Determinants of uptake of whole-body skin self-examination in older men

Josephine Auster, MAppSc⁽¹⁾; Cameron Hurst⁽¹⁾; PhD; Rachel E Neale, PhD⁽²⁾; Phillipa Youl, MPh⁽³⁾;

David C Whiteman, PhD⁽²⁾; Peter Baade, PhD⁽³⁾; Monika Janda, PhD⁽¹⁾

1. School of Public Health, Institute of Health and Biomedical Innovation, Queensland University of Technology, Queensland, Australia
2. Queensland Institute of Medical Research, Queensland, Australia
3. Viertel Centre for Research in Cancer Control, Cancer Council Queensland, Queensland, Australia

Corresponding author:

Monika Janda, PhD

Senior research fellow

Queensland University of Technology

Victoria Park Rd

Kelvin Grove, Brisbane, 509

Australia

Phone: 0061 7 31383018

Fax: 0061 7 3138 3130

Email: m.janda@qut.edu.au

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Abstract

Early detection through whole-body Skin Self-Examination (wbSSE) may decrease mortality from melanoma. Using the Health Action Process Approach (HAPA) or Health Belief Model (HBM) we aimed to assess determinants of uptake of wbSSE in 410 men 50 years of older who participated in the control group of a randomised trial. Overall, the HAPA was a significantly better predictor of wbSSE compared to the HBM ($p < 0.001$). The construct of self-efficacy in the HBM was a significant predictor of future wbSSE ($p = 0.001$), while neither perceived threat ($p = 0.584$) nor outcome expectations ($p = 0.220$) were. In contrast, self-efficacy, perceived threat, and outcome expectations predicted intention to perform SSE, which predicted behaviour ($p = 0.015$). The HAPA construct volitional self-efficacy was also associated with wbSSE ($p = 0.046$). The use of the HAPA model for future SSE interventions for this population is warranted.

Keywords: melanoma; self-examination; early diagnosis; middle aged males; psychological theories;

Introduction

Australia has the highest incidence of skin cancer worldwide ¹, and men aged 50 years or older have been identified as a high risk group for melanoma ². Secondary skin cancer prevention measures, such as skin self-examination (SSE), have the potential to improve survival from melanoma ³. While there is no longitudinal evidence for the effectiveness of SSE, it may reduce mortality from melanoma by up to 63% ⁴, as well as reducing the thickness and severity of melanoma at diagnosis ⁴⁻⁷. Despite this, reported prevalence of SSE in the general population is low, especially in older men ⁸, and men are less likely to engage in preventative SSE than women ⁹.

Interventions to increase preventative behaviours such as SSE are often based on theoretical models ¹⁰. The Health Belief Model (HBM) in particular, is the most widely applied model of health behaviour ¹¹ and many scholars believe that it forms the foundations for behaviour change practice ¹⁰. It rests on the premise that an individual's likelihood of performing a behaviour is predicted by their underlying beliefs about that behaviour and the health problem it will prevent ¹². The major constructs of the HBM are a person's perceived threat (perceived seriousness and perceived susceptibility) from a particular health problem, their expected outcomes (benefits and barriers) from performing the preventative behaviour and self-efficacy, which is belief in their ability to correctly perform the behaviour ^{11,13}. Although there is evidence that the HBM effectively predicts health behaviours ^{14,15}, it has some limitations ^{11,14,16}. It has been argued that the model has poorly defined constructs ¹¹ and focuses on motivational factors without considering how intention to perform a behaviour translates into actual uptake and long-term maintenance of that behaviour. For example, while the HBM indicates that intervening on a person's motivation to wbSSE will increase their intention to perform the behaviour, it gives no indication of how likely it is that this will lead to actual uptake of wbSSE.

By contrast, the Health Action Process Approach (HAPA) is a more recently developed model ^{17,18} that attempts to overcome weaknesses of earlier social cognitive theories by including constructs which stand between intention and behaviour, thereby addressing the ‘intention-behaviour’ gap ¹⁷. There are two implicit phases in the model: the motivational phase, which deals with motivational constructs leading to the formation of an intention to change behaviour; and the volitional phase, which specifies constructs that explain variance in actual behaviour change ¹⁷ (see Figure 1).

Insert Figure 1 about here

The motivational phase is defined by three constructs, which are similar to those specified in the HBM. Action self-efficacy refers to an individual’s belief in their ability to correctly perform a behaviour, while risk perception is a measure of a person’s perceived vulnerability to develop skin cancer (susceptibility) and severity the person attaches to such diagnosis ¹⁹. Outcome expectancies are a person’s positive and negative expectations about the consequences of taking up a behaviour ¹⁹. These constructs are hypothesised to predict intention to perform a behaviour. In the volitional stage are the constructs of action planning and volitional self-efficacy. Action planning involves a person making plans to perform a behaviour, such as when, where and how they will do it ¹⁷. Volitional self-efficacy refers to a person’s belief in their capacity to overcome unexpected barriers that affect their ability to maintain that behaviour, and belief in their ability to overcome setbacks or relapses into old behaviour ¹⁷.

A review of HAPA’s efficacy presented empirical evidence for the predictive value of the model ¹⁷. In five studies HAPA constructs explained significant amounts of variance for differing kinds of behaviours, and the hypothesised pathways between constructs were

confirmed. For example, in a study measuring physical activity in cardiac rehabilitation patients, volitional constructs explained 32% of variation in physical activity behaviour²⁰.

Within the current context of SSE, numerous studies have cited either health behaviour models or a combination of constructs from multiple models to guide the development of SSE interventions²¹⁻²⁵. Despite this, neither the complete HBM nor HAPA models have been specifically tested for their predictive value for SSE in any population. Given criticisms of the HBM and potential advantages of the HAPA, it may be that the HAPA provides a better theoretical basis for why some men choose to take up and maintain wbSSE, and others do not. If the HAPA explains SSE behaviour more completely than the HBM, the constructs it includes may provide a potential focus for future interventions. Using the HAPA or HBM models, the aim of the present study therefore was to assess determinants of uptake of wbSSE behaviour in these men 50 years or older.

Methods

Ethical considerations. Ethical clearance was granted from the Queensland University of Technology (QUT) Human Research Ethics Committee, and the trial was registered with the Australian New Zealand Clinical Trials Registry (ANZCTR N12608000384358).

Randomised trial. This analysis used data from a randomised intervention trial to improve wbSSE, the Skin Awareness Study. Full details of the study design and methods have been previously described ^{21,26}. In brief, the Skin Awareness Study was conducted between 2008 and 2010 in Queensland, Australia. Men aged 50 years or older randomly selected from the Australian electoral roll (enrolling to vote is compulsory in Australia) were mailed an invitation to participate. Of the total 2276 (78%) men who responded to the initial mail-out, 1019 (45%) refused participation and 289 (12.7%) were deemed ineligible due to cognitive or hearing impairment, non-English speaking ability, no access to either a DVD or VCR player (required for the intervention) or a previous melanoma diagnosis. Overall, 930 eligible men agreed to participate and were randomised to either the intervention group or the control group. Two weeks following a baseline measure, the intervention group received a tailored video-delivered intervention, while the control group received 'usual care' print-based materials. Data were collected by Computer Assisted Telephone Interviews (CATIs) at baseline, and again at 7 and 13 months after participants received the study materials.

Current analysis. To reduce variation induced by the intervention, only data from control group participants were used for the analyses described here. Furthermore, as data relating to the HBM and HAPA were only collected at baseline and the 13-month time point, data from the 7-month time point was not included in the analysis. Participants were included if they had completed interviews at both the baseline and 13-month time points. Of those who

completed the baseline interview (n=460), 50 did not complete the 13-month interview, leaving a final sample of 410. Participants who did not complete both interviews were similar to those who did in terms of basic demographic characteristics.

Measures. Data on demographic and health characteristics including area of residence, marital status, age group, education, income, and past participation in other cancer screening tests were collected at baseline.

The primary outcome variable used for these analyses was wbSSE at 13 months. Men were classified as having performed a wbSSE in the last 6 months if they had indicated that they had examined each of 13 body areas and that they had either had a person help them or used mirrors to check hard to see parts of the body.

Measures were selected from the baseline interview which best represented the similar HBM and HAPA constructs of self-efficacy ('action self-efficacy' in the HAPA), perceived threat, and outcome expectations ('outcome expectancies' in the HAPA; Table 2). Measures of the remaining HAPA constructs were selected from either the baseline or 13-month interview in line with Schwarzer's¹⁹ suggestion that 'at least two measurement points are recommended to test the model assumptions: [perceived threat], [outcome expectations], action self-efficacy, and intention at Wave 1, and planning, maintenance self-efficacy, recovery self-efficacy, and behaviour at Wave 2'. Several of the measures used were taken from previous SSE research⁸; while others were developed for the purposes of this study.

Statistical analysis. Basic descriptive statistics were generated to describe participants' demographic and health characteristics.

Structural Equation Modelling (SEM) with Mplus version 6²⁷ was used to test hypothesised associations between model constructs and to compare the two models. A

maximum likelihood (ML) estimation and logistic regression were used to estimate regression coefficients (unstandardised) and significance values for each parameter. We considered relationships between constructs to be important if they were statistically significant at the standard $p < 0.05$ level.

The models were compared using a nested comparison based on the loglikelihood ratio test¹⁹ and Akaike's information criterion (AIC) was reported for each model. This statistic provides an indication of model fit, adjusted for parsimony. As it is not normed on a 0-1 scale, AIC can only be used in a comparative sense; there is no objective cut-off point which indicates a 'good fit'. When comparing two models, however, smaller values indicate a more well fitting and parsimonious model²⁸.

Variables. SEM allows for the inclusion of latent variables in a model, which represent an underlying construct measured by multiple data items. In the present study, multiple data were available for a single construct only: self-efficacy at baseline (three items as listed in Table 2). To determine whether these items appropriately measured the underlying construct, a single factor measurement model was specified and estimated using the maximum likelihood method. To identify the model, error variances for 'correct SSE' and 'monthly SSE' were constrained to be equal, as they were found to be similar in an initial model. The model fit was satisfactory: $\chi^2 = 0.847$ (df 1, $p = 0.358$); Root Mean Square Error of Approximation (RMSEA) < 0.001 ; Comparative Fit Index (CFI) = 0.999. Standardised factor loadings were all significant at the $p < 0.001$ level (see Fig 2).

The remaining variables were directly derived from single or combined items as listed in Table 1. The constructs of planning, intention and wbSSE were specified as categorical variables.

Model specification. Model 1 (Fig 2) is a simple representation of the HBM, where constructs on the left (self-efficacy, perceived threat, and outcome expectations as measured at baseline), were specified as predictors of wbSSE at 13 months.

Insert Figure 2 about here

Extra constructs were added to Model 1 to represent the hypothesised pathways of the HAPA (Fig 3).

Insert Figure 3 about here

Given Schwarzer's hypothesis concerning the closure of the 'motivational' phase in forming intentions to perform a behaviour¹⁹, *intention* was included as a mediator between the constructs that motivate behaviour performance and wbSSE. In addition, the theoretical framework of the HAPA model suggests that an individual must make plans for behaviour performance prior to executing it¹⁹. Given this, the construct of *SSE planning*, as measured at 13 months, was specified as a mediator between *intention* at baseline and wbSSE at 13 months. Schwarzer also reported that *volitional self-efficacy* is important in maintaining behaviour change and overcoming obstacles and relapses over time¹⁹. This construct, also measured at 13 months, was added into the model as a predictor of wbSSE.

In order to perform a nested comparison of the HBM with the HAPA, model 2 was run again, constraining the paths to HAPA constructs to equal zero (Figure 4).

Insert Figure 4 about here

Whether the HAPA model was significantly better than the HBM at predicting SSE behaviour was tested using a likelihood ratio test (80), for which the formula is as follows:

$$D = -2 \times (\text{likelihood for null model}) - \ln(\text{likelihood for alternative model}) \square$$

Degrees of freedom are calculated by subtracting the number of free parameters for the null model from the number of free parameters from the alternative model. If the difference statistic D was found to be significant, the HAPA was considered a significantly better model for predicting wbSSE behaviour.

Results

Participants' baseline demographic and health characteristics are described in Table 1. The majority of participants were married or living with a partner (85.6%); and most (80.7%) were aged between 50 and 70 years. In addition, most participants indicated they had previously participated in other cancer screening tests; namely Prostate Specific Antigen (PSA) tests (78.8%) and Fecal Occult Blood Tests (FOBT) (58.3%). [A full description of baseline characteristics of the control group has been published elsewhere²¹. In multivariable analyses using the whole study sample, demographic characteristics were not found to be significantly associated with wbSSE²¹.](#)

Figures 2 and 3 demonstrate the results of each analysis. In all models, unstandardised regression coefficients are displayed for each of the paths, with odds ratios shown in brackets where they could be calculated (for categorical variables).

Model 1 represents the HBM. In this model, the baseline measure of action self-efficacy was found to significantly predict wbSSE at 13 months ($\beta=0.316$; $p=0.001$); while neither perceived threat ($\beta=0.055$; $p=0.584$) nor outcome expectations ($\beta=0.244$; $p=0.220$) significantly predicted wbSSE. For this model $AIC = 6372.80$.

In Model 2 (representing the HAPA), volitional self-efficacy was a significant predictor of wbSSE ($\beta=0.383$, $p=0.046$) but SSE planning did not significantly predict wbSSE ($\beta=0.169$, $p=0.085$). However, the direct path from intention to wbSSE (not shown in

the diagram) remained significant ($\beta=1.11$; OR: 2.21; $p=0.015$). For this model AIC = 8687.60.

In addition to the individual models 1 and 2 above, we performed a nested comparison of the HBM and HAPA models, first restricting the HAPA paths to zero thus only allowing HBM components to contribute, then allowing and unconstrained model with all HAPA paths estimated (Table 3). Based on loglikelihood comparisons (Table 3), the HAPA fitted the data significantly better (chi-square = 164.34; $df=8$, $p<0.001$), even taking into account the additional complexity it contained. This is further demonstrated by a comparison of the AIC statistics; the HAPA model had a lower AIC (AIC = 8688.85 compared to the HBM-HAPA restricted model AIC=8837.18), indicating a comparatively better model.

Comment

A Structural Equation Modelling analysis of data from the Skin Awareness Study provided preliminary evidence that the HAPA model is better at predicting wbSSE in a sample of older men than the HBM. Furthermore, the findings tend to support the hypothesised pathways of the HAPA model.

Previous analysis of a similar sample revealed no significant associations between wbSSE and demographic characteristics²¹. Analysis of the HBM revealed that only self-efficacy at baseline was associated with reported wbSSE at 13 months, while neither outcome expectations nor perceived threat predicted wbSSE. This differs from the findings of previous cross-sectional studies, which measured items representing HBM constructs. Perceived threat for melanoma was found to increase the odds of having performed SSE in three studies^{8,29,30}. These studies included samples from the general population and younger adults. Threat perception may increase preventative behaviours more in these populations compared to

older men, a group who have been shown to have a lower uptake of SSE^{8,9}. In terms of outcome expectations, a study involving relatives of melanoma survivors found that barriers to performing SSE decreased the odds of having performed the behaviour in the past, and perceived benefits of SSE increased the odds³¹. Similar correlations may have been overlooked in the current study, as benefits and barriers were not measured as individual constructs. However, in addition to these factors, results of the present study may also differ due to its longitudinal study design. While the cross-sectional studies mentioned above demonstrated associations between HBM constructs and past SSE behaviour, in this study only self-efficacy, and not perceived threat or outcome expectations, prospectively predicted future wbSSE. This raises the possibility that the HBM may not be a sufficient model to predict the range of variance in future wbSSE behaviour in this population.

The HAPA model was found to fit the data better than the HBM, and all but one of the hypothesised pathways were significant. Firstly, all three motivational variables were significantly associated with *intention* to perform SSE at baseline, which in turn increased the odds of having performed wbSSE at 13 months. Although no previous longitudinal work has linked intention to perform SSE with the behaviour, these findings correspond with the body of evidence from other areas of health research demonstrating that intentions are usually associated with performing a health behaviour³². Secondly, while planning slightly mediated the effect of intention on wbSSE, it did not significantly increase the odds of wbSSE when *volitional self-efficacy* was also included in the model. Planning has been linked to other health behaviours in previous studies using the HAPA model, but this has not been assessed in the context of SSE. For example, in a sample of 418 women, planning was the best direct predictor of breast self-examination³³; and similarly it was significantly associated with seat-belt use in a population of adolescents³⁴. In a study of dietary behaviours in a Korean population, planning predicted behaviour in women but not in men, while self-efficacy was

of equal predictive value in both genders³⁵. In the current population of men aged 50 years or older, the results indicate that self-efficacy may be a more important proximal predictor of wbSSE than planning. Volitional self-efficacy at 13 months (confidence in ability to maintain the behaviour and recover from set-backs) was significantly associated with wbSSE, and was predicted by action self-efficacy at baseline (having confidence in ability to take up SSE).

In regards to practice, these findings could be applied by designing future interventions towards variables more proximal to behaviour (planning and volitional self-efficacy). This could be particularly relevant if, as Schwarzer suggests, different parts of the model are relevant for people in different mindsets¹⁷. According to the stage version of the HAPA model, people can be divided into three groups: non-intenders (for example, do not intend to perform wbSSE); intenders (intend to perform wbSSE but have not yet done so); and actors (are already performing wbSSE)¹⁷. Some past studies in other health behaviour fields targeting constructs more proximal to behaviour have led to increases in those behaviours¹⁷. For example, an intervention to improve action planning in patients already motivated to increase their physical activity ('intenders') successfully increased levels of activity³⁶. Another study increased the initiation and/or maintenance of breast self-examination via an intervention focused on action and maintenance self-efficacy³⁷.

Limitations. Limitations of the Skin Awareness Study have been published elsewhere²¹. Briefly, all data were collected via self-report, introducing potential recall bias. Men who participated in the study may have had higher incomes and been more health conscious than the general population, making uptake of wbSSE more likely²⁶. Furthermore, specific limitations exist that are unique to the particular analyses used here. Firstly, the single items used in this study were not specifically designed to measure constructs of the HBM or HAPA and therefore may not reflect them accurately. For the HBM, as no item was available for

perceived severity, we used combined measures of perceived threat (perceived susceptibility as a proxy) and outcome expectations (composite score of perceived barriers/perceived benefits). For the HAPA, while the measures used in this analysis for *perceived threat*, *self-efficacy*, *intentions*, and *planning* were similar to recommended items, the measure for the construct of *outcome expectancies* was quite different¹⁹. A composite score from data on a single negative outcome item was used (*'I think checking my skin would make me anxious'*), which may not have encompassed the range of negative outcome expectations about SSE; and two positive outcome items: *'Checking my skin regularly is a priority for me'* and *'It is important to check my skin for skin cancer even if I have no symptoms'*, which were assumed to be sufficient proxies.

Finally, as this study focused on constructs related to two specific models, it did not consider the influence of all factors potentially relevant to the uptake of wbSSE; for example, the presence of psychological disorders, which may affect adherence to health promoting behaviours³⁸. Future research could investigate the affect of these and other relevant factors in conjunction with a model such as HAPA.

Conclusions. In summary, men aged 50 years or older are at high risk of melanoma, and are less likely to perform wbSSE than the general population. A strength of the current study was its longitudinal design, and the results provide preliminary support for the hypothesis that the HAPA model is better at predicting wbSSE in this context. However, due to limitations in data measurement, further investigation is required to confirm this. There is also some indication that intervening on motivational variables alone may increase intention to examine skin, but not necessarily the behaviour itself. Future interventions for this high-risk population could therefore benefit from considering variables more proximal to actual

behaviour (such as volitional self-efficacy and action planning) as described in the HAPA model.

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Figure Key

Figure 1: Health Action Process Approach (HAPA) models

Figure 2: Model 1. Prediction of behaviour – Health Belief Model

Figure 3: Model 2. Prediction of intention and behaviour including planning and volitional self-efficacy

Figure 4: Model 3. Null model with HAPA paths constrained

Figure 1

Figure 2

*p<0.05

Figure 3

* $p < 0.05$; ** $p < 0.001$

Figure 4

* $p < 0.05$; ** $p < 0.001$

Table 1: Participants' baseline demographic and health characteristics ^a

Characteristic	n=410	(%)
Area of Queensland		
Urban	194	(48.0)
Rural	210	(52.0)
Marital status		
Does not live with a partner	58	(14.1)
Married/lives with partner	351	(85.6)
Age group		
50-60 years	189	(46.1)
61-70 years	142	(34.6)
71-90 years	179	(19.3)
Highest level of education completed		
Less than junior high school	30	(7.3)
Completed junior high school	124	(30.2)
Completed senior high school	68	(16.6)
Trade or technical certificate or diploma	100	(24.4)
University or college degree	85	(20.7)
Household income (yearly, before tax)		
Less than \$20,000	48	(11.7)
\$20,001 to \$40,000	96	(23.4)
\$40,001 to \$60,000	76	(18.5)
\$60,001 to \$80,000	44	(10.7)
>\$80,001	114	(27.8)
Refused	32	(7.8)
Has had a Prostate Specific Antigen (PSA) test	323	(78.8)
Has had a Fecal Occult Blood Test (FOBT)	239	(58.3)

^a Some variables have missing data.

Table 2: Questionnaire items used to measure constructs of the HBM or HAPA

Construct	Items	Measurement scale	Handling
Action self-efficacy (baseline)	How confident are you that you ... a) ...can check your own skin correctly? b) ...will find time in the next 12 months to check your own skin? c) ...will remember to check your own skin at least once a month?	0–10 (lowest–highest)	Three items were specified as a latent variable in SEM
Perceived threat (baseline)	How likely is it that you will get skin cancer at some time in the future?	1–4 (not at all likely–very likely)	
Outcome expectations (baseline)	It is important to check my skin regularly for the early signs of skin cancer, even if I have no symptoms. Checking my skin regularly is a priority for me. I think checking my skin would make me anxious.	1–5 (strongly disagree–strongly agree)	Mean of three items was found to give an overall score
Intention (baseline)	In the next 12 months, do you intend to check your skin for early signs of skin cancer?	No/don't know or yes	
Planning (13 months)	I have made plans on when to examine my own skin.	1–5 (strongly disagree–strongly agree)	
Volitional self-efficacy (13 months)	I am able to keep examining my own skin regularly, even if I have no one to help me. I am confident that I can take up examining my own skin again even if I have not looked at my skin the past few months.	1–5 (strongly disagree–strongly agree)	Mean of two items was found to give an overall score

Abbreviations: HBM – Health Belief Model; HAPA (Health Action Process Approach); SEM – Structural Equation Modelling

Table 3: Revised HBM and HAPA model comparison

Model	Loglikelihood value	Number of free parameters	AIC
Null model (revised HBM): HAPA paths constrained to equal zero	-4401.59	17	8837.18
Alternative model (HAPA): Unconstrained model with all HAPA paths freely estimated, includes direct paths from baseline motivational factors to behaviour	-4319.42	25	8688.85

Formula applied:

$$D = -2 \times (\ln(\text{likelihood for null model}) - \ln(\text{likelihood for alternative model}))$$

$$D = -2 \times (-4401.59) - (-4319.42)$$

$$D = -2 \times -82.17$$

$$D = 164.34$$

$$\text{Degrees of freedom} = 25 - 17 = 8$$

Abbreviations: HBM = Health Belief Model; HAPA Health Action Process Approach