sutton, 1998), and behavioral intention has been found to predict BSE prospectively (e.g., Hodgkins & Orbell, 1998). In one of the few studies that have incorporated behavioral intention into HBM as a mediating variable, King (1982) reported that the HBM was predictive of intentions to attend screening for hypertension and that intention was in turn the strongest predictor of actual attendance.

The present paper reports a prospective application of the HBM in relation to the prediction of BSE in a national sample of women with a family history of breast cancer. The study also considered the utility of adding self-efficacy to the HBM and including behavioral intention as a mediating variable between the HBM and BSE. In addition, the study provided an opportunity to test the sufficiency of the HBM. It was hypothesized that the HBM would

be predictive of women's intentions to perform BSE and that in turn intention would be predictive of BSE. However, it was also hypothesized that past behavior would increase the amounts of variance explained in behavioral intention and BSE.

Method

Participants and Procedure

The data presented in this paper were collected as part of the TRACE Project (TRial of genetic Assessment for breast CancEr); a national randomized controlled trial comparing the impact of a multi-disciplinary genetic and surgical assessment service (Trial group) with that of an existing surgical service (Control group). Women living in Wales who had an apparent family history of breast cancer were referred by their general practitioner to the breast surgeon at their local District General Hospital. Women fulfilling the TRACE Project eligibility criteria, who verbally consented to participate in the trial were then referred by their surgeon to the TRACE project. Eligibility criteria were as follows: having a first-degree relative diagnosed with breast cancer before age 50 years, a first-degree female relative with bilateral breast cancer at any age, two or more first-degree relatives with breast cancer, or a first-degree relative and second-degree relative with breast cancer. Exclusion criteria included: having had breast cancer, having previously received generic counseling, or not being a resident in Wales. On receiving the referral form, the TRACE Project office sent a package to women containing a questionnaire, an information sheet, and a consent form. The women were blind to their group allocation when completing the time 1 questionnaire. Following receipt of the questionnaire women were sent an invitation to attend an assessment clinic provided by either a multi-disciplinary genetic and surgical assessment service or an existing surgical service. Nine months after attendance at the clinic women were sent another questionnaire. In order to maximize response rates to the questionnaires, a number of follow-

up reminders were sent to those women who had not returned their questionnaires. Full details of the TRACE Project have been published elsewhere (Brain et al., 2000).

One thousand women fulfilling the TRACE Project criteria were recruited into the project over the recruitment period (1996-1997). Completed time 1 questionnaires were returned by 833 women (83.3% response rate), of whom 571 also completed the time 2 questionnaire (68.5% response rate). In order to assess attrition bias, the time 1 questionnaire responses of those who returned the time 2 questionnaire were compared to those who failed to return the time 2 questionnaire. No significant differences were found on any of the measures contained in the time 1 questionnaire.

Measures

The time 1 questionnaire consisted of measures of the main components of the HBM and were based on items used in previous applications of the model in relation to BSE (Alagna et al., 1987; Champion, 1984; Fallowfield, Rodway & Baum, 1990; Lerman, Trock, Rimer, Jepson, Brody & Boyce, 1991). All HBM items were scored using 5 point response scales, with high scores indicating high levels on the variable of interest. Respondents' perceptions of their susceptibility to breast cancer were assessed using two items (e.g., In your opinion, what would you say that your chances of getting breast cancer are…. Much lower/much higher than the average woman) (alpha=.64). The perceived severity of breast cancer was measured using four items (e.g., If I had breast cancer, my whole life would change) (alpha=.71). Three items were used to assess the perceived benefits of performing BSE (e.g., Doing regular breast self-examination means that breast cancer can be found early on) (alpha=.69). Respondents were presented with a list of eight potential barriers to performing BSE were asked to indicate the extent to each would prevent them from performing BSE regularly. Principal components analysis indicated that there were two factors underlying responses to these items, explaining 45.7% and 14.9% of the variance in

item scores. On the basis of this analysis, two scales were constructed to measure perceived barriers to performing regular BSE. Five items were used to measure perceived emotional barriers (e.g., Finding breast self-examination emotionally distressing) (alpha=.82), and three items were used to measure perceived skill barriers (e.g., Concern about not being able to examine my breasts properly) (alpha=.68). Self-efficacy was assessed using two items (e.g., I am confident that I can examine my own breasts regularly) (alpha=.75). The time 1 questionnaire also contained a single item measure of intention (i.e., I intend to do breast self-examination regularly over the next year). Respondents were asked to indicate the extent to which they currently performed BSE using seven response categories: Hardly ever/not at all (0), once a year (1), 3-4 times a year (2), once a month (3), once a fortnight (4), once a week (5), and once a day or more (6). For data analysis, respondents were classified as either performing BSE at least once a month (1) or performing BSE less than once a month (0). Respondents were also asked to indicate the number of first-degree and second-degree relatives affected with breast cancer as a measure of family history, as well as a range of socio-demographic information. BSE at time 2 was measured in the same way as in the time 1 questionnaire.

Results

The sample consisted of 833 women, aged between 17 and 77 (Mean=41.31, SD=9.84), with an average of two relatives affected with breast cancer (Mean=2.37, SD=1.26). The majority of respondents were married or co-habiting (80.9%) and had gained educational qualifications at secondary school (46.5%) or above (22.3%). Most respondents indicated that they performed BSE at least once a month at time 1 (74.7%) and time 2 (76.5%). As shown in Table 1, perceived benefits, perceived emotional barriers, perceived skill barriers and self-efficacy were found to correlate with intention to perform regular BSE,

along with the time 1 BSE measure. The same variables, along with intention, were found to correlate with BSE at time 2.

A hierarchical linear regression analysis was used to predict intention to perform BSE (see Table 2). The independent variables were entered in two blocks: (a) perceived susceptibility, perceived severity, perceived benefits, perceived emotional barriers, perceived skill barriers and self-efficacy, and (b) time 1 BSE. The HBM variables were able to explain 33% of the variance in intention scores (R^2=.33, adj.R^2=.32, F=65.50, df=6,798, p<.001). All the HBM variables, with the exception of perceived severity, made a significant contribution to the regression equation. The addition of time 1 BSE led to a significant increase in the amount of variance explained (R^2 change=.08, F change=107.14, p<.001). In the final regression equation, the variables under consideration were able to explain 41% of the variance in intention scores (R^2=.41, adj.R^2=.40, F=78.92, df=7,797, p<.001), with perceived benefits, perceived emotional barriers, perceived skill barriers, self-efficacy and time 1 BSE emerging as significant independent predictors.

Given that time 2 BSE was a dichotomous variable, a hierarchical logistic regression was used to predict BSE at time 2. The independent variables were entered in three blocks: (a) intention, (b) perceived susceptibility, perceived severity, perceived benefits, perceived emotional barriers, perceived skill barriers and self-efficacy, and (c) time 1 BSE. Beta coefficients and corresponding Wald significance test results for each step are shown in Table 3. The initial –2 Log Likelihood value for the constant only model was 606.04. The addition of intention produced a significant improvement in the –2 Log Likelihood value (chi-square=67.85, df=1, p<.001). The addition of the HBM variables at step 2 led to a further significant improvement in the prediction of time 2 BSE (chi-square=51.54, df=6, p<.001). At this step, intention, perceived benefits, perceived skill barriers and self-efficacy were significant independent predictors of time 2 BSE. The addition of time 1 BSE also led to a

significant improvement in the –2 Log Likelihood value (chi-square=33.22, df=1, p<.001), with perceived benefits, self-efficacy and time 1 BSE emerging as significant independent predictors of time 2 BSE in the final model.

Finally, in order to assess the impact of potential confounder variables, age, family history of breast cancer and trial group were correlated with the outcome variables. For each of the outcome variables, the correlations were non-significant: intention (-.03, -0.1, -0.3 for age, family history and trial group respectively), time 2 BSE (-.07, .02, -0.3). Moreover, there was no substantive effect on the nature of the regression analyses when these variables were entered at a first step.

Discussion

The present study sought to apply an extended health belief model (HBM) to the prediction of breast self-examination (BSE) among a sample of women with a family history of breast cancer. The HBM model was able to explain 33% of the variance in intention to perform BSE, with perceived susceptibility, perceived benefits, perceived emotional barriers, perceived skill barriers and self-efficacy emerging as significant independent predictors. These results are in line with Hill et al.'s (1985) study that found that perceived benefits and perceived barriers were predictive of intention to perform BSE. Considering the prediction of BSE at 9-month follow-up, the present study found that intention, perceived benefits, perceived skill barriers and self-efficacy were significant independent predictors of BSE performance. The present results are therefore broadly consistent with previous applications of the HBM in relation to BSE that have found significant effects for perceived benefits (e.g, Calnan & Rutter, 1986; Champion, 1990; Hallal, 1982) and perceived barriers (e.g., Calnan & Rutter, 1986; Champion, 1987, 1988, 1990; Friedman et al., 1994; Fung, 1998). In contrast, non-significant effects are typically reported for perceived severity (e.g., Owens et al., 1987; Ronis & Harel, 1989; Rutledge & Davis, 1988), while the evidence for perceived

susceptibility is mixed with some studies reporting significant effects (e.g., Calnan & Rutter, 1986; Champion, 1987, 1988, 1990; Hallal, 1982; Massey, 1986) and others reporting non-significant effects (e.g., Champion, 1985; Murray & McMillan, 1993; Rutledge, 1987).

Considering the utility of adding a measure of self-efficacy to the HBM, the present results support Rosenstock, Strecher and Becker's (1988) assertion that the HBM should be expanded to focus on individuals' confidence in their ability to perform a recommended behavior. Self-efficacy was found to be predictive of both behavioral intention and BSE at follow-up which is consistent with previous studies that have reported significant effects for self-efficacy in relation to BSE (e.g., Champion, 1990; Champion & Scott, 1997; Friedman et al., 1994; Murray & McMillan, 1993). It is noteworthy that of the HBM variables, self-efficacy was the strongest predictor of both behavioral intention and BSE. The present study also addressed the suggestion that behavioral intention should be considered as a mediating variable between the HBM and behavior (e.g., Calnan, 1984; King, 1982; Norman, 1995). Behavioral intention was found to be predictive of BSE at time 2. However, when the HBM variables were added to the regression equation they were found to improve the prediction of BSE, although behavioral intention remained as a significant independent predictor along with perceived benefits, perceived skill barriers and self-efficacy. Thus, despite being predictive of BSE, behavioral intention was unable to fully mediate the influence of the HBM variables.

The present study also addressed the role of past behavior in the HBM. Past behavior was found to be the strongest predictor of both behavioral intention and BSE. Moreover, the addition of past behavior after the HBM variables led to significant increases in the amounts of variance explained in BSE intentions and BSE behavior. Similar findings have been reported in previous applications of the HBM (e.g., Calnan & Rutter, 1986; Champion, 1990). The present results indicate that the HBM is not a sufficient model of either behavioral

intention or behavior. However, it should be noted that some of the HBM variables remained significant in the regression analyses after the addition of past behavior suggesting the HBM is able to partially mediate the influence of past behavior.

It is likely that the HBM would benefit from further elaboration. Recent models of health behavior have made the distinction between various stages, or phases, in the initiation, adoption and maintenance of health behavior, with a particular focus on the volitional cognitions that may aid the translation of intentions into action (e.g., Prochaska & DiClement, 1984; Schwarzer, 1992; Weinstein, 1988). For example, Gollwitzer (1993) has proposed that in addition to having a goal intention to perform a behavior it is also necessary to form an implementation intention that specifies where, when and how the behavior will be performed. Orbell, Hodgkins and Sheeran (1997) tested this proposal by instructing a group of women to make an implementation intention stating where and when they would perform BSE in the next month. At1-month follow-up 64% of women in the implementation intention group were found to have performed BSE compared with only 14% of women in a control group.

The present results have a number of implications to encourage regular BSE performance among women with a family history of breast cancer. In particular, heath professionals should continue to highlight the positive benefits of performing regular BSE as well as developing ways to address the barriers that women may experience. Moreover, given the strong predictive utility of self-efficacy interventions should seek to enhance women's confidence in their ability to perform regular BSE. Bandura (1986) has outlined four sources of self-efficacy that could usefully be used to enhance feelings of self-efficacy and thereby promote BSE. First, feelings of self-efficacy can be enhanced through personal mastery experience. For example, it may be possible to split BSE into various sub-behaviors so that mastery of each is achieved in turn. Second, self-efficacy may be enhanced through vicarious experience. For example, interventions may provide practical demonstrations of BSE. Third,

standard persuasive techniques could be used, for example in pamphlets, to enhance self-efficacy. Finally, given that high levels of anxiety may be used by individuals as a source of information to infer that they are not capable of performing a behavior, it may be necessary to teach relaxation techniques. This may be particularly relevant in the present context as the distress experienced by some women with a family history of breast cancer may result in the avoidance of screening behaviors such as BSE (Lerman & Schwartz, 1993; Valdimarsdottir, Bovbjerg, Kash, Holland, Osborne & Miller, 1995). Encouragingly, interventions encompassing some of the above considerations have been found to increase the frequency of BSE. For example, Calnan and Rutter (1986) found that a hospital class including of a short instructional film and a talk by a nurse produced a significant increase in BSE. An experiment conducted by Craun and Deffenbacher (1987) compared combinations of three types of intervention: information (i.e., a lecture about BSE and breast cancer), demonstration (i.e., a demonstration of the technique of BSE on a foam rubber model followed by practice with feedback), and prompts (i.e., postcard reminders to perform BSE each month). It was found that the demonstration increased BSE knowledge and confidence. However, only the use of prompts increased BSE frequency over the 6-month follow-up period which is consistent with Orbell et al's (1997) study that highlighted the importance of making specific plans as to when and where to perform BSE.

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Table 1

Descriptive Statistics and Correlations Between the HBM Variables, Intention and BSE.

	SEV	BEN	EMO	SKL	SEF	INT	BSE1[a]	BSE2[a]	Mean	SD
Perceived Susceptibility (SUS)	.17***	-.05	.01	.00	-.08*	.05	.07*	.04	3.66	0.64
Perceived Severity (SEV)		.01	.16***	.11**	-.02	.03	.02	.01	3.09	0.76
Perceived Benefits (BEN)			-.13***	-.32***	.56***	.40***	.27***	.17***	4.00	0.72
Perceived Emotional Barriers (EMO)				.47***	-.27***	-.31***	-.23***	-.24***	1.22	0.48
Perceived Skill Barriers (SKL)					-.51***	-.44***	-.39***	-.36***	1.74	0.81
Self-Efficacy (SEF)						.50***	.38***	.38***	3.61	0.91
Intention (INT)							.51***	.36***	4.46	0.73
Time 1 BSE (BSE1)								.45***	622[b]	74.7[c]
Time 2 BSE (BSE2)									437[b]	76.5[c]

Note. [a] point-biserial correlations. [b] N. [c] %.

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

Table 2

Predicting Intention to Perform BSE: Hierarchical Linear Regression.

Step	Variable	B	SE B	β
Step 1	Perceived Susceptibility	.08	.03	.07*
	Perceived Severity	.06	.03	.06
	Perceived Benefits	.17	.04	.17***
	Perceived Emotional Barriers	-.20	.05	-.13***
	Perceived Skill Barriers	-.17	.03	-.19***
	Self-Efficacy	.23	.03	.28***
Step 2	Perceived Susceptibility	.05	.03	.04
	Perceived Severity	.05	.03	.05
	Perceived Benefits	.15	.03	.15***
	Perceived Emotional Barriers	-.17	.05	-.11***
	Perceived Skill Barriers	-.10	.03	-.12***
	Self-Efficacy	.17	.03	.21***
	Time 1 BSE	.53	.05	.32***

Note. R^2=.33 for Step 1 (p<.001); ΔR^2=.08 for Step 2 (p<.001).

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

Table 3

Predicting Time 2 BSE: Hierarchical Logistic Regression.

Step	Variable	B	SE B	Wald Test
Step 1	Intention	1.19	.16	55.16***
Step 2	Intention	.74	.20	13.71***
	Perceived Susceptibility	.17	.19	.76
	Perceived Severity	.10	.16	.39
	Perceived Benefits	-.42	.20	4.36*
	Perceived Emotional Barriers	-.41	.25	2.76
	Perceived Skill Barriers	-.40	.17	5.88*
	Self-Efficacy	.78	.17	21.24***
Step 3	Intention	.39	.22	3.20
	Perceived Susceptibility	.06	.20	.09
	Perceived Severity	.08	.17	.23
	Perceived Benefits	-.48	.21	5.30*
	Perceived Emotional Barriers	-.48	.26	3.48
	Perceived Skill Barriers	-.26	.18	2.09
	Self-Efficacy	.72	.17	17.80***
	Time 1 BSE	1.55	.27	32.96***

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