Understanding women's mammography intentions:

A theory-based investigation

Mikako Naito, Frances V. O'Callaghan, Shirley Morrissey

School of Psychology, Griffith University, Gold Coast, QLD, Australia, 4222

Mikako Naito, M.Clin. Psychology is a psychologist in private practice on the Gold Coast, Queensland, Australia. Frances V. O'Callaghan, PhD and Shirley Morrissey, PhD are health psychologists and Senior Lecturers in the School of Psychology, Griffith University, Gold Coast, Queensland, Australia. Correspondence should be directed to:

Frances V. O'Callaghan, PhD

Phone: 61 7 5552 8606 Fax: 61 7 5552 8291 Email: f.ocallaghan@griffith.edu.au

Abstract

The present study compared the utility of two models (the Theory of Planned Behaviour; TPB and Protection Motivation Theory; PMT) in identifying factors associated with intentions to undertake screening mammography, before and after an intervention. The comparison was made between the unique components of the two models. The effect of including implementation intentions (IIs), was also investigated. Two hundred and fifty-one women aged 37 to 69 years completed questionnaires at baseline and following the delivery of a standard (control) or a PMT-based informational intervention. Hierarchical multiple regressions indicated that TPB variables were associated with mammography intentions. Results also showed that inclusion of implementation intention in the model significantly increased the association with mammography intentions. The findings suggest that future interventions aiming to increase screening mammography participation should focus on the TPB variables and that implementation intention should also be targeted.

Key words: TPB, PMT, screening mammography, intentions, implementation intentions

Breast cancer is the most frequently diagnosed cancer and the highest cause of cancer-related deaths for Australian women (Australian Institute of Health and Welfare & National Breast Cancer Centre: AIHW & NBCC, 2006). Two-yearly mammography screening has been shown to be the most effective method for early detection of breast cancer and reducing mortality and morbidity, especially among women aged 50 to 69 years (AIHW, 2007). BreastScreen Queensland, part of an Australia-wide public health program offers free screening mammograms to Queensland women over the age of 40 years, with the 50-69 year age bracket as the target age group (Queensland Health, 2005). However, fewer than 60% of Queensland women in the target age group take advantage of the free screening mammography service (Queensland Health, 2005).

The present study compared the utility of two social cognitive models in identifying factors associated with intentions to undertake screening mammography before and after women received information relating to breast cancer and screening mammography. The two models – the Theory of Planned Behaviour (TPB; Ajzen, 1991, 1998) and Protection Motivation Theory (PMT; Rogers, 1975) - state that intentions predict actual behaviour. These theoretical models have been used to predict various intentions and actual behaviours (e.g., Hardeman et al., 2002; Kaljee et al., 2005), but they have not been compared extensively (Boer & Mashamba, 2005) to each other, nor has any previous research investigated the validity of the combined TPB-PMT model when implementation intentions, or specific plans to carry out intentions (Gollwitzer, 1993, 1999), were included.

The Theory of Planned Behaviour and Screening Mammography

According to the TPB, intention is the key predictor of actual behaviour, and intentions are in turn predicted by attitudes (positive or negative beliefs about the consequences of the

behaviour), perceived behavioural control (PBC; beliefs about how easy or difficult the behaviour would be to perform), and subjective norms or perceived social pressure in relation to performing the behaviour (Ajzen, 1991, 1998). Considerable support exists for this theory in predicting a range of health-related intentions and behaviours (e.g., Boer & Mashamba, 2005; Brickell, Chatzisarantis, & Pretty, 2006; Heeran, Jemmott, Mandeya, & Tyler, 2007; Myers & Horswill, 2006; Rutter, 2000; Steadman & Rutter, 2004; Vaile, Calnan, Rutter, & Wall, 1993).

Protection Motivation Theory and Screening Mammography

Protection Motivation Theory (PMT; Rogers, 1975) differs from the TPB in that it specifically aims to predict health-related intentions from individuals' cognitive responses to health-related interventions (Fry & Prentice-Dunn, 2006). Further, intention is determined by their appraisals of the threat and of the recommended behaviour (Rogers, 1975; Prentice-Dunn & Rogers, 1986). People are considered likely to intend to adopt the recommended health behaviour when their perceived threat is high (high 'perceived vulnerability,' 'perceived severity' and 'fear') and when they believe the recommended behaviour will be effective (high 'response efficacy') with little cost (low 'response cost'), and easy to adopt (high 'self-efficacy') (Fry & Prentice-Dunn, 2006; Prentice-Dunn & Rogers, 1986).

Participation in screening mammography has not been specifically investigated in the framework of the PMT model. However, research evidence provides indirect support for the suggested relationships between the PMT variables and screening mammography intention and participation (Haitt, 1997; Pearlman, Clark, Rakowski, & Ehrich, 1999; Rutter, 2000; Vail et al., 1993). In addition, providing information and using persuasion are popular methods of health-related interventions (Hardeman et al., 2002), and the PMT model has explained, at least partially, the mediating cognitive processes that link informational interventions to their ultimate

goal of cognitive and behavioural changes (Fry & Prentice-Dunn, 2006). Informational interventions based on the PMT framework have been shown to increase intentions for health behaviours in a variety of studies (Fry & Prentice-Dunn, 2006; Kaljee et al., 2005; Milne, Orbell, & Sheeran, 2002; Prentice-Dunn, Floyd, & Flourney, 2001). However, while research findings support the anticipated relationships between information on breast cancer and screening mammography, knowledge of screening and risk factors, PMT variables, and mammography intentions, the effects of PMT-based informational interventions on women's mammography intentions have not been explicitly investigated.

Theory of Planned Behaviour and Protection Motivation Theory

Theoretical models aiming to predict health-related behaviours show considerable overlap, and according to Ajzen (1988), sometimes use different labels for near-identical constructs. The TPB and PMT models also overlap in predicting intentions, with the unique contribution from each model only amounting to 5% (Boer & Mashamba, 2005). At the variable level, attitudes in the TPB are essentially equivalent to the descriptions of PMT's response efficacy and response cost. Moreover, scales for attitudes in TPB studies often comprise items that are combinations of response efficacy beliefs (e.g., 'Having my breasts screened will lead to an early diagnosis of breast cancer if I have it') and response cost beliefs (e.g., 'Having my breasts screened will possibly be harmful because of X-rays') (Rutter, 2000; Steadman, Rutter, & Field, 2002; Vaile et al., 1993). Likewise, PBC and self-efficacy are very similar constructs (e.g., Ajzen, 1998; Heeran et al., 2007; Hutchinson & Wood, 2007), although some researchers have demonstrated that PBC and self-efficacy are distinct and have assessed them separately (Boer & Mashamba, 2005; Myers & Horswill, 2006).

One objective of the present study was to compare the utility of the TPB and PMT models

in examining factors associated with mammography intentions. The TPB and PMT models have been compared previously in a study investigating condom use (Boer & Mashamba, 2005). Both models were valuable in explaining condom use intentions, with subjective norm and response efficacy being the significant predictors. These results, however, may not be readily generalized as the TPB and PMT constructs were measured in an atypical manner, apparently in an effort to minimize the overlap. In the current study, rather than attempting to minimize the potential overlap by omitting or changing frequently used items and scales, we incorporated the potential overlap into the study model and made comparisons between only the unique components of the TPB and PMT models. We grouped the variables related to attitude (response efficacy and response cost) and PBC/self-efficacy as the common components of the TPB and PMT models, and grouped the variables involved in perceived threat (perceived vulnerability, perceived severity, and fear) as the unique components of the PMT, and finally categorized subjective norm as the unique component of the TPB.

Because the TPB focuses on individuals' existing beliefs and attitudes (Ajzen 1998), most researchers aim to make behavioural predictions by measuring the TPB variables and intentions at baseline or in studies that do not involve interventions (Hardman et al., 2002). The present study also anticipated the unique TPB component to be effective in predicting intentions at baseline. On the other hand, the PMT focuses on individuals' perception of threat after fear-provoking information and on how they cope with the threat (Boer & Mashamba, 2005; Fry & Prentice-Dunn, 2006). The PMT model has typically been used as the theoretical basis of interventions and to predict intentions after the interventions have been administered (e.g., Fry & Prentice-Dunn, 2006; Kaljee et al., 2005; Milne et al., 2002). In the present study it was also anticipated that the unique PMT components would be effective in predicting intentions after the participants had read a PMT-based informational intervention.

Implementation Intentions (IIs)

Intentions, such as New Year's resolutions, are not always translated into actual behaviour. Gollwitzer (1993, 1999) attributes this phenomenon to the failure to form implementation intentions (IIs) (specific plans about where and when to execute the intention). Intentions are often vague (e.g., 'I will exercise more this year') whereas IIs specify the details of the intentions (e.g., 'I will ride my exercise bike for one hour after work on Mondays starting tomorrow'). Some studies have reported that significantly more people who had been asked to form IIs regarding health behaviours, such as breast self-examination (Orbell, Hodgkins, & Sheeran, 1997) and testicular self-examination (Steadman & Quine, 2004), acted upon their intentions than the people who had not been asked to do so. Conflicting findings have also been reported, however, with Rutter and colleagues (2006) finding no improvement in attendance at breast screening among those who received an II-based intervention. This study differed in that analyses examined all women in the intervention condition, whether they had recorded their plans to overcome three potential barriers to attendance or not (i.e., thereby including non-planners as well as planners).

The Hypotheses of the Present Study

The present study investigated whether adding IIs to the model would enhance the identification of factors associated with intentions. We also investigated the effects of an intervention aiming to promote formation of an II on the participants' IIs to have screening mammograms. In the present study, validities of the TPB and PMT models were investigated regarding women's screening mammography intentions before and after an intervention containing PMT-based information and a passage on IIs. We hypothesized that the informational

intervention would influence women's knowledge, components unique to the PMT, components common to the PMT and TPB, and II and that these variables would in turn influence the women's mammography intentions. Specifically, it was hypothesized that the experimental group who would receive the PMT-based informational intervention along with a passage on IIs would have higher knowledge scores, higher perceived threat regarding breast cancer, more favourable attitudes and higher PBC/self-efficacy, more specific IIs and higher screening mammography intentions than the control group who would receive a standard informational intervention at post-intervention (Hypothesis 1).

Secondly, the two models were compared. We hypothesized that the subjective norm (the unique component of the TPB) would be more strongly related to intentions than perceived threat (the unique component of the PMT) at baseline (Hypothesis 2), but that the unique component of the PMT would be more strongly associated with intentions than the unique component of the TPB in the experimental group at post-intervention (Hypothesis 3). We also examined changes in the identified associations of the combined TPB-PMT model when II was included. It was hypothesized that including II in the model would increase the variance explained in mammography intentions (Hypothesis 4).

Methods

Participants

Participants consisted of a convenience sample of 251 women aged 37 to 69 years, living in southeast Queensland, Australia. Invitations to participate were distributed by email to approximately 500 women who worked at a university and 1 000 women working at a city council. The subject heading in the email message specified that the research was for women who were aged 40 to 69 years, or who had a family history of breast cancer. Women who replied to the

email and stated that they wished to participate in the study were sent questionnaire packages. At the shopping centre, 40 adult women leaving the premises were approached by the first author and told that participants, as described above, were being sought. To be eligible to participate, women were required to be eligible for BreastScreen Queensland's mammography services (i.e., aged 40 years or over, or younger than 40 years if they had a family history of breast cancer). Three hundred and fifty women volunteered to participate in response to the invitation and received survey packages which assessed baseline data (i.e., Time 1). The participants were instructed to read an information sheet prior to participation to ensure their understanding of the details of the study, their rights, and the contact details for the researchers and the University's Human Research Ethics Committee. Participants were informed that by completing the survey, they would be deemed to have consented to their participation in the research, in accordance with the University's Ethics Committee guidelines.

Of the 350 women invited to participate, 300 completed and returned the Time 1 surveys and received a further package which provided an intervention and assessed post-intervention data four weeks later (i.e., Time 2). Two hundred and fifty-one women completed and returned the Time 2 surveys. The completed surveys showed that all 300 women fulfilled the eligibility criteria to participate in the study, and all were accepted on this basis. The mean age of the 251 participants was 49 years (range = 37 – 69 years). Three women were aged below age 40 as they had indicated a previous family history of breast cancer.

Materials

Each Time 1 package contained a research information sheet, which the participants were instructed to read before participating in the study, and a survey booklet comprising knowledge items and a questionnaire. Each Time 2 package contained reading materials and the same survey

booklet as the Time 1 package.

Knowledge. The knowledge items assessed the participants' baseline and post-intervention knowledge of breast cancer mortality and risk factors, screening mammograms, and services provided by BreastScreen Queensland. It was also designed to motivate the participants to peruse the reading materials. The items consisted of six questions and used a multiple-choice format with 4 - 6 response options.

Questionnaire. The questionnaire was adapted from measures used previously (Milne et al., 2002; Rutter, 2000). Twenty-five items aimed to assess the TPB and PMT variables, mammography intentions and II, but three items were removed from analyses because of their ambiguity and to increase scale reliability. Two items assessed 'perceived vulnerability' by asking participants about their perception of their likelihood of developing breast cancer in the future. Two items assessed 'perceived severity' by asking how serious they felt having breast cancer would be. Two items assessed 'fear' by asking how fearful they felt about having breast cancer. One item assessed 'response efficacy' with a statement describing mammography as the best early detection method for breast cancer. Three items assessed 'response cost' with statements describing mammography as involving possible pain, being embarrassing or time-consuming. Two items assessed PBC with statements describing the potential difficulties in arranging for a breast screen and gaining access to services. Four items assessed 'subjective norm' with statements about whether various important others thought that mammography was important. Two items assessed mammography intention by asking if the participant intended to have a mammogram. Three items assessed II by asking when and how the participants intended to have a mammogram and how clear those plans were.

All items were followed by 5-point Likert-type scales, with two extreme response options (such as 'strongly disagree' and 'strongly agree'). Higher scores indicated stronger inclination

towards screening mammography. Reliability (Cronbach's alpha) for the scales used in the questionnaire ranged from .52 (Response Cost) to .92 (Subjective Norm and II).

Reading materials. Reading 1 was the electoral roll invitation letter which BreastScreen Queensland sends out to women who have not registered to have their first screening mammograms. The one-page letter contained brief descriptions of the risk factors relating to breast cancer, the BreastScreen Queensland service and procedure, and contact details. Reading 2 was a photocopy of the flyer which is sent along with the electoral roll invitation letter. It contained brief descriptions of BreastScreen Queensland services, service locations, and contact details. It also addressed frequently asked questions, such as breast lumps, disability, and breast implants. Reading 3 was a one-page information sheet on breast cancer and screening mammography. The information had been taken from the BreastScreen Queensland brochure 'Cancer Screening: Your Guide' and was presented to manipulate key PMT variables. Namely, the information aimed to increase the participants' perceived severity, perceived vulnerability, response efficacy and self-efficacy/PBC and to decrease their response cost. Reading 4 was a one-page passage on IIs in lay terms. It detailed the usefulness of IIs by describing how three fictional individuals successfully accomplished their intentions when they had formed IIs. The passage also asked the participants what specific plans they could make to help them attend mammography screening regularly, aiming to prompt the participants to form IIs which, in turn, should increase the likelihood of attending BreastScreen for a screening mammogram.

Procedure

The 300 participants were randomly allocated to control or experimental groups. Participants received the Time 1 package along with a reply-paid postcard. On the reply-paid postcard they were instructed to write their names and postal addresses to enter for an inducement

prize draw and to indicate that they had completed and posted the Time 1 survey booklets. Four weeks after each Time 1 reply-paid postcard was received, a Time 2 package for the corresponding participant was posted. The Time 2 packages contained Readings 1 and 2 (standard informational intervention) for the control group and Readings 1 to 4 (experimental informational intervention containing PMT-based information and a passage on IIs) for the experimental group. The survey booklets and reply-paid postcards had code numbers to ensure participant anonymity while allowing the investigator to have enough information for data analysis. The participants were instructed to use the Time 2 reply-paid postcards to enter for the second prize draw and to request a research summary.

Statistical Analysis

All statistical analyses were conducted using SPSS (version 13). Descriptive analyses (means, standard deviations, frequencies, and percentages) were used to describe sample characteristics and summarize questionnaire data. A series of ANOVAs and a factorial MANOVA were performed to determine distributions of key variables and demographic variables and to compare those on-schedule (i.e., had undertaken a screening mammogram within the past 2 years) to those not on-schedule (i.e., reported not having done so for more than 2 years or ever), on key variables. To examine the relationships between the key variables, zero-order correlation analyses were conducted. Subsequently, a mixed factorial MANOVA was conducted to determine the effects of the informational interventions (control vs. experimental) and time (Time 1 vs. Time 2), as well as of the potential confounding variable of schedule status (on-schedule vs. not on-schedule). The dependent variables were knowledge scores, perceived vulnerability, perceived severity, fear, response efficacy, response cost, subjective norm, PBC, intention and II. The dependent variable (intervention vs. control) was considered to be significant in distinguishing

between on-schedule and not on-schedule participants if the multivariate F statistic reached a significance level of $p < .05$. Univariate effects were examined using a Bonferroni correction ($\alpha = .005$). Finally, hierarchical multiple regressions were performed to determine the unique contributions made by the TPB and PMT models to the variance in intentions. Variables were included in the multivariable models in accordance with the theories guiding the research (i.e. TPB and PMT). The results were compared between the control and experimental groups at both Time 1 and Time 2. Schedule status was entered at step 1 so that its confounding effect would be controlled. Variables of focal importance were entered at Steps 2 and 3. Variables were retained if a significant increase in explained variance resulted, as determined by R^2 values. Hierarchical multiple regressions including II were then performed in the same manner.

Results

Seventy-nine percent of participants reported annual family income of over \$50,000 AUD, and 19% reported between \$20,000 and \$50,000. Three percent of the participants had been diagnosed with breast cancer previously, and 32% had family members who had been diagnosed with breast cancer. Seventy-two percent of the participants were on-schedule, and 28% were not on-schedule. Given the large percentage of participants who had recently undertaken a mammogram, this variable was controlled in subsequent analyses.

The experimental and control groups were similar on demographic variables at baseline. They were also similar on the key variables, except for intention, for which the experimental group scored higher than the control group (Table 1). However, across the experimental and control groups, significant differences were found between the participants who were on-schedule and those who were not on-schedule for a mammogram. On-schedule participants were

significantly older than those who were not on-schedule ($50.9 \pm .9$ vs. 45.7 ± 1.3 years old, $F(1, 249) = 43.4$, $p < .005$). Participants who were on-schedule also scored higher on the knowledge items, subjective norm, response cost, PBC, mammography intention and II at baseline than those who were not on-schedule. Thus screening mammogram schedule status was incorporated as a variable to control the confounding differences. No significant differences were found between participants with a family history of breast cancer and those without, on any of the demographic or key variables.

[Insert Table 1]

PMT, TPB and Informational Intervention

Hypothesis 1 was examined using zero-order correlations from the 300 participants at Time 1 and the 251 participants at Time 2. Knowledge scores showed significant relationships with response cost, PBC, subjective norm, and IIs at Time 1 ($r = .13 - .28$, $p < .05 - .001$) and with perceived vulnerability and subjective norm at Time 2 ($r = .21$ and $.18$, $p < .01$). Perceived vulnerability, perceived severity, and fear were significantly intercorrelated both at Time 1 and Time 2 ($r = .14 - .41$, $p < .05 - .001$). Also a strong intercorrelation was observed among response cost, PBC, subjective norm, and IIs at Time 1 ($r = .35 - .63$, all $p < .001$) and at Time 2 ($r = .20 - .54$, $p < .01 - .001$). These zero-order correlations partially supported the first hypothesis.

Effects of the informational interventions were further examined by mixed factorial MANOVA. The multivariate tests showed significant effects for all the independent variables, significant two-way interactions, but not a three-way interaction. Examination of the univariate effects using Bonferroni correction ($\alpha = .005$) showed that time-treatment interaction was significant on knowledge score ($F(1, 182) = 34.8$, $p < .001$), accounting for 16.1% of the variance. The increase in the mean knowledge scores from Time 1 to Time 2 was significantly greater in

the experimental group than in the control group, partially supporting Hypothesis 1.

Factors Associated with Mammography Intentions

To determine the unique contributions made by the TPB and PMT models to the variance in intentions, hierarchical multiple regressions were performed. The results were compared between the control and experimental groups at both Time 1 and Time 2. Schedule status was entered into hierarchical multiple regressions at step 1. Sequences of the variables entered, their relative associations (β) at each step, and changes in the amount of variance explained (R^2) for the control and experimental groups are summarized below. Furthermore, to examine the ability of the study model to identify factors associated with intentions when IIs were included, additional hierarchical multiple regressions were performed on intentions using the TPB and PMT variables and IIs.

Examining Mammography Intentions Using TPB and PMT Models

[Insert Tables 2 and 3]

At Time 1, the unique components of the TPB and PMT models added 11.2% to the explained variance in mammography intention in the control group ($F(4, 127) = 9.7, p < .001$) and 16.4% in the experimental group ($F(4, 144) = 11.9, p < .001$) (Table 2). In both control and experimental groups, subjective norm was the only factor significantly associated with intention ($\beta = .37$ and $.47$, respectively, $p < .001$), which supported Hypothesis 2.

At Time 2, the unique components of the TPB and PMT models added 3.0% in the control group ($F(4, 107) = 2.7, p < .05$) and 25.6% in the experimental group ($F(4, 122) = 16.5, p < .001$) to the explained variance in mammography intention (Table 3). In both control and experimental groups, subjective norm was the only factor significantly associated with intentions ($\beta = .20, p$

$< .01$ and $\beta = .56$, $p < .001$, respectively). This result was contrary to that hypothesized (Hypothesis 3), which was that perceived threat would explain more variance than subjective norm.

Mammography Intentions, II, PMT and TPB

[Insert Tables 4 and 5]

At Time 1, the final model accounted for 76.4% of the variance in intention in the control group ($F(9, 124) = 44.5$, $p < .001$) (Table 4). In contrast, the model without II accounted for 63.4% ($F(8, 127) = 27.5$, $p < .001$). In the experimental group, the final model accounted for 61.2% of the variance in intention ($F(9, 142) = 24.9$, $p < .001$). In contrast, the model without II accounted for 50.2% ($F(8, 144) = 18.1$, $p < .001$), supporting Hypothesis 4.

At Time 2, the final model accounted for 74.7% of the variance in intention in the control group ($F(9, 106) = 34.7$, $p < .001$) (Table 5). In contrast, the model without II accounted for 70.2% ($F(8, 107) = 31.4$, $p < .001$). In the experimental group, the final model accounted for 71.5% of the variance, ($F(9, 121) = 33.8$, $p < .001$). In contrast, the model without II accounted for 52.8% ($F(8, 122) = 17.1$, $p < .001$), supporting Hypothesis 4.

Discussion

PMT, TPB and Informational Intervention

Because the experimental intervention was intended to influence the PMT variables, to promote II formation, and to assist in gaining high knowledge scores, it was anticipated that all of the PMT variables and II would show significant relationships with the knowledge score at Time 2. Only perceived vulnerability showed the anticipated relationship. This was probably due to the insufficient effect of the experimental intervention, as indicated by the MANOVA result,

discussed below. On the other hand, the significant relationship between knowledge scores and subjective norm detected both at Time 1 and Time 2 had not been anticipated. Subjective norm was considered to be the unique component of the TPB, which had not been previously associated with information or knowledge. This was contrary to previous findings. A meta-analysis study that investigated predictors of intentions to attend various screening programs including screening mammography showed that attitudinal beliefs most strongly predicted screening intentions (Cooke & French, 2008). Subjective norm was one of the weakest predictors. These authors recommended providing informational interventions designed to increase positive attitudes to increase attendance, but our study has suggested mammography intentions may be influenced by more complex factors.

The anticipated 3-way interactions between time, treatment, and schedule, as outlined in Hypothesis 1 did not reach statistical significance on any of the dependent variables. However, time-treatment interaction was significant in the anticipated directions, partially supporting the hypothesized effect of the informational interventions. The mean knowledge scores of the experimental group increased from Time 1 to Time 2 at a significantly greater rate than the mean knowledge scores of the control group. This 2-way interaction on the knowledge score suggested that the experimental intervention was sufficiently more informative than the control intervention. The difference in the interventions, however, was not reflected on the PMT variables. Hypothesis 1, therefore, was only partially supported.

Examining Mammography Intentions Using the TPB and PMT Models

Subjective norm, the component unique to the TPB model, was the only variable associated with mammography intentions both at Time 1 and Time 2. This indicated that, when the effects of screening mammogram schedule status and TPB-PMT common components were removed, this

unique component of the TPB model was a better fit of intention while the unique components of the PMT model were not. This result supported Hypothesis 2 but not Hypothesis 3. PBC, being on-schedule and response cost have been reported to be significant predictors of mammography intention among on-schedule women (O'Neill et al., 2008). In our study, these variables were strongly associated with mammography intention until subjective norm was entered into the models. On the other hand, subjective norm was not a predictor of mammography intention in the O'Neill study (2008). The difference is possibly due to the difference in sample size and participants being or not being on schedule.

Mammography Intentions, II, PMT and TPB

When II was included in the combined TPB-PMT model, the variance explained in mammography intentions increased by 4.5 – 18.7%. This result supported Hypothesis 4 that inclusion of II would improve the validity of the model. II was also the most strongly associated with intention both at Time 1 and Time 2. Previous research findings have reported both independent relationships (e.g., Steadman & Quine, 2004) and strong relationships (Brickell et al., 2006) between intentions and IIs, but the present result was consistent with the latter.

Limitations

Limitations of the study include the limited sample size (which may have resulted in the failure to detect some differences as statistically significant, particularly in the multivariable models) and the potential for selection and participation biases due to the use of a convenience sample, which may have reduced the representativeness of the sample and hence the generalizability of the findings.

General Discussion

The effect of the experimental informational intervention was detected on knowledge scores. Knowledge scores were correlated with perceived vulnerability, response cost, PBC/self-efficacy, subjective norm, and IIs. Response cost, PBC/self-efficacy, subjective norm, and IIs were associated with intentions. When the effect of the components common to both models had been removed, the TPB model fit women's intentions to have screening mammograms better than the PMT model both at baseline and after the informational interventions. The common components of the TPB-PMT were also associated with intentions to have screening mammograms, which strengthens the indicated validity of the TPB model. These findings suggest that interventions aiming to increase screening mammogram participation should focus on the TPB variables.

The experimental intervention did not produce the anticipated effects on the PMT variables. One possible explanation for the lack of anticipated effects may be that the impact of the PMT-based component of the intervention in the current study was insufficient compared to PMT-based interventions which have successfully increased intentions to perform breast self-examinations in other studies (Fry & Prentice-Dunn, 2006; Prentice-Dunn et al., 2001). The PMT-based intervention in the present study contained only factual descriptions of breast cancer, whereas previous interventions contained fear-provoking graphic descriptions, photographs, and videos of breast cancer. Thus, the effect of higher-impact interventions needs to be tested in future research. Another possible explanation for the lack of anticipated effects was failure to detect such effects due to the limited sample size. Furthermore, potential sampling bias due to convenience sampling was another possible explanation.

The present study also showed that including II significantly increased the validity of the TPB-PMT model regarding women's intentions to have screening mammograms. This was

consistent with a previous finding which showed inclusion of II significantly improved prediction of exercise behaviour (Brickell et al., 2006). This finding may suggest II should also be targeted in addition to the TPB and PMT variables in future interventions designed to increase mammography intentions.

The MANOVA result showed that the increase in IIs from Time 1 to Time 2 did not differ between the control and experimental groups. This suggested that basic information on when, where, and how women can have screening mammograms (such as that found in a reminder letter) may be as sufficient as a detailed passage on the usefulness of IIs (as described in Reading 4) to increase their IIs. Similarly, as IIs were strongly associated with mammography intentions in the present study, simple reminder letters highlighting contact details of the screening mammography services may be sufficient to increase IIs to have screening mammograms. It is noteworthy that examination of the qualitative information showed that many (44%) of the women who gained the highest scores on the II scale reported reliance on the reminder letters to have screening mammograms. However, it should be noted that 72% of our sample were on-schedule and probably required little additional encouragement to boost their IIs and mammography intentions. Reminder letters specifically targeting women who are not on-schedule may need to contain more detailed information.

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