

Deakin Research Online

This is the authors' final peered reviewed (post print) version of the item published as:

Mullan, Barbara, Wong, Cara, Kothe, Emily and MacCann, Carolyn 2013, Predicting breakfast consumption: a comparison of the theory of planned behaviour and the health action process approach, *British food journal*, vol. 115, no. 11, pp. 1638-1657.

Available from Deakin Research Online:

<http://hdl.handle.net/10536/DRO/DU:30052247>

Reproduced with the kind permission of the copyright owner.

Copyright : 2013, Emerald

Predicting breakfast consumption

A comparison of the theory of planned behaviour and the health action process approach

Barbara Mullan, Cara Wong, Emily Kothe and Carolyn Maccann
School of Psychology, University of Sydney, Sydney, Australia

Abstract

Purpose – Breakfast consumption is associated with a range of beneficial health outcomes including improved overall diet quality, lower BMI, decreased risk of chronic disease, and improved cognitive function. Although there are many models of health and social behaviour, there is a paucity of research utilising these in breakfast consumption and very few studies that directly compare these models. This study aims to compare the theory of planned behaviour (TPB) and the health action process approach (HAPA) in predicting breakfast consumption.

Design/methodology/approach – University students (N = 102; M = 19.5 years) completed a questionnaire measuring demographics, TPB and HAPA motivational variables, and intentions. Behaviour and HAPA volitional variables were measured four weeks later.

Findings – Using structural equation modelling, it was found that the TPB model was a superior fit to the data across a range of model indices compared to the HAPA. Both models significantly predicted both intentions and behaviour at follow up; however, the TPB predicted a higher proportion of the variance in breakfast consumption (47.6 per cent) than the HAPA (44.8 per cent). Further, the volitional variables did not mediate the intention-behaviour gap, and the data were not an adequate statistical fit to the model compared to the TPB.

Research limitations/implications – The results support the use of the TPB and show that some aspects of the HAPA are useful in predicting breakfast consumption, suggesting that risk perception and self-efficacy be targeted in interventions to increase behaviour. The volitional variables did not appear to mediate breakfast consumption indicating that intention is still the strongest predictor, at least in this behaviour.

Originality/value – The current study is the first to compare the TPB and HAPA in predicting breakfast consumption.

Keywords Breakfast consumption, Health action process approach, Self efficacy

Paper type Research paper

Breakfast consumption has long been considered as one of the “healthy habits” related to concurrent physical health status and long-term survival (Belloc and Breslow, 1972). Regular breakfast consumption has been linked with a range of beneficial health outcomes including: improved overall diet quality, lower fat intake, lower body mass index (BMI) and contributes to the daily recommended intake of essential nutrients such as calcium, thiamine and iron (Affenito, 2007; Ortega et al., 1998; Rampersaud et al., 2005; Yang et al., 2006). Breakfast consumption may also have long term positive effects such as decreased risk of depression, stress, obesity and chronic disease (Timlin and Pereira, 2007; Yang et al., 2006). However, despite the widely recognised importance of regular breakfast consumption, breakfast skipping remains prevalent in many populations (Mullan and Singh, 2010). Research has also linked breakfast skipping with low mood (Smith, 2002), and poor concentration and memory (Cueto et al., 1998). In particular, studies have found that as adolescents age they become less likely to consume breakfast (Siega-Riz et al., 1998), such that 19-24 year olds have the highest rates of breakfast skipping of any age group (Williams, 2007). Understanding the predictors of breakfast consumption in this age group is an important first step in designing effective interventions to increase breakfast consumption and improve attitudes and motivation to consume breakfast (Kothe and Mullan, 2011; Rampersaud et al., 2005).

A number of theoretical models have been utilized in an attempt to predict what motivates behaviour. Arguably the most widely used of these is the theory of planned behaviour (TPB) (Ajzen, 1991). According to the TPB the most immediate and important predictor of behaviour is the person’s intention (Ajzen, 1991; Fishbein and Ajzen, 1975). Intention is determined by three constructs: attitude – the person’s overall evaluation of favourableness or unfavourableness of the outcomes of behavioural performance; subjective norm – the person’s perceptions of social pressure to perform or not to perform the behaviour; and perceived

behavioural control (PBC) – the individual’s perceptions of the ease or difficulty of performing the behaviour of interest. PBC is also thought to directly affect behaviour when PBC reflects actual control (Ajzen, 1991). The TPB has been successfully applied to explain a number of health behaviours including smoking (Van De Ven et al., 2007), and exercise (Courneya and McAuley, 1995), as well as a variety of nutritional behaviours including adolescent food choice (Dennison and Shepherd, 1995), fruit and vegetable consumption (Gratton et al., 2007), soft drink consumption (Kassem and Lee, 2004), individual fish consumption (Verbeke and Vackier, 2005), consuming a low fat diet (Armitage and Conner, 2001) and food hygiene behaviours (Mullan and Wong, 2009). A meta-analysis of 161 studies using the TPB (Armitage and Conner, 2001) found that attitudes, subjective norms and PBC accounted for 39 per cent of the variance in intention, whilst intention accounted for 25 per cent of the variance in behaviour. PBC accounted for an extra 2 per cent variance in behaviour over and above the influence of intention.

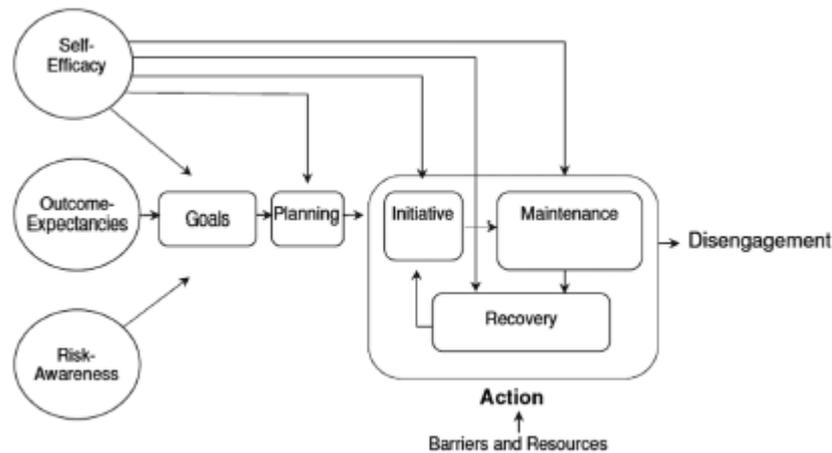
A very small number of studies have been conducted using the TPB to predict breakfast consumption. Two studies in Sweden using school children examined healthy vs unhealthy bread and milk choices (i.e. low or high fat milk, white or wholemeal bread) at breakfast time (Berg et al., 2000; Gummesson et al., 1997). Both studies found that the model was reasonably useful in predicting healthy food choices. Neither study however, considered the impact of the TPB variables on actual frequency of breakfast consumption. Two recent studies using a young adult population have explored the use of the TPB in predicting breakfast consumption frequency. Wong and Mullan (2009) found that the model was successful at predicting 53 per cent of the variance in intention and 64 per cent of the variance in behaviour to consume breakfast daily over a one week follow-up. These findings were extended by Kothe et al. (2011), who found that the TPB predicted 33 per cent of breakfast consumption at four week follow-up.

Although the TPB has been used to successfully model breakfast consumption in a young adult sample in past studies, there is still a large proportion of variance in behaviour unaccounted for. Reviews of the TPB conclude that the model is better at predicting intentions than behaviour. This is consistent with the use of the model in other health behaviours (Conner and Sparks, 2005; Godin and Kok, 1996) leaving what is commonly known as the “intention-behaviour gap” (Sniehotta et al., 2005). As such, a number of researchers have suggested that the addition of further variables to the model may increase the predictive power of the TPB.

Some researchers have argued that theories of behaviour that include post-intentional processes would better predict behaviour than the TPB. In particular, it has been argued that the health action process approach (HAPA) (Schwarzer, 1992) may offer a more useful model of health behaviour than the TPB (Sutton, 2005, 2008) since the HAPA includes post-intentional variables and constructs of perceived self-efficacy and action planning. As such it may provide a more complete model of health behaviour than the TPB.

The HAPA is a social-cognition model of health behaviour which contends that the performance of health behaviour is a process which includes a motivational and a volitional phase (Schwarzer, 2008; Schwarzer et al., 2003). In the motivational phase the individual forms an intention to either adopt a behaviour, or not perform the behaviour. The subsequent volitional phase covers the processes of implementing intentions into actual behaviours, and includes planning, maintenance self-efficacy and recovery self-efficacy (Schwarzer et al., 2003). In the motivational phase, risk awareness, outcome expectancies, and perceived action self-efficacy lead to the formation of an intention (see Figure 1). Risk awareness is an important component as a minimum level of threat or concern must exist before an individual considers the benefits of possible actions and reflect on their inability to actually perform them (Schwarzer et al., 2003). Risk awareness is also split into two dimensions of vulnerability and severity. Vulnerability is the perceived probability of being affected by a health threat, and severity is the perceived relevance of the threat. Health risks refer to any threat to one’s immediate or long-term health and well-being (Schulenberg and Maggs, 1999). For example, immediate risks of skipping breakfast include depleted cognition and poor concentration, whereas longer term risks include depression, stress, obesity and chronic disease. If an individual is aware of the risks of not eating breakfast, then this will increase the likelihood that they will consider eating breakfast. Different positive and negative outcome expectancies are then balanced. This leads to formation of a behavioural intention if the outcomes are perceived to be more beneficial than not taking action. In relation to breakfast consumption this will involve evaluating the potential outcomes of consuming or not consuming breakfast. Individuals who believe that there will be more benefits of eating breakfast will have higher intentions than those who do not. Action self-efficacy is seen as the most influential motivational factor and a strong predictor of behavioural intentions (Schwarzer et al., 2003). Persons with high self-efficacy are more likely to attain their goals as they can set clear objectives and are optimistic about their capabilities and competence to perform and achieve their desired behaviour (Sniehotta et al., 2005).

Figure 1. The health action process approach (HAPA)



Source: HAPA; from Schwarzer *et al.* (2003)

Goal intention in the HAPA is similar to the behavioural intention in the TPB. However, at this stage the model differs as according to the HAPA, once an intention to perform a behaviour is formed, the behaviour must be planned, initiated, and maintained, and relapses have to be managed. These constructs form the volitional stage of the model (see Figure 1). The most commonly used version of the HAPA views the stages as a continuum where planning mediates the intention-behaviour relationship (Schwarzer, 2008). This means that individuals with high intentions are more likely to engage in action planning, and those who plan are consequently more likely to achieve their desired behaviour (Sutton, 2008). In relation to breakfast consumption, the model would predict that those with greater intention to eat breakfast will be more likely to make action plans, for example, when, where and how breakfast consumption would be implemented. Consequently there will be a higher probability of implementing behaviour. As well as being dependent on action planning, the HAPA suggests successful regular breakfast consumption is also dependent on perceived capability in maintaining the behaviour (maintenance self-efficacy) and perceived capability in coping after a period of absence in behaviour (recovery self-efficacy).

HAPA has been applied to several nutrition related behaviours including eating salty and high-fat food (Satow and Schwarzer, 1998), preventative nutrition (Schwarzer and Renner, 2000), low fat food (Renner *et al.*, 2000), adopting or maintaining a healthy diet (Schwarzer and Renner, 2000), and fruit and vegetable consumption (Luszczynska *et al.*, 2007). The HAPA has also been successfully applied to other health behaviours including dental flossing and seat belt use (Schwarzer *et al.*, 2007), which like breakfast consumption are thought to be routine and habitual. Compared to more static models of health behaviour (such as the TPB), the HAPA considers behaviour to be a dynamic process which may be more particularly useful for predicting routine and habitual behaviours such as breakfast consumption. However this may be more important at the starting point or when individuals are making a change to begin eating breakfast regularly. To make health protective behaviour habitual requires planning and maintenance, and the ability to restart behaviour if there are setbacks. On the other hand, if people are already habitually eating breakfast, they may not consider that they need to make any plans. However, to date no studies have used the HAPA to predict breakfast eating. Although researchers have argued that the TPB and HAPA should be directly compared (Sutton, 2008), to date few studies have done so in any health behaviour domain (Garcia and Mann, 2003; Weinstein *et al.*, 1998). As such, the extent to which HAPA would provide a more comprehensive understanding of breakfast consumption than the TPB is currently unknown.

The aim of the present study is to address this gap in the existing literature by comparing the TPB and HAPA in a single university based sample. Three hypotheses were developed. Consistent with previous research that has applied the TPB to the prediction of breakfast consumption and with research that has applied the HAPA to nutrition behaviours it is hypothesised that both theories will predict intention to consume breakfast and actual breakfast consumption at four week follow-up. The development of the HAPA has been justified by the argument that the inclusion of post-intention variables and self-efficacy and risk perception means that the theory provides a more complete model of behaviour than the TPB. On the basis of this argument it is expected that the HAPA will provide a better model of breakfast consumption than the TPB. The models will be compared using the percentage of variance in breakfast consumption accounted for by both theories and a comparison of model fit statistics for the two theories. It is expected that HAPA will explain a greater

proportion of the variance in breakfast consumption and will demonstrate a better fit to the data than the TPB. Finally, based on predictions made by the HAPA model, it is also hypothesised that action planning will mediate the intention and behaviour relationship.

Method

Participants

Participants were 102 first year psychology students from an Australian University. The average age was 19.5 years (SD = 2.5, range = 17-35 years). Ethical approval was obtained from the University Human Ethics Committee where the research was conducted. Participants were recruited via an online system and received course credit for undertaking the study.

Procedure

The participants completed two online questionnaires spaced four weeks apart. At time one participants completed questions related to demographic variables, attitudes, beliefs, PBC, subjective norm, risk perception, outcome expectancies, action self-efficacy, and intention. Behaviour and volitional variables of maintenance self-efficacy, recovery and planning were measured at time two.

Materials

For all items in the present study, breakfast was defined as the consumption of a meal within two hours of waking. This is consistent with a number of previous studies in the field (Mullan and Singh, 2010).

The TPB questionnaire items were designed following the layout of Conner and Armitage (2002) and recommendations by Conner and Sparks (2005). The principle of compatibility was followed and measures of behaviours and components of the TPB were formulated at the same level of specificity with regard to action, target, context and time. These items were designed as the result of a series of elicitation interviews in an Australian university based sample and have previously been used in two earlier studies of the TPB and breakfast consumption (Kothe et al., 2011; Wong and Mullan, 2009). In the elicitation interviews, concurrent themes about breakfast consumption included physical well-being (e.g. feeling healthy, having energy), mental well-being (e.g. helps to concentrate, increases productivity), time (e.g. eating breakfast is time consuming) and weight maintenance (e.g. eating breakfast means I snack less; skipping breakfast makes me lose weight) (Wong, 2007).

Attitudes were assessed as the mean of six semantic differential scales, e.g. (eating breakfast within two hours of waking would be: bad-good, unpleasant-pleasant). Scores ranged from 1 to 7 with a higher score indicating a more positive attitude. An alpha coefficient of 0.90 was reported.

Subjective norm was assessed by a single item "people who are important to me think I should eat breakfast within two hours of waking" (unlikely-likely), scored 1 to 7 with a higher score indicating more normative pressure.

Perceived behavioural control was assessed as the mean of four, seven-point unipolar (p1 to p7) items including two items for controllability (e.g. how much control do you have over whether you eat breakfast within two hours of waking) and two for self-efficacy (e.g. for me eating breakfast within two hours of waking is – very difficult-very easy). An alpha coefficient of 0.81 was reported.

The HAPA questionnaire items were adapted from a previous HAPA study (Schwarzer et al., 2003). The layout and number of items for each measure were identical to this study however the content about breakfast consumption beliefs were adapted from previous breakfast studies (Kothe et al., 2011; Wong and Mullan, 2009). Similar adapted HAPA items have been used in a number of previous studies of health behaviours in Australian university samples (Chow and Mullan, 2010; Mullan et al., 2010).

Risk awareness was measured with three risk components-relative risk (e.g. compared to other people of your age and sex, how likely is it that you will have less energy/less concentration/feel less healthy because you do not eat breakfast; Cronbach's alpha $\frac{1}{4}$ 0.90), absolute risk (e.g. how likely is it that you will have less energy if you do not eat breakfast; Cronbach's alpha $\frac{1}{4}$ 0.87) and risk severity (e.g. how severe would the following health related problems be for you, less energy; Cronbach's alpha $\frac{1}{4}$ 0.76). Short-term risks, rather than long term risks such as chronic disease were chosen as these were the risks and perceived consequences of not eating breakfast brought up in elicitation interviews in this population (Wong, 2007). Each component consisted of three questions where scores ranged from 1 to 7 with a higher score indicating higher estimated risk. These three components were combined to calculate the overall risk awareness score. The Cronbach's alpha for all risk components was 0.85.

Outcome expectancies were assessed as the mean of three items on a seven point scale (e.g. If I start eating breakfast regularly: I will have more energy/more concentration/better general health, – not at all true – exactly true). An alpha coefficient of 0.92 was reported.

Action self-efficacy was measured as the mean of three items measuring confidence to consume breakfast (e.g. I am confident that I am able to eat breakfast within two hours of waking even if I have to: make a detailed plan to have food available/overcome my usual habit of not eating breakfast/rethink my behaviours and opinions regarding breakfast) scored 1 (not at all true) to 7 (exactly true). An alpha coefficient of 0.88 was reported.

Behavioural intention was assessed as the mean of five items, each measured on seven-point scales (e.g. I intend/plan/aim to eat breakfast within two hours of waking over the next four weeks). For behavioural intention the alpha coefficient was 0.98.

Maintenance self-efficacy was assessed as the mean of three items measured on a seven-point scale which asked how confident participants were that they could maintain eating breakfast within two hours of waking (e.g. even if I will have to make a detailed plan to have food available). An alpha coefficient of 0.91 was reported.

Recovery self-efficacy was assessed as the mean of three items which asked participants to report on their confidence in being able to return to regular breakfast consumption even if they happen to –, e.g. give it up for a period of time. Each item was measured on a seven point scale with a higher score indicating higher confidence. An alpha coefficient of 0.94 was reported.

Planning was assessed as the mean of five items that asked if participants had a plan for when, where, how, with whom and how often they will eat breakfast and scored from 1 (not at all true) to 7 (exactly true). An alpha coefficient of 0.90 was reported.

Behaviour was measured by asking how many days over the past week participants had eaten breakfast, possible scores ranged from 1 to 7 days, over the last four weeks.

Analysis

Structural equation modelling (SEM) with Amos 19.0 using the maximum likelihood estimation was used to test the HAPA and TPB model. Loehlin (1992) and Hoyle (1995) recommend a sample size of at least 100, when using SEM. Although the current sample was relatively small, there were 102 participants so the decision was made to use SEM as it reached this cut off and is better to compare the model fit of the TPB and HAPA. Each model was evaluated by examining the comparative fit index (CFI), the Tucker-Lewis index (TLI), the goodness of fit index (GFI), the root-mean-square-error of approximation (RMSEA) and χ^2 divided by degrees of freedom (χ^2/df). All fit measures overestimate goodness of fit for small samples ($n < 200$), however, RMSEA and CFI were used as these indices are less sensitive to sample size than others (Fan et al., 1999). A good model fit was indicated by a high CFI, GFI, or TLI (0.90), a low RMSEA (0.08) and a χ^2/df between 1 and 2 (Kline, 2005). The models were compared on the basis of the percentage of variance accounted for and through AIC and ECVI fit statistics. For both fit statistics, the model with the lower value provides a better fit to the data.

Model 1

HAPA can be conceptualised either using an implicit or explicit stage structure. In order to facilitate comparisons between the TPB and HAPA, and in light of criticism of the explicit stage model made by Sutton (Sutton, 2005, 2008), this study used the continuum version of the HAPA model. In the hypothesised model, action self-efficacy, outcome expectancies, and risk awareness were entered as predictors of intention, and intention as a predictor of breakfast consumption at time 2. Planning, maintenance and recovery self-efficacy were entered as predictors of behaviour. A path was also specified from intention to planning as according to Schwarzer et al. (2003), planning can mediate the intention-behaviour link. In addition, action self-efficacy was entered as a predictor of planning, maintenance and recovery self-efficacy.

Model 2

The second model tested the TPB. In the hypothesised model, attitude, subjective norm and PBC were entered as predictors of intention, and intention as a predictor of breakfast consumption at time 2. A path was also specified from PBC to behaviour, as according to Ajzen (1991), PBC may influence behaviour over and above its influence on intention.

Results

There were no dropouts in the present study probably due to the incentive of course credit offered on completion of both questionnaires at time 1 and 2. Due to the use of forced response questions on the online questionnaire, there was no missing data in the results. There were 79 females and 23 males in the sample. A total of 53 per cent of participants were Caucasian-Australian, followed by 29.5 per cent of Asian ethnicity, 14 per cent European, and 3.5 per cent from other ethnic groups. The majority of participants lived at home with parents (76.5 per cent) and were of middle or upper class socioeconomic status.

In this sample, 15 per cent ate breakfast one to two times per week, 50 per cent ate breakfast three to six times a week and 35 per cent of participants ate breakfast every day. There were no participants who skipped breakfast every day at follow-up. No gender differences in breakfast consumption were found ($F = 1.41, p > 0.05$). Mean scores for TPB and HAPA items are shown in Table I. All measures are out of 7. The table indicates that people generally had high scores in all the TPB measures suggesting that this sample had generally positive attitudes, normative influence and perceived control over breakfast consumption. Participants also indicated that they would eat breakfast on average five and a half times a week for the next four weeks. For the HAPA variables, motivational variables were also fairly high although risk perception was the lowest indicating that people only moderately perceive themselves to be vulnerable to the risks of skipping breakfast or did not perceive risks to be that severe. Planning was also only moderate, suggesting that participants did not generally specify plans for where when and how they would consume breakfast.

Table II presents the intercorrelations between TPB variables at Time 1 and behaviour at Time 2. As shown, attitude, subjective norm, and PBC were all correlated with both intention and behaviour. Intention at time 1 and behaviour at time 2 were also significantly correlated.

Table I. Means and standard deviations for TPB and HAPA variables

	Mean	SD
PBC	5.62	1.23
Attitude	6.05	0.96
Subjective norm	5.57	1.42
Intention	5.58	1.51
Risk awareness	4.72	0.95
Outcome expectancies	5.45	1.28
Action self-efficacy	5.07	1.42
Planning	3.90	1.69
Maintenance self-efficacy	4.96	1.73
Recovery self-efficacy	4.50	1.70

Table III presents the intercorrelations between motivational HAPA variables, intention at Time 1 and volitional HAPA variables and behaviour at Time 2. As shown, planning was not correlated with intention or behaviour. All other HAPA variables were associated with intention and behaviour as expected.

Model 1: HAPA

The first model tested the prediction of breakfast consumption using the HAPA model of behaviour. Model fit statistics indicated acceptable fit for the theoretical model to the data: $\chi^2 = 26.69, df = 12; CFI = 0.945, TLI = 0.871; GFI = 0.942, RMSEA = 0.110$ (90 per cent C.I.: 0.053 to 0.167). Although the CFI and GFI indices were good, several of the reported fit statistics were just outside of the range specified as indicating reasonable fit (see Table IV). The χ^2/df ratio was over 2, and the overall significant was $p = 0.009$, indicating that the data did not fit the model very well.

Action self-efficacy and risk awareness were significant predictors of intention, however, outcome expectancies were not. Action self-efficacy was the strongest predictor of intention out of all the motivational variables, and also significantly predicted maintenance and recovery self-efficacy variables. The HAPA motivational variables predicted 43.3 per cent of the variance in intention at time 1. With regard to behaviour, intention, and recovery self-efficacy were significant predictors of behaviour, but planning and maintenance self-efficacy were not. Planning was not found to mediate the relationship between intention and behaviour. Intention however, was the strongest predictor of behaviour. Overall the HAPA model predicted 44.8 per cent of the variance in behaviour at time 2 (Figure 2).

Model 2: TPB

The second model tested the prediction of breakfast consumption using the TPB model. The model was a reasonable fit for the data (see Table IV). Model fit statistics indicated good fit for the theoretical model to the

data: $\chi^2 = 1.248$, $df = 2$, $CFI = 1.00$, $GFI = 0.995$, $TLI = 1.02$, $RMSEA = 0.00$ (90 per cent C.I.: 0.00 to 0.172). The χ^2/df ratio was 0.624 and the overall significance was $p \geq 0.54$. The reported fit statistics all fell within the range specified as indicating reasonable fit (see Table IV). The TPB model appeared to fit the data better than the HAPA model.

The TPB predicted 55.9 per cent of the variance in intention to consume breakfast regularly. Attitude and PBC, but not subjective norm had significant direct effects on intention. PBC also significantly predicted behaviour; however intention remained the strongest predictor of breakfast consumption. Overall the TPB model predicted 47.6 per cent of the variance in behaviour at time 2 (Figure 3).

Table II. Correlation coefficients: TPB variables and behaviour

	PBC	Attitude	Subjective norm	Behaviour	Intention
PBC	–	0.527*	0.419*	0.596*	0.628*
Attitude		–	0.435*	0.519*	0.660*
Subjective norm			–	0.338*	0.468*
Behaviour				–	0.644*
Intention					–

Note: *Correlation is significant at the 0.01 level (2-tailed)

Table III. Correlation coefficients: HAPA variables and behaviour

	Risk awareness	Outcome expectancies	Action self-efficacy	Maintenance self-efficacy	Recovery self-efficacy	Planning	Intention	Behaviour
Risk awareness	-	0.669**	0.344**	0.183	0.152	-0.084	0.495**	0.250*
Outcome expectancies		-	0.471**	0.222*	0.311**	0.029	0.505**	0.189
Task self-efficacy			-	0.498**	0.445**	0.041	0.567**	0.356**
Maintenance self-efficacy				-	0.369**	0.024	0.350**	0.351**
Recovery self-efficacy					-	-0.085	0.496**	0.531**
Planning						-	-0.094	-0.009
Intention							-	0.644**
Behaviour								-

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

Comparison of the two models

The two models were compared using comparative fit statistics: ECVI and AIC. For both statistics lower values indicate better fit. As shown in Table V, the TPB provided a better fit than the HAPA using both methods of fit comparison.

Table IV. HAPA and TPB model fit indices

Fit index	HAPA (model 1)	TPB (model 2)
TLI	0.871	1.029
RMSEA	0.110	0.000
CFI	0.945	1.000
GFI	0.942	0.995
χ^2/df	2.22	0.624

Figure 2. Model 1 – HAPA variables predicting breakfast consumption at week 4

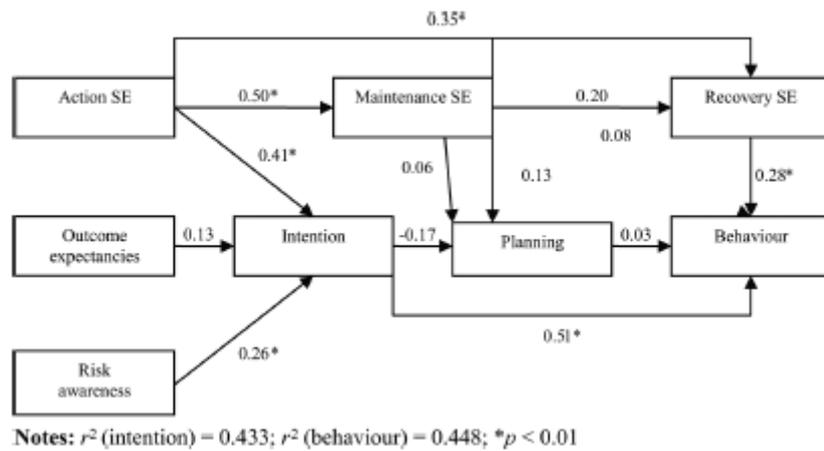
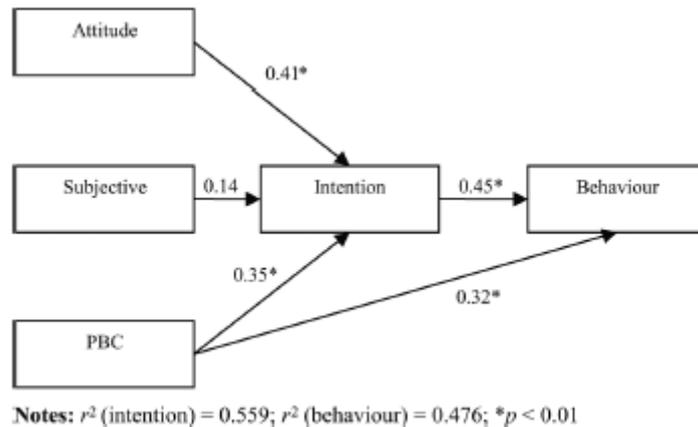


Figure 3. Model 2 – TPB variables predicting breakfast consumption at week 4



Discussion

The primary aim of this study was to compare the HAPA and TPB in the context of the prediction of regular breakfast consumption, an important health-promoting behaviour. SEM was used to analyse both models. The predictive utility and statistical fit of the models is compared and discussed below.

This study was the first to apply the HAPA model to breakfast consumption. Overall the model predicted 43.3 per cent of the variance in intention to consume breakfast. This is similar to previous prediction studies of breakfast using the TPB (Kothe et al., 2011; Wong and Mullan, 2009), and a favourable proportion of variance predicted when compared with previous studies using the HAPA. For example, Mullan et al. (2010) found the HAPA predicted 30 per cent of the variance in intention to prepare food hygienically, with only action self-efficacy and outcome expectancies as significant predictors. For other nutrition behaviours the HAPA predicted 40 per cent of the variance in intention to adopt preventative nutrition habits such as increasing fibre and decreasing fat intake in a slim sample, and 47 per cent of the variance in intention for an overweight sample (Schwarzer and Renner, 2000). As with Mullan et al. (2010), Schwarzer and Renner found risk perception was the least significant predictor of intention indicating participants did not consider themselves to be vulnerable to major health risks such as heart disease or stroke. This was particularly true for the younger sample (aged 17-30) where risk perception did not predict any variance in intention.

In comparison, the current study found that action self-efficacy and risk awareness were significant predictors of intention, whilst outcome expectancies were not. Risk awareness may have been more predictive for this nutrition behaviour than previous studies, due to the measures of risk being more immediate and therefore potentially less significant. For example the risk measures asked participants whether they felt at risk of “having less energy”, or “less concentration”. In contrast to long-term hypothetical risk of heart disease or stroke, participants may have directly experienced these consequences but not consider them that “risky”. Immediate risks were chosen as these were the issues raised by students in elicitation interviews about breakfast consumption in previous studies. Further, young adults and adolescents have been shown to have

more optimism bias about their health, and perceive less risk in health-risk behaviours (Cohn et al., 1995). Therefore it was thought that long-term risks such as chronic illness might be too distal for participants to connect with breakfast consumption. However, future studies could include longer-term health risks and measure differences with immediate risks and how this affects risk awareness as a predictor of intentions. Further, outcome expectancies were expected to be a significant predictor of behaviour as the variable is arguably a similar construct to attitudes in the TPB, which was found to significantly predict intention here, and in previous studies on breakfast consumption (Kothe et al., 2011; Wong and Mullan, 2009). However, TPB attitudes were measured more generally and indirectly (e.g. eating breakfast would be good-bad), whilst outcome expectancies in the current study were measured more specifically (e.g. eating breakfast gives me more energy/concentration) which may have led to the disparity in results. In addition, the result is consistent with the premise that outcome expectancy should have a direct impact on intentions only when individuals lack experience of the behaviour (Armitage and Conner, 2000), which is unlikely in the case of breakfast consumption. Outcome expectancies are viewed as precursors to self-efficacy where individuals have experience of the behaviour (Schwarzer, 1992). As almost two-thirds of the population ate breakfast regularly (5-7 times a week) and as none of the participants asserted that they never ate breakfast, all participants had experienced breakfast consumption along with its outcomes and benefits. Consequently, self-efficacy should be more important for this behaviour, and accordingly it was found to be the strongest predictor of intention in the current study, and significantly predicted the volitional self-efficacy variables. Breakfast consumption is also likely to have different benefits or detriments for different individuals, therefore not all outcomes will be experienced by the whole sample. Future studies may need to tailor questions to suit the individual and their own perceived outcomes of behaviour.

Table V. Comparative fit statistics

Fit index	HAPA (model 1)	TPB (model 2)
ECVI	0.803	0.330
AIC	90.718	37.249

Overall the HAPA predicted 44.8 per cent of the variance in behaviour, which is higher than the proportion of variance explained by a previous TPB study using the same follow-up period (Kothe et al., 2011). However, although the HAPA variables did account for a significant proportion of the variance in intention and behaviour, the model fit statistics suggest that the HAPA was not a good model of breakfast consumption. Further, the construct of planning was not associated with intention or behaviour, which is in contrast to the majority of research using HAPA. This effect was apparent in both the simple bivariate correlations between these variables, and in the SEM analysis of the HAPA. This is in contrast to studies that have suggested planning can activate automatisisation processes by creating situational cues (Sniehotta et al., 2005). The lack of influence on planning in this study is consistent with an intervention study by Kothe et al. (2011) that investigated whether implementation intentions could increase breakfast consumption in a university sample. Implementation intentions function similarly to planning as the individual must specify, when, where and how an intended action is to be completed (Gollwitzer, 1999). However, Kothe et al. (2011), found that the implementation intention intervention was not successful in harbouring behaviour change. Indeed, conscious planning with regard to breakfast consumption may not be necessary if behaviour is already habitual. Wong and Mullan (2009) provided evidence that executive control planning as measured by scores on a cognitive planning Tower of London task explained unique variance in breakfast consumption behaviour. Therefore individuals who already habitually eat breakfast may not need to make conscious detailed plans to achieve successful behavioural performance as it is no longer effortful. Planning may only be useful when trying to initiate behaviour rather than maintain one that is already being performed regularly. This may also explain why maintenance self-efficacy was not a significant predictor of behaviour, as the majority of participants were already regular breakfast eaters and therefore did not need to consider difficulties of maintaining behaviour when faced with barriers. Recovery self-efficacy however, was found to significantly predict behaviour, which suggests that participants, who were more confident about consuming breakfast regularly, even if they had to stop for a period of time, were more likely to eat breakfast. Although the HAPA was able to explain a significant proportion of variance in behaviour, intention was still by far the strongest predictor of behaviour, rather than the volitional variables. The results raise the question of whether the volitional components of the HAPA may only be useful in behaviours that require more cognitive effort and self-regulation, or in behaviours in which participants wish to change. In this particular study, the

majority of the participants already ate breakfast regularly. Future research is needed to compare models of health behaviours within other domains.

Unlike the HAPA, the TPB provided a better model fit for breakfast consumption in the current study. This study was the first to examine the use of the TPB in explaining breakfast consumption using structural equation modelling. Encouragingly, fit statistics indicate that the model does provide a reasonable fit for breakfast consumption. Overall the TPB variables accounted for 47.5 per cent of breakfast eating frequency at week 4, which was slightly higher than the proportion accounted for by the HAPA. This compares favourably with previous studies of breakfast consumption in similar populations, for example, Wong and Mullan (2009) found the TPB predicted 64 per cent of the variance in behaviour with a one week follow-up, and Kothe et al. (2011) found it to explain 33 per cent of the variance in behaviour after four week follow-up. These results are also broadly consistent with studies which have applied the TPB to other nutrition related health behaviours. For example Verbeke and Vackier (2005) found the TPB to explain 42 per cent of the variance in fish consumption, and Sainsbury and Mullan (2011) found the TPB predicted 36 per cent of the variance in adherence to a gluten free diet in coeliac patients.

Consistent with research in other health behaviours, attitudes and PBC were significant predictors of intention however subjective norm was not (Armitage and Conner, 2001; Godin and Kok, 1996). Previous research into the role of subjective norm in breakfast consumption has also found that it is the weakest predictor of the model (Kothe et al., 2011; Wong and Mullan, 2009). It was suggested that this could be due to the age of the participants, being mainly over 18, and the private nature of breakfast consumption resulting in social/parental influence having less impact than behaviours performed in public (Wong and Mullan, 2009). An alternative reason could be related to the operationalisation of the construct of subjective norm (Godin and Kok, 1996). Following the guidelines of the TPB, direct subjective norm was only measured by a single item (Conner and Norman, 2005). More recently there are thought to be several other normative components including moral and descriptive norms, which are the perceived moral correctness of a behaviour, and perceptions of how other people are actually behaving (Cooke et al., 2007; Godin et al., 2005) respectively. Future research may want to include these other components when exploring breakfast consumption. However, moral norms have been argued to be only relevant for behaviours that require moral obligation for example donating blood or speeding (Godin et al., 2005) and consequently may not be applicable to breakfast eating habits.

PBC was found to be a significant predictor of both intention and behaviour after four weeks. Nutrition behaviours such as breakfast consumption may not always be under control, particularly for university students who have irregular timetables and may not always have appropriate foods at home. PBC also includes a component of self-efficacy (Ajzen, 1991) which was found to be the strongest predictor of intention in the HAPA model. Therefore it appears that the decision to consume breakfast is influenced by both personal motivation (intention) and PBC.

The primary aim of the current study was to investigate the relative utility of the TPB and HAPA in predicting breakfast consumption. It was expected that the HAPA would provide a better model for breakfast consumption than the TPB. Specifically, that it would account for a larger proportion of variance in breakfast consumption behaviour and that it would provide a better fit to available data. However, this was not supported by the analyses conducted in the present study. Firstly, despite including more variables, the HAPA accounted for a lower proportion of variance in breakfast consumption than the TPB. While the proportion of variance accounted for was not statistically compared – the finding that the TPB accounted for more variance than HAPA is directly contrary to predictions. Secondly, the HAPA provided a much poorer fit than the TPB. This is the case when comparing the extent fit statistics for each model fell within parameters thought to indicate adequate good fit and when the models were compared using comparative fit statistics. Overall, the findings from this study suggest that the TPB provides a better model of breakfast consumption than the HAPA. It should be noted that although this study does not provide support for the use of the HAPA, that should not be taken to imply that HAPA variables may not add to the explanation of breakfast consumption in this population. While outside the scope of the present study, it may be fruitful to consider whether HAPA variables could be added to the TPB to provide a more complete model of breakfast consumption. Future research should consider whether inclusion of some aspects of the HAPA model could increase the proportion of variance in behaviour accounted for by the TPB. That said, given the considerable overlap between many of the variables in the TPB and HAPA, the failure of the HAPA to account for more variance in breakfast consumption may not be that surprising. In particular, the HAPA includes several variables assessing different components of self-efficacy. However, it may be the case that these variables can largely be captured by perceived behavioural control. This would be consistent with arguments about self-efficacy and perceived behavioural control within the TPB literature (Fishbein and Ajzen, 2010), and may partially explain why HAPA is

no more successful than the TPB at predicting breakfast consumption. The overlap between variables contained within each theory would best be assessed in a study which attempts to combine HAPA and TPB variables into a single statistical model. While outside the scope of the current study, this would be an interesting direction for future research in this area.

This study is not without limitations. Firstly, this sample was more likely to consume breakfast compared to previous studies (Williams, 2005). This may be related to the fact that the participants were students, who predominantly lived at home. Therefore the current sample may not be representative of the general population. However as the majority of people still did not eat breakfast every day, the findings can still be generalised. Secondly, due to the non-nested nature of the models tested in this study it is not possible to statistically compare the TPB and HAPA (Kline, 2005), as such it is not possible to determine whether the differences between the predictive utility and fit of the models is statistically meaningful. Thirdly, the sample size in the current study is smaller than others using SEM to investigate HAPA (Schwarzer, 2008; Sniehotta et al., 2005). As such, one has to interpret the inadequate fit of the models with caution (Kline, 2005). Another limitation was the wording of some of the construct measures, particularly from the HAPA model. The current study based the wording of questions on those in Schwarzer et al. (2003). This may have not been appropriate for this particular behaviour, e.g. "I am confident I am able to eat breakfast [. . .] even if I have to rethink my behaviours and opinions regarding breakfast". Therefore future studies may need to tailor questions more appropriately to the behaviour of interest to increase the validity and reliability of the construct measures. Lastly, past behaviour was not measured in the current study, however this was because Wong and Mullan (2009) found it to confound their results as it was too strongly correlated with behaviour. Although past behaviour is often found to be the strongest predictor of future behaviour, it cannot explain behaviour per se. As past behaviour has previously found to correlate highly with breakfast consumption it was decided that it would not add anything novel to the current literature to include it in the current study.

Implications of the current study suggest that targeting attitudes, PBC, action self-efficacy and risk perception may lead to increases in intentions to consume breakfast. Self-efficacy beliefs have been found to be positively related to the goals individuals set and their commitment to engage in the intended behaviour, even if failure occurs (Schwarzer, 1992). Therefore interventions aiming to increase peoples' confidence and perceptions of control over eating breakfast regularly may be initially achieved through making breakfast more accessible, providing opportunities to achieve behaviour successfully. Offering strategies to overcome individual difficulties and barriers will also assist in increasing self-efficacy. Risk perception could also be increased by providing people with knowledge about the more immediate risks involved with not eating breakfast. The current study focused on more immediate risks such as loss of concentration and energy. These were assumed to be more salient. However, future research could investigate whether more serious long-term perceived risks such as obesity or increased risk of diabetes and heart disease, would be more beneficial at changing behaviour.

In conclusion, both the HAPA and TPB were significant in predicting breakfast eating intentions and behaviour after a four week follow-up. However, contrary to expectations intention remained the strongest predictor of behaviour in the present study and the HAPA was less successful at predicting breakfast consumption than the TPB in the present study. Indeed, despite including three more predictors of behaviour than the TPB, the HAPA model accounted for less variance in behaviour. As outlined above fit statistics also appear to provide greater support for the use of the TPB than the HAPA model. Despite limitations using SEM to compare models, even assuming that the TPB is not statistically superior to the HAPA it is clear that the TPB provides a more parsimonious model of behaviour. This does suggest that in terms of breakfast eating, personal motivation or intentions appears to have the strongest influence over behaviour. As such, it would appear that at least in the area of breakfast eating, the TPB should be used in preference to the HAPA.

References

- Affenito, S. (2007), "Breakfast: a missed opportunity", *Journal of the American Dietetic Association*, Vol. 107 No. 4, pp. 565-569.
- Ajzen, I. (1991), *Attitudes, Personality and Behaviour*, Open University Press, Milton Keynes
- Armitage, C. and Conner, M. (2000), "Social cognition models and health behaviour: a structured review", *Psychology & Health*, Vol. 15 No. 2, pp. 173-189.
- Armitage, C. and Conner, M. (2001), "Efficacy of the theory of planned behaviour: a meta-analytic review", *British Journal of Social Psychology*, Vol. 40, pp. 471-499.
- Belloc, N.B. and Breslow, L. (1972), "Relationship of physical health status and health practices", *Preventive Medicine*, Vol. 1 No. 3, pp. 409-421.
- Berg, C., Jonsson, I. and Conner, M. (2000), "Understanding choice of milk and bread for breakfast among Swedish children aged 11-15 years: an application of the theory of planned behaviour", *Appetite*, Vol. 34 No. 1, pp. 5-19.

Chow, S. and Mullan, B. (2010), "Predicting food hygiene. An investigation of social factors and past behaviour in an extended model of the health action process approach", *Appetite*, Vol. 54 No. 1, pp. 126-133.

Cohn, L.D., Macfarlane, S., Yanez, C. and Imai, W.K. (1995), "Risk-perception: differences between adolescents and adults", *Health Psychology*, Vol. 14 No. 3, p. 217.

Conner, M. and Norman, P. (2005), *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, 2nd ed., Open University Press, Maidenhead.

Conner, M. and Sparks, P. (2005), "Theory of planned behaviour and health behaviour", in Conner, M. and Norman, P. (Eds), *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, Open University Press, Maidenhead, pp. 170-222.

Cooke, R., Sniehotta, F. and Schuz, B. (2007), "Predicting binge-drinking behaviour using an extended TPB: examining the impact of anticipated regret and descriptive norms", *Alcohol and Alcoholism*, Vol. 42 No. 2, p. 84.

Courneya, K.S. and McAuley, E. (1995), "Cognitive mediators of the social influence-exercise adherence relationship: a test of the theory of planned behaviour", *Journal of Behavioral Medicine*, Vol. 18 No. 5, pp. 499-515.

Cueto, S., Jacoby, E. and Pollitt, E. (1998), "Breakfast prevents delays of attention and memory functions among nutritionally at-risk boys", *Journal of Applied Developmental Psychology*, Vol. 19 No. 2, pp. 219-233.

Dennison, C.M. and Shepherd, R. (1995), "Adolescent food choice: an application of the theory of planned behaviour", *Journal of Human Nutrition and Dietetics*, Vol. 8, pp. 9-23.

Fan, X., Thompson, B. and Wang, L. (1999), "Effects of sample size, estimation method, and model specification on structural equation modeling fit indexes", *Structural Equation Modeling*, Vol. 6, pp. 56-83.

Fishbein, M. and Ajzen, I. (1975), *Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.

Fishbein, M. and Ajzen, I. (2010), *Predicting and Changing Behavior: The Reasoned Action Approach*, Psychology Press, New York, NY.

Garcia, K. and Mann, T. (2003), "From 'I wish' to 'I will': social-cognitive predictors of behavioural intentions", *Journal of Health Psychology*, Vol. 8 No. 3, pp. 347-360.

Godin, G. and Kok, G. (1996), "The theory of planned behaviour: a review of its applications to health-related behaviours", *American Journal of Health Promotion*, Vol. 11 No. 2, pp. 87-98.

Godin, G., Conner, M. and Sheeran, P. (2005), "Bridging the intention behaviour 'gap': the role of moral norm", *British Journal of Social Psychology*, Vol. 44, pp. 497-512.

Gollwitzer, P.M. (1999), "Implementation intentions: strong effects of simple plans", *American Psychologist*, Vol. 54 No. 7, pp. 493-503.

Gratton, L., Povey, R. and Clark-Carter, D. (2007), "Promoting children's fruit and vegetable consumption: interventions using the theory of planned behaviour as a framework", *British Journal of Health Psychology*, Vol. 12 No. 4, pp. 639-650.

Gummesson, L., Jonsson, I. and Conner, M. (1997), "Predicting intentions and behaviour of Swedish 10-16-year-olds at breakfast", *Food Quality and Preference*, Vol. 8 No. 4, pp. 297-306.

Hoyle, R.H. (Ed.) (1995), *Structural Equation Modeling: Concepts, Issues, and Applications*, Sage Publications, Thousand Oaks, CA.

Kassem, N.O. and Lee, J.W. (2004), "Understanding soft drink consumption among male adolescents using the theory of planned behaviour", *Journal of Behavioral Medicine*, Vol. 27 No. 3, pp. 273-296.

Kline, R.B. (2005), *Principles and Practice of Structural Equation Modeling*, 2nd Ed., The Guilford Press, New York, NY.

Kothe, E. and Mullan, B. (2011), "Increasing the frequency of breakfast consumption", *British Food Journal*, Vol. 113 No. 6, pp. 784-796.

Kothe, E., Amaratunga, R. and Mullan, B. (2011), "Randomised controlled trial of a brief theory-based intervention promoting breakfast consumption", *Appetite*, Vol. 56 No. 1, pp. 148-155.

Loehlin, J.C. (1992), *Latent Variable Models: An Introduction to Factor, Path, and Structural Analysis*, Lawrence Erlbaum, Hillsdale, NJ.

Luszczynska, A., Tryburcy, M. and Schwarzer, R. (2007), "Improving fruit and vegetable consumption: a self-efficacy intervention compared with a combined self-efficacy and planning intervention", *Health Education Research*, Vol. 22 No. 5, pp. 630-638.

Mullan, B. and Singh, M. (2010), "A systematic review of the quality, content, and context of breakfast consumption", *Nutrition & Food Science*, Vol. 40 No. 1, pp. 81-114.

Mullan, B. and Wong, C.L. (2009), "Hygienic food handling behaviours: an application of the theory of planned behaviour", *Appetite*, Vol. 52 No. 3, pp. 757-761.

Mullan, B., Wong, C.L. and O'Moore, M.K. (2010), "Predicting hygienic food handling behaviour: modelling the health action process approach", *British Food Journal*, Vol. 112 No. 11, p. 5.

Ortega, R.M., Requejo, A.M., Lopez-Sobaler, A.M., Andres, P., Quintas, M.E. and Navia, B. (1998), "The importance of breakfast in meeting daily recommended calcium intake in a group of schoolchildren", *Journal of the American College of Nutrition*, Vol. 17 No. 1, pp. 19-24.

Rampersaud, G.C., Pereira, M.A., Girard, B.L., Adams, J. and Metz, J.D. (2005), "Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents", *Journal of the American Dietetic Association*, Vol. 105 No. 5, pp. 743-760.

Renner, B., Knoll, N. and Schwarzer, R. (2000), "Age and body make a difference in optimistic health beliefs and nutrition behaviours", *International Journal of Behavioural Medicine*, Vol. 7 No. 2, pp. 143-159.

- Sainsbury, K. and Mullan, B. (2011), "Measuring beliefs about gluten free diet adherence in adult coeliac disease using the theory of planned behaviour", *Appetite*, Vol. 56 No. 2, pp. 476-483.
- Satow, L. and Schwarzer, R. (1998), "Psychological factors in preventive nutrition: a longitudinal study", in Schwarzer, R. (Ed.), *Advances in Health Psychology Research*, Freie Universitat Berlin, Berlin.
- Schulenberg, J. and Maggs, J. (1999), *Health Risks and Developmental Transitions During Adolescence*, Cambridge University Press, Cambridge.
- Schwarzer, R. (1992), "Self-efficacy in the adoption and maintenance of health behaviours: theoretical approaches and a new model", in Schwarzer, R. (Ed.), *Self-efficacy: Thought Control of Action*, Hemisphere, Washington, DC, pp. 217-243.
- Schwarzer, R. (2008), "Modeling health behaviour change: how to predict and modify the adoption and maintenance of health behaviours", *Applied Psychology*, Vol. 57 No. 1, pp. 1-29.
- Schwarzer, R. and Renner, B. (2000), "Social-cognitive predictors of health behaviour: action self-efficacy and coping self-efficacy", *Health Psychology*, Vol. 19 No. 5, pp. 487-495.
- Schwarzer, R., Sniehotta, F.F., Lippke, S., Luszczynska, A., Scholz, U. and Schuz, B. (2003), "On the assessment and analysis of variables in the health action process approach: conducting an investigation", available at: http://web.fu-berlin.de/gesund/hapa_web.pdf
- Schwarzer, R., Schuz, B., Ziegelmann, J.P., Lippke, S., Luszczynska, A. and Scholz, U. (2007), "Adoption and maintenance of four health behaviours: theory-guided longitudinal studies on dental flossing, seat belt use, dietary behaviour, and physical activity", *Annals of Behavioural Medicine*, Vol. 33 No. 2, pp. 156-166.
- Siega-Riz, A.M., Popkin, B.M. and Carson, T. (1998), "Trends in breakfast consumption for children in the United States from 1965-1991", *American Journal of Clinical Nutrition*, Vol. 67 No. 4, pp. 748S-756S.
- Smith, A.P. (2002), "Stress, breakfast cereal consumption, and cortisol", *Nutritional Neuroscience*, Vol. 5 No. 2, pp. 141-144.
- Sniehotta, F.F., Scholz, U. and Schwarzer, R. (2005), "Bridging the intention-behaviour gap: planning, self-efficacy, and action control in the adoption and maintenance of physical exercise", *Psychology & Health*, Vol. 20 No. 2, pp. 143-160.
- Sutton, S. (2005), "Stage theories of health behaviour", in Conner, M. and Norman, P. (Eds), *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, Open University Press, Maidenhead.
- Sutton, S. (2008), "How does the health action process approach (HAPA) bridge the intention-behaviour gap? An examination of the model's causal structure", *Applied Psychology*, Vol. 57 No. 1, pp. 66-74.
- Timlin, M.T. and Pereira, M.A. (2007), "Breakfast frequency and quality in the etiology of adult obesity and chronic diseases", *Nutrition Reviews*, Vol. 65 No. 6, pp. 268-281.
- Van De Ven, M.O.M., Engels, R.C.M.E., Otten, R. and Van Den Eijnden, R.J.J.M. (2007), "A longitudinal test of the theory of planned behaviour predicting smoking onset among asthmatic and non-asthmatic adolescents", *Journal of Behavioral Medicine*, Vol. 30 No. 5, pp. 435-445.
- Verbeke, W. and Vackier, I. (2005), "Individual determinants of fish consumption: application of the theory of planned behaviour", *Appetite*, Vol. 44 No. 1, pp. 67-82.
- Weinstein, N.D., Rothman, A.J. and Sutton, S.R. (1998), "Stage theories of health behaviour: conceptual and methodological issues", *Health Psychology*, Vol. 17, pp. 290-299.
- Williams, P. (2005), "Breakfast and the diets of Australian adults: an analysis of data from the 1995 National Nutrition Survey", *International Journal of Food Sciences and Nutrition*, Vol. 56 No. 1, pp. 65-79.
- Williams, P. (2007), "Breakfast and the diets of Australian children and adolescents: an analysis of data from the 1995 National Nutrition Survey", *International Journal of Food Sciences and Nutrition*, Vol. 58 No. 3, pp. 201-216.
- Wong, C. (2007), "Predicting breakfast eating habits: application of the theory of planned behaviour and investigation of the effects of past behaviour and executive function", unpublished honours thesis, University of Sydney, Sydney.
- Wong, C.L. and Mullan, B. (2009), "Predicting breakfast consumption: an application of the theory of planned behaviour and the investigation of past behaviour and executive function", *British Journal of Health Psychology*, Vol. 14 No. 3, pp. 489-504.
- Yang, R.-J., Wang, E., Hsieh, Y.-S. and Chen, M.-Y. (2006), "Irregular breakfast eating and health status among adolescents in Taiwan", *BMC Public Health*, Vol. 6 No. 1, p. 295.

About the authors

Barbara Mullan is Senior Lecturer at the School of Psychology at the University of Sydney, and is a Chartered Psychologist with the British Psychological Society and a Health Psychologist registered with the Health Professions Council. She coordinates the Masters of Applied Science (Health Psychology) at the School of Psychology at the University of Sydney. Barbara Mullan is the corresponding author and can be contacted at: barbara@psych.usyd.edu.au

Cara Wong completed her Bachelor of Science (Honours) at the University of Sydney, and is currently completing her PhD studies in the School of Psychology in Cognitive Neuroscience at the University of Sydney.

Emily Kothe completed her Bachelor of Arts (Honours) at the University of Sydney, and is currently completing her PhD studies in Health Psychology in the School of Psychology at the University of Sydney.

Carolyn Maccann is a Lecturer at the School of Psychology at the University of Sydney. Her research interests include personality, methods of assessment, health and wellness and attitude assessment.