A Review of the use of the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Trans-Theoretical Model (TTM) to study and predict health related behaviour change

Professor David Taylor, Professor Michael Bury, Dr Natasha Campling,

Dr Sarah Carter, Dr Sara Garfied, Dr Jenny Newbould, Dr Tim Rennie

The School of Pharmacy
University of London

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Correspondence to:

Professor David Taylor
The Department of Practice and Policy
The School of Pharmacy, University of London
London WC1N 1AX
David.Taylor@Pharmacy.ac.uk

The National Institute for Health and Clinical Excellence (NICE) has been asked by the Department of Health to develop guidance on *'the most appropriate means of generic and specific intervention to support attitude and behaviour change at population and community levels'.* This review, undertaken by The School of Pharmacy, University of London, was, with five others, commissioned by NICE to support the preparation of its response to this request.

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1. The Health Belief Model

The Health Belief Model presented in Figure 1 is an updated version of the original schema, primarily based on Rosenstock et al (1994). The HBM is a health specific social cognition model (Ajzen 1998), the key components and constructs (that is, complex theoretical components) of which are:

- **Perceived susceptibility.** The subjective perception of the risk the individual is at from a state or condition.
- **Perceived severity.** Subjective evaluation of the seriousness of the consequences associated with the state or condition.
- **Perceived threat, the product/sum of severity and susceptibility.** This combined quantum might be seen as indicative of the level of motivation an individual has to act to avoid a particular outcome.
- **Perceived benefits.** The subjectively understood positive benefits of taking a health action to offset a perceived threat. This perception will be influenced not only by specific proximal factors, but an individual's overall 'health motivation'.
- **Perceived barriers.** The perceived negatively valued aspects of taking the action, or overcoming anticipated barriers to taking it.
- **Self-efficacy.** This component has been added to the HBM on many occasions since the late 1970s, when Bandura first introduced this concept of act or task specific self confidence, i.e. belief in one's ability to execute a given behaviour (Bandura 1977 – see chronology in Table 1).
- **Expectations, which are the product/sum of perceived benefits, barriers and self-efficacy.** This may be seen as indicative of the extent to which the individual will try to take a given action (Smedslund 2000)
- **Cues to action.** Reminders or prompts to take actions consistent with an intention, ranging from advertising to personal communications from health professionals, family members and/or peers.
- **Demographic and socio-economic variables.** These may include age, race, ethnicity (cultural identity), education and income.

Figure 1. The Components of the Health Belief Model

(HERE)

1.1 *Social, economic and environmental factor integration*

Applied in a systematic way the full set of model components described above (to which may on occasions be added a general health perception variable) would have the potential to provide a relatively comprehensive understanding of the influence of social, economic and environmental factors on health behaviours, in addition to that of cognitive factors contained in the psycho-social equation at the heart of the HBM. However, the use of this model has in practice focused largely on measurements and analyses of susceptibility, severity, benefit and barrier perception components alone. (See, for example, Chen and Land 1990, Yarbrough and Braden 2001 **2-B,** Crepaz and Marks

2002, Harrison et al 1992 **2-B,** Zimmerman and Vernberg 1994 **2+B).**

The research literature analysed during this review did not provide evidence that applications of the HBM have enabled the influence of social, economic or other environmental factors (including variables such as low income, exposure to racial prejudice, cultural exclusion, low health valuations as cultural norms or inconvenient service access arrangements) to be better understood by researchers, practitioners or policy makers. This conclusion is consistent with that of commentators such as Cochran and Mays (1993).

However, where factors such as socio-economic status have been analysed in studies employing the HBM the results reported suggest impacts of comparable significance to, or greater significance than, its cognitive components. Chen and Land (1990) observed this in the context of dental care uptake. This point is also well illustrated by the work of Yarbrough and Braden (2001 **2-B).** They conducted a systematic review of the utility of the Health Belief Model as a guide for predicting breast cancer screening behaviours. These authors concluded that the application of the model was inconsistent, and that at best it 'explained 47 per cent of the observed variance in screening behaviour when socio-economic status was included. Otherwise predictive power was low, ranging from 15 per cent to 27 per cent.'

1.2 *Areas of use*

Hochbaum was originally concerned with the uptake of TB screening opportunities provided via mobile X-ray units. In that context (in the early 1 950s, when new medicines for tuberculosis were becoming available) it was found that beliefs about susceptibility to the infection and the benefits of screening were strongly correlated with chest X-ray acceptance. Subsequent extensions of the model were associated with efforts to apply it in other contexts, including not only other forms of screening but also immunisation and compliance with medical treatment for conditions such as diabetes, renal failure and hypertension (Becker 1974, Rosenstock 1974, Janz and Becker 1984, Harrison et al 1992 **2-B).** It has more recently still been used in areas ranging from HIV prevention to weight control. But various studies have questioned the extent to which cognitions such as perceived threats are effective behavioural motivators. (See, for example, Abraham and Sheeran 1994). This concern may be particularly relevant in the contexts of child and adolescent behaviours (Baranowski et al 2003, Finfgeld et al 2003).

1.3 *Effectiveness in predicting and efecting behavioural change*

The available evidence indicates that the HBM has only a weak predictive power in most areas of health related behaviour. This is in part a result of poor construct definition, a lack of combinatorial rules and weaknesses in the predictive validity of the HBM's core psychological components (Armitage and Conner 2000). Harrison et al (1992 **2-B)** conducted a meta-analysis of studies using the Health Belief Model in adult populations, aimed at quantifying the independent relationships between each of its four main components and the reported health behaviours. They found weak effect sizes, accounting for between 0.1 and 9 per cent of variance. These authors were not able to include other elements of the model because of the lack of studies incorporating them, and concluded that 'the weak effect sizes and lack of (study and construct) homogeneity indicate that it is premature to draw conclusions about the predictive validity of the HBM as operationalised'.

Zimmerman and Vernberg conducted a critical comparative meta-analysis of models of preventive health behaviour (1994 **2+B).** This quality rated and included a total of 60 studies overall. Of these 30 (50 per cent) were HBM studies. They found that that the Theory of Reasoned Action (see below) was a substantially better predictor of health behaviours than the HBM. The TRA was able to explain just over 34 per cent of observed health behavioural variance, as compared to 24 per cent in the case of the HBM. The authors concluded that the HBM is in essence a list of variables rather than a theory based on adequately specified relationships between its core components.

1.4 *Impact on health outcomes*

This review identified no evidence indicative of the extent to which the use of HBM based interventions has contributed positively to improved health outcomes in the United Kingdom. See discussion relating to this research question below[1].

1.5 *Overall model evaluation and summary evidence statement*

The development of the Health Belief Model was of pioneering significance in the early 1950s. Systematic analyses using the full range of components that it today incorporates might cast light on the impact of social and other factors associated with inequalities in health, and the reasons why individuals and groups may not take up health improvement or protection opportunities. However, the HBM is not in itself clearly or adequately specified, and the available evidence indicates that in practice its application appears to be inadequate for such purposes. Further, although the HBM may be used to derive information that may then prompt interventions designed to change health beliefs and behaviours, using the model itself cannot inform decision making as to how such interventions might best be structured.

The value of the 'perceived threat' element serving as a central indicator of behavioural motivation in the HBM has been questioned. So has the phenomenological orientation of its design. Notwithstanding components like perceived barriers and demographic and socio-economic descriptors, as normally applied this model may be taken implicitly to assume that people are rational actors, driven by their conscious perceptions of the world. This may misleadingly suggest that health behaviours can always best be understood as being under volitional control, rather than in a large part determined by combinations of circumstantial reality and individuals' habitual, emotional, unconscious and/or otherwise non-rational reactions to the external world. The research identified provides evidence that the overall explanatory power of the HBM is limited, even simply as compared to that of alternative social cognition models such as the TRA.

Evidence statement

The HBM is characterised by a lack of adequate combinatorial rules and inconsistent application (Armitage and Conner 2000, Yarbrough and Braden 2001 2-B). Its main components have weak effect sizes, and its predictive capacity is limited as compared to that of other social cognition models (Harrison et al 1992 2-B, Zimmerman and Vernberg 1994 2+B).

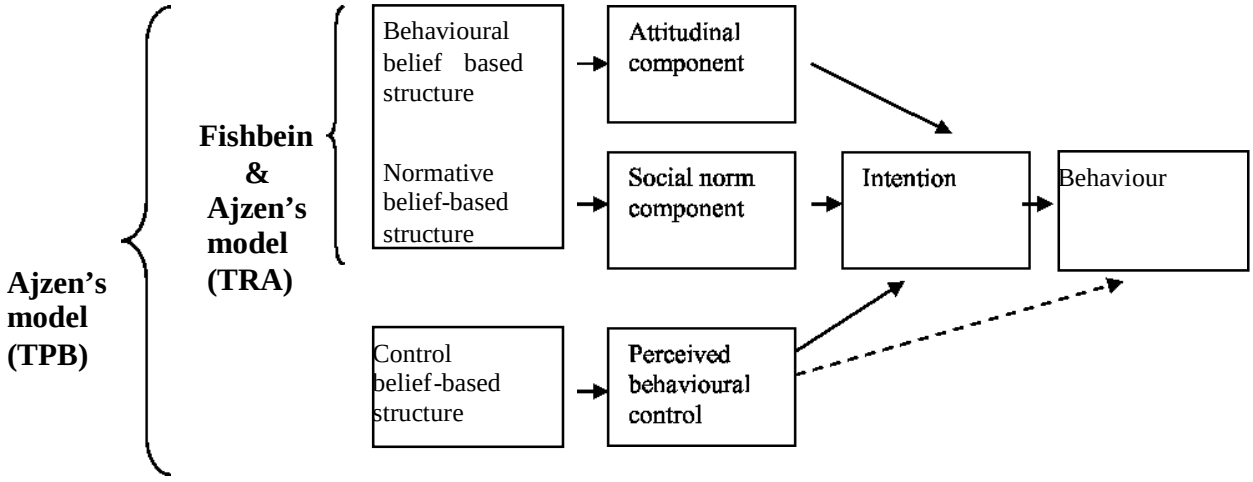
1 This conclusion does not, of course, constitute evidence that the use of the HBM or sets of its components has not on occasions enabled individuals or groups to design and deliver health promotion contributions that have effectively changed health related behaviours. Individual intervention evaluations are required to demonstrate this, although it is unlikely that in such circumstances outcomes could meaningfully be attached to the use of the HBM *per se.* Similar points apply in relation to other models discussed in this review.

2. The Theory of Reasoned Action (TRA) and The Theory Planned Behaviour (TPB)

The historical development of these two closely associated theories was such that they are best described here together, rather than sequentially. The Theory of Reasoned Action was formulated towards the end of the 1 960s, and in some respects may be seen as refining and taking forward approaches embodied in the HBM. At that time psychologists were concluding that attitudes (at least in the form of uni-dimensional phenomena) have very limited validity as predictors of future behaviour (Wicker 1969, Fishbein and Ajzen 1975). As expressed in its final form, the TRA (see Figure 2) combines two sets of belief variables, described under the headings of 'behavioural attitudes' and 'the subjective norm'.

The Theory of Planned Behaviour built further on this framework. Its design and dissemination followed Bandura's work on self-efficacy and the publication of his Social Cognitive Theory in 1986 (Ajzen 1985, 1988). It is differentiated from the TRA, as Figure 2 shows, by the additional dimension of perceived behavioural control.

Figure 2. The Theory of Reasoned Action and the Theory of Planned Behaviour



Both the TRA and the TPB assume that the immediate cognitive precursors to behaviours are not attitudes but behavioural intentions. These are in essence defined as complex amalgams of prior beliefs. Hence the shared components of the TRA and the TPB are:

- **Behavioural beliefs,** salient to a) the likelihood that an action might promote or negate a given outcome and b) evaluating outcomes achieved or avoided, in terms of their desirable and negative consequences.

- **Behavioural attitudes,** defined as the multiplicative sum of the individual's relevant likelihood and evaluation/severity related behavioural beliefs. However such attitudes may also be independently measured.

- **Normative beliefs,** including a) referent beliefs about what behaviours others expect and b) the degree to which the individual wants to comply with others' expectations.

- **Subjective norms,** which (like behavioural attitudes) are defined as the

multiplicative sum of the two sets of normative beliefs, although these may also be independently assessed.

- **Behavioural intentions,** derived from the combination of the behavioural attitude and the subjective norm. Intents rather than attitudes are, as noted above, regarded as the main proximal cognitive precursors to acting.

In the case of the TPB, behavioural intentions and behaviours are also taken to be functions of:

- **Control beliefs,** salient to the individual's perceptions of a) the external factors inhibiting or facilitating an action and b) self-efficacy, the individual's internal, behaviour specific, executional self confidence.

- **Perceived Behavioural Control,** defined as the product of the control beliefs and self-efficacy. PBC is seen as acting as a determinant of intentions alongside subjective norms and behavioural attitude, and also as a direct influence on behaviour additional to intention.

Like the HBM, the TRA and the TPB are both value-expectancy theory based models. Although they lack the threat concept normally seen as central to the HBM, their constructs in part reflect the perceived susceptibility/severity and benefits/barriers balances incorporated in the latter. Ajzen (1998) has pointed out that the TRA and TPB are both mathematically and structurally better specified than, and framed at a higher level of generalisation than, the HBM. But he has also commented that the TRA was developed to promote understanding of volitional behaviours, rather than those in large part determined by situational factors outside the control of the subject. The extent to which the additional of the PBC construct to the TPB in fact corrects this limitation is a critically important issue.

2.1 *Social, economic and environmental factor integration*

The Theory of Reasoned Action has been criticised because it is said to ignore the social nature of human action. (See, for example, Kippax and Crawford 1993). Behavioural and normative beliefs are derived from individuals' perceptions of the social world they inhabit, and are hence likely to reflect the ways in which economic or other external factors shape behavioural choices. Yet there is a compelling logical case to the effect that the model is inherently biased towards individualistic, rationalistic, interpretations of human behaviour. Its focus on subjective perception does not necessarily permit it to take meaningful account of social realities.

Proponents of the TRA might reasonably respond that it was designed to elucidate cognitive rather than other variables, and that its authors did not purport to be offering a comprehensive understanding of the social and economic determinants of health behaviour. Rather, its focus is on identifying patterns of belief and attitude which if changed could help individuals respond more effectively to their objective situations, through where possible taking rational advantage of available health protection and improvement opportunities.

However, the acceptance by Ajzen of the need to include PBC within the TPB model can be regarded as an acknowledgement on his part that the TRA was by itself unable adequately to predict health related behaviours, especially in fields characterised by low levels of volitional control. The PBC construct introduces into the TPB model self-efficacy, which may in part be determined by social positioning. It might also further facilitate the inclusion of perceptions of external influences such as, say, economic barriers to service access or discriminatory racial attitudes amongst service providers or other users.

But individuals' beliefs about such issues are again unlikely to reflect entirely accurately the

potentially observable social facts. Thus although a constructive use of the TRA and TPB in research and/or public health intervention programmes might well contribute valuably to understanding issues related to health inequalities and the roles that, say, ethnicity related or other environmental factors have in determining health behaviours and outcomes, neither the TRA nor the TPB are specifically structured for this purpose.

2.2 *Areas of use*

The general theoretical frameworks of the TRA and the TPB have allowed them to be very widely used in the retrospective analysis of health behaviours (Kashima and Gallois 1993) and to a lesser extent in predictive investigations and the design of health interventions (Hardeman et al 2002 **2-A).** Examples of their use could be taken from any area of health promotion relating to health behaviour change. But in the current English and other UK policy environments the most relevant areas of application include:

- exercise intentions and behaviours (Ajzen and Driver 1991, Godin 1993, Blue 1995 **2-B,** Hausenblas et al 1997 **2-B,** Hagger et al 2002 **2-B,** Downs and Hausenblas 2005 **2-B);**

- weight gain prevention and eating behaviour (Godin and Kok 1996 **2-B,** Baranowski et al 2003);

- addiction related behaviours such as smoking and alcohol abuse (Godin and Kok 1996 **2-B);** and

- HIV prevention and condom use (Sheeran and Taylor 1999 **2-A,** Albarracin et al 2001 **2-B).**

Other areas of use identified during this review include blood donation (Ferguson 1996 **2-A,** which is for the purposes of this analysis is regarded as a health behaviour) and also oral hygiene, clinical screening, and driving behaviours. The use of the TRA and even more so the TPB appears to have been more extensive than that of the HBM and also less strongly focused on the issue of tobacco addiction than that of the Trans-Theoretical Model.

2.3 *Effectiveness in predicting and efecting behavioural change*

There has recently been extensive debate on issues such as whether or not the TPB should be further extended to include additional components. (See, for example, Abraham et al 1998, Sutton 1998). Problems relating to the statistical interpretation and analytical as opposed to synthetic status of the findings that the TRA and TPB generate have also been raised (French and Hankins 2003, Ogden 2003, Ajzen and Fishbein 2004). There has also been a robust consideration of topics like the extent to which the PBC construct is essentially the same as, or should be seen as strengthening or weakening the application of, Bandura's self-efficacy concept (Ajzen 2002).

But for the immediate purposes of this review the key observation to make is that there is a large volume of research indicating that both the Theory of Reasoned Action and the Theory of Planned Behaviour have utility in predicting health behaviours, and that observed statistical relationships between their internal constructs based on behavioural, normative and control beliefs have significance across a wide range of contexts (Armitage and Christian 2003).

For example, Hausenblas et al (1997 **2-B)** investigated via a meta-analysis the application of the TRA and TPB in the context of exercise behaviour. These authors found strong general support for the validity of both theories. Hausenblas et al reported large effect sizes for the relationships between intention and exercise behaviour, attitude and intention, attitude and

exercise behaviour, PBC and intention and PBC and exercise behaviour. By contrast, the correlations they found between the subjective norm and intention and behaviour were respectively moderate and zero. The authors interpreted this as providing an accurate insight into the nature of exercise motivation. They concluded that the TPB has greater explanatory power in relation to sports and allied behaviours than the TRA.

Similar conclusions have been reported by Blue (1995 **2-B)** and Hagger et al (2002 **2-B).** For example, the meta-analysis by Hagger and his colleagues reported that TRA model constructs explained 37 per cent of variance in exercise intentions and 26 per cent of behavioural variance. With the addition of self-efficacy, the TPB model accounted for 50 per cent of intentional variance and 29 per cent of the variance in behaviour. Attitudinal differences were again found to be the dominant factor in influencing intentionality. These figures broadly correspond with Godin and Kok's (1996 **2-B)** earlier systematic review finding that in the exercise context the TPB could account for 42 per cent of the variance in intentions and 36 per cent of the variance in behaviour.

Taking all eight of the fields this last study covered together (addictive behaviours, clinical screening, driving behaviours, eating, exercising, HI V/AIDS and oral hygiene, with results drawn from a total of 56 studies), the overall proportion of variance in intention predicted by the PBC was 41 per cent. The equivalent average figure for reported behavioural variance was 34 per cent. The reported behaviour specific statistics ranged from just over 15 per cent in the case of clinical interventions and screening uptake to 42 per cent in the case of HIV/AIDS prevention related behaviours such as condom use.

Finally in this context, Downs and Housenblas (2005 **2-B)** emphasise the importance of detailed belief elicitation studies in the context of using the TPB to understand cognitive aspects of exercise. Their systematic review covered 47 studies conducted over a period of 22 years. They reported that the most salient behavioural belief is that exercise improves physical and psychological health; that family members have the strongest normative influence on exercise; and that beliefs about physical limitations have the most important control effects. Overall belief variations accounted for between 34 and 56 per cent of the reported variances in attitudes, subjective norms and perceived behavioural control. These authors also commented that most studies failed to report demographic variables. This makes it impossible directly to compare and contrast their findings on cognitive and behavioural variations in this context with other data on the social and economic determinants of exercise and health behaviour.

Two meta-analyses have examined the predictive power of the TRA and the TPB in relation to condom use. Sheeran and Taylor (1999 **2-A)** found that while the HBM variables had small (weighted average correlation) associations with condom use, the TRA and TPB had medium to strong correlations. Attitudes and subjective norms were more strongly predictive than the PBC. But the authors noted that its inclusion in the TPB enhanced its predictive power. They interpreted their findings as showing that in the HIV prevention context beliefs about condom use *per se* are more important motivational factors than beliefs about HIV. They also noted the additional importance of sexual partner norms and descriptive norms. That is, perceptions relating to the condom use patterns that partners are anticipated to require and that other community members are believed to be practicing.

Albarracin et al's (2001 **2-B)** meta-analysis came to a similar conclusion about the predictive power of both the TRA and the TPB in this context, and confirmed the significance of attitudes and behavioural norms as determinants of intention, and intention as a predictor of reported condom use (weighted mean correlation r = 0.45). Perceived behavioural control was observed to be a statistical determinant of intention, but was not found to be a significant contributor to actual condom use. However, in low risk populations and teenagers the TRA/TPB models did not fit well. The authors also questioned the validity of condom use

self reporting, and as with other studies referred to here expressed concerns relating to the homogeneity of the primary studies and associated effect heterogeneity. Like Sheeran and Taylor, they also raised questions regarding the extent to which past behaviour determines ongoing beliefs, intentions and behaviours.

Ferguson (1996 **2-A)** undertook a systematic review of the relative efficacy of theoretical models in predicting future behaviours in relation to blood donation. Although this covered a range of studies using varying constructs, he was able to conclude that intentions can be shown to account for a significant (19 per cent) proportion of the reported behavioural variance in this field. However, organisational factors relating to variables such as waiting times and other aspects of convenient service access and use accounted for a similar proportion of variance (17 per cent). Given the difficulties and uncertainties inherent in trying to change behaviour via modifying knowledge, beliefs, attitudes and intentions, this author argued that is likely to be easier (and more cost effective) to seek to moderate factors such as service organisation.

Finally, Armitage and Conner (2001 **2-A)** published a meta-analytic review aimed at providing a quantitative integration of research findings on the overall performance of the TPB and its main constructs, based on 185 studies covering a wide range of health and other fields. Its specific relevance to health may therefore be questioned. But in response it should be noted that one of the potential strengths of both the TRA and the TPB is that they are framed at a high level of generalisability – they are not health specific models (Ajzen 1998). It may also be argued that the level of contextual variance likely to be encountered within the health behaviour arena could be as great as that likely to be found between health and other behavioural fields.

Armitage and Conner calculated that in aggregate the TPB accounted for 39 per cent of variation in intentions, and 27 per cent of reported variation in behaviour. When behaviour measures were self reports the TPB accounted for 11 per cent more of the overall variance than when behaviours were externally observed. This implies an 'objective' figure of 21 per cent of behavioural variance explained. This is below Godin and Kok's (1996 **2-B)** reported aggregate figure of 36 per cent, which was not similarly adjusted. Armitage and Conner also found the subjective norm construct to be a relatively weak behavioural predictor, and discussed ways in which the TPB's predictive power might in future be enhanced.

2.4 *Impact on health outcomes*

As with the HBM model, this review has identified no evidence relating to the extent to which the use of TRA and TPB informed interventions has contributed to either improved or reduced health outcomes in the United Kingdom, over and above changes achievable via other theoretically or non-theoretically based interventions. This can in large part be explained by the fact that TRA and TPB based studies have mainly been aimed at predicting and understanding intentions and behaviours. As presently specified, neither the TRA nor the TPB address issues relating to how behavioural change goals can most effectively be pursued. Indeed, in as much as they rather serve as instruments that can only be used to generate information on the cognitive determinants of health behaviours, it is arguably incorrect to refer to any health behaviour change intervention as being TRA or TPB 'based'.

It follows logically from this that even though the available evidence indicates that use of the TPB model can normally explain a greater degree of behavioural variance associated with beliefs and cognitions than either the HBM or the TRA, this does not necessarily mean that interventions designed on TPB research based information will in practice out-perform other theory based or more pragmatically derived interventions. The health gains derived from HBC interventions will in any given context depend largely on the effectiveness of the behaviour change strategy or strategies employed.

To the extent that the TRA and TPB may, for instance, have biased some 'health educators' in the direction of seeking to change knowledge levels rather than other behavioural determinants, their employment could in some cases have been relatively unproductive. However, it is also important to note that in areas such as HIV/AIDS prevention there are also reasons to hope that the use of such social cognition models has been of positive value (Fishbein 1995, Abraham et al 1998, Fishbein 2000).

In 2002 Hardeman et al **(2-A)** undertook a systematic review of 30 published applications of the TPB in behaviour change interventions. These authors concluded that the TPB is relatively rarely used pro-actively to develop health promotion and other interventions. When reported, about two thirds of the interventions were effective in changing behaviours. But effect sizes were generally small and effectiveness was unrelated to the use of the theory to develop interventions. The authors called for more effort to be put in to comparing the utility of TPB based approaches with alternative models and interventions.

In response to these and allied concerns a number of researchers have suggested that the predictive power of the TPB could be further enhanced by the inclusion of additional factors aimed either at improving the prediction of intentions, or better understanding or supporting the translation of intentions into desired behaviours (Maddux 1993, Abraham et al 1998, Sutton 1998, Conner and Armitage 1998, Armitage and Conner 2000, Ajzen 2001, Hobbis and Sutton 2005). Illustrations of the types of possible modification identified include:

- **Applying the outcomes of research on moderating factors such as variations in the temporal stability of, and ambiguities in, beliefs and attitudes to increase the strength of intentions as predictors of behaviours.** Cooke and Sheeran (2004 **2-A)** conducted a meta-analysis offering substantive evidence that 7 identified factors act as moderators in the relationships between TPB constructs. This indicates that the predictive power of the TPB could be further improved, albeit at some cost to the model's parsimony.

- **Re-specifying the PBC construct to take into account additional moderators.** Notani (1998 **2-B)** published a meta-analysis indicating that the PBC may be strengthened as a behavioural predicator when operationalised as a global (i.e. overall) rather than plural belief based measure, and/or conceptualised to reflect control over factors internal to rather than external to the individual.

- **Using descriptive norms as predictors of intention.** Rivis and Sheeran (2003 **2-A)** undertook a meta-analysis that found that the additional use of descriptive norms (cognitions relating to how others actually behave) would increase the variance explained by intention by circa 5 per cent.

- **Promoting involvement in preparatory activities as a prelude to enabling individuals to successfully implement their expressed intentions** (Abraham et al 1998). Opportunities in this area may also stem from an improved understanding of self regulation skills and supports.

- **Applying Cognitive Behavioural Therapy based methods to support health related belief, attitude and behaviour change goals identified via TPB based approaches.** Hobbis and Sutton (2005) have suggested that, despite underlying differences between the TPB and the assumptions upon which CBT is based, the use of CBT in this way could enable people to experience 'mastery' of cognitive and subsequent behavioural change, and enable the productive application of TPB based insights in health behaviour change interventions.

This last proposal has engendered mixed reactions, in part because of its possible service

cost implications (Baranowski 2005, Conner 2005, Fishbein and Ajzen 2005). But as with the concept above on preparatory behaviours its potential significance relates to operationalising TPB health interventions, and facilitating the model's development in a direction parallel to that of the TTM. If this proposal were taken forward in an appropriately structured way it would be possible to compare the cost effectiveness of TTM as opposed to TPB based HBC interventions in meaningful ways, relevant to health outcome oriented measures of their impacts.

2.5 *Overall model evaluation and summary evidence statement*

There is systematic and meta-analytical evidence that in relation to changes in health behaviour the predictive performance of both the TRA and the TPB is in most superior to that of the HBM. Further, there is also evidence that the additional components/constructs contained in the TPB normally allow it to predict a greater percentage of behavioural variance than the TRA. The available evidence indicates that, as it is presently specified, the use of the TPB can in countries such as the UK and the US typically account for between 20 and 30 per cent of the observed variance in adult (although not child or adolescent and young adult) health behaviours (Godin and Kok 1996 **2-B,** Armitage and Conner 2001 **2-A,** Hagger et al 2002 **2-B,** Sutton 1998). Its capacity to predict behavioural intention is higher.

However, there is also evidence derived from both narrative and systematic reviews regarding the limitations of the TPB as a social as distinct from a cognitive theory, and its applications in practice (Hardeman et al 2002 **2-A).** While the potential significance being able to explain in the order of 20 per cent of the observed variance in health behaviours should not be under-estimated, neither should the potential benefits of being able to understand and act to complement or offset the remaining 80 per cent be ignored.

In itself the TPB cannot be used to answer questions relating to how beliefs and attitudes underpinning behavioural intentions can most cost effectively be changed, or what health promotion strategies are likely to prove most productive in health gain terms. The effect size measures normally quoted to indicate the efficacy of social cognition based models of health behaviour have no direct relevance to their possible public health impacts. To the extent that long-standing health inequalities are functions of factors such as material and other socio-cultural differences between and within communities, interventions based mainly on changing individual cognitions are unlikely to eliminate them. Indeed, they may even exacerbate them. This indicates that further developments in models such as the TPB, aimed at enhancing the latter's power to predict health behaviours and also help individuals and groups to achieve desired changes in their daily lives, would be a logical step forward.

Evidence statement

There is evidence that the Theory of Reasoned Action and the Theory of Planned Behaviour can both be used to predict health related behaviour with greater effect than the Health Belief Model (Zimmerman and Vernberg 1994 2+B). There is also evidence that the predictive power of the TPB exceeds that of the TRA (Hausenblas et al 1997 2-B). Across a wide range of health behaviours the TPB can explain 20 per cent or more of observed behavioural variance (Godin and Kok 1996 2-B, Armitage and Conner 2001 2-A, Sheeran and Taylor 1999 2-A, Albarracin et al 2001 2-B, Ajzen and Driver 1991, Godin 1993, Blue 1995 2-B, Hagger et al 2002 2-B, Downs and Hausenblas 2005 2-B). However, there is also evidence that TPB based research is infrequently used directly to inform behavioural change interventions, and when this has been the case the additional health benefits gained appear to have been relatively limited (Hardeman et al 2002 2-A).

3. The Trans-Theoretical Model of Health Behaviour Change

The Trans-Theoretical Model was developed by Prochaska and DiClemente at the start of the 1980s. As with the HBM, the TRA and the TPB it in part builds on concepts pioneered by Lewin. But the TTM's roots are also closely linked to the desire of its originators to integrate and enhance the effectiveness of psycho-therapeutically oriented efforts to address and reduce the harm caused by tobacco smoking (Burkholder and Nigg 2002). In order to link together concepts drawn from a variety of theories it uses a temporal dimension, the stages of change (SoC) construct, as a basic framework around which other model components relating to the promotion of behavioural change (that is, the processes of change components) and its monitoring and support are located (Prochaska et al 1994, Prochaska and Velicer 1997, Velicer et al 1998).

FIGURE 3 The Trans-Theoretical Model of health behaviour change

(HERE)

The TTM therefore differs significantly from the other models considered in this review. This is because it is designed to be of direct value in the delivery of desired behavioural change in individuals and populations. Nevertheless, some of the elements it includes are similar or identical to those utilised in other social cognition based models of health behaviour change (Noar and Zimmerman 2005). The precise format of the TTM and its central stages of change construct has varied over time. But the main components of the model described diagrammatically in Figure 3 above are:

- **The five (or six) stages of change (SoC).** These are ***pre-contemplation*** (in which the individual has no intention of changing his or her behaviour in the foreseeable future); ***contemplation,*** in which the individual is considering changing his or her behaviour in the next six months; ***preparation,*** in which change is planned within the coming month; ***action,*** in which stage the individual has made the behaviour change within the last six months; and ***maintenance,*** in which the health behaviour has been sustained for at least six months. A final stage, ***termination,*** is included in some versions of the TTM. In this stage the new behaviour is seen as being fully established, after a period of five or more years. The progress of individuals between stages is not seen as linear, but as 'a spiral staircase' upon which subjects may on occasions 'jump' either up or down.

- **The ten processes of change.** These are sub-divided into experiential and behavioural processes, which the model indicates are of varying significance at different stage transitions (Adams and White 2003). The processes seen as most significant at the time of the pre-contemplation/contemplation shift are ***consciousness raising*** (creating new awareness of a problem), ***dramatic relief*** (emotional expression and affective change) and ***environment re-evaluation*** (consideration of the problem in the context of the individual's social and physical world). The move from contemplation to preparation is considered to involve ***self re-evaluation,*** defined as the intellectual and emotional acceptance of changed values. At the preparation/action interface ***social*** and ***self liberation*** are believed to be key drivers. These processes involve heightening awareness of alternative lifestyles that negate the problem, and developing a strengthened personal sense of commitment and ability to change. At the action through to maintenance stage the main behavioural processes involved are ***counter-conditioning*** (adopting alternative

behaviours, like chewing gum instead of smoking) forming ***helping relationships,*** and ***reinforcement management*** and ***stimulus control.*** These relate to behavioural conditioning, and the reward of desired actions and the avoidance of cues associated with unwanted habits.

- **Decisional balance.** This component is derived from the work of Janis and Mann (1977), who researched the ways in which people weigh the costs and benefits and identified two sets of four positive and four negative variables. Thus the decisional balance schema incorporated in the TTM differs from that in the HBM and TRA/TPB. Yet all these models share the concept of an implicitly innate psychological cost/benefit mechanism that is important in driving and/or directing (health) behaviour.

- **Self-efficacy relating to the desired behavioural change.** This construct is now also incorporated in both the HBM and the TPB. Within the TTM framework of analysis self-efficacy is predicted to rise as individuals move towards the action and maintenance stages.

- **Temptation.** This component is not mentioned in all descriptions of the TTM. It reflects the intensity of urges to engage in the undesired behaviour, and may thus be a function of both physical addiction and social conditioning. Such urges may also become apparent when an individual is stressed and/or distressed. Temptation frequency and strength is predicted to fall as self-efficacy rises.

In the application of the TTM model measures of decisional balance, self-efficacy and temptation can be used both as population descriptors and as individual care or case management instruments. They are employed to monitor progress and identify and manage crises. However, as with the HBM many studies and programmes appear to use only a truncated form of the TTM, and there is a large degree of heterogeneity in its application within and across disparate health fields. (See, for example, Spencer et al 2002 **2+A,** Whitelaw et al 2000, van Sluijs et al 2004 **2++B).** Failures to define adequately stages and behavioural change goals may on occasions account for apparent limitations in the effectiveness of TTM based interventions. (Similarly, in the case of the TRA or the TPB a lack of correspondence or compatibility between a measured intention – the behavioural predictor – and the observed behaviour may similarly account for a lack of model efficacy, as measured in terms of its capacity to explain variances - Sutton 1998).

To the extent that the TTM has been widely used in interventional programmes aimed at changing health behaviour and health outcomes (rather than simply to provide a framework for identifying correlates which may or may not be indicative of causal relationships), the body of evidence relating to its effectiveness is substantively different from that available in the contexts of the HBM, the TRA and the TPB. This difference has arguably allowed the TTM and TTM based interventions to be subject to testing in a manner that the other social cognition models of health behaviour change considered in this report have not been, and perhaps cannot be (Ogden 2003). The TTM has, in part because of its widespread popularity amongst health education and promotion practitioners (Whitelaw at al 2000, Jones and Donovan 2004), attracted criticism from a number of psychologists (Bridle 2005, Davidson 1998, West 2005a).

In addition to concerns about its ability to integrate social and economic factors, a central focus of such concern has been on the validity of the stages of change (SoC) construct in relation to smoking cessation and changing other (addictive and non-addictive) behaviours, such as dietary habits and exercise patterns (Adams and White 2003 **2-A,** Adams and White 2005, Bridle et al 2002 **1++A,** Brug et al 2005, Buxton et al 1996, Etter 2005, Hodgins 2005, Horwarth 1999, Rosen 2000 **2-B,** Sutton 2005, West 2005b, West & Hardy 2006,

Whitelaw et al 2000). Rosen (2000 **2-B)** in his meta-analysis on the sequencing of change processes by stage, found that stage assignment explained only 11 per cent of the reported variance in use of cognitive affective (experiential) processes and 14 per cent of the variance in behavioural processes. The use of cross-sectional as opposed to longitudinal research based data has been criticised as being meaningless in relation to demonstrating the validity of the TTM's SoC hypotheses. The statistical integrity of some of the key studies used in the TTM's formulation has also been questioned (Bridle et al 2005 **1++A**).

Notwithstanding the availability of instruments such as University of Rhode Island Change Assessment Scale – URICA – there are additional concerns about TTM staging validity. There is narrative, systematic and meta-analytical review evidence (see below) indicating that TTM stages are in many instances unlikely to reflect cognitive realities. The processes of change/stages of change linkages specified in the model appear to be weak.

Davidson (1998) has pointed out that there are several other influential stage of change models in health related social and clinical psychology. For example, Kubler-Ross (1969) described five stages of change in emotional responses to terminal illness. These were denial, anger, bargaining, fear/depression and acceptance. In reality, not everyone goes through such stages. It would almost certainly be counter-productive for health professionals to assume they do. But Davidson suggests that for heuristic and didactic purposes the Kubler-Ross model is of value, provided that its limitations are understood and it is not rigidly applied.

Davidson's analysis suggests that this is also a reasonable way to approach a consideration of the TTM's utility. It could also inform the application of social cognition based HBC models more broadly (DiClemente 2005, Michie 2005, Littell and Girvin 2002 **2-B).** Ajzen and Fishbein have, for instance, agreed that for the TPB to be of practical value its findings need to be translatable into action. This logically implies a temporal relationship between cognitive re-adjustments and subsequent behavioural changes (Fishbein and Ajzen 2005). Nevertheless, assessments of the TTM should also take into account the possibility that it might be detrimental to health improvement if its use were to displace more effective approaches, or lead to a misleading acceptance of intermediate stage changes as (false) indicators of progress towards desired health outcomes.

3.1 *Social, economic and environmental factor integration*

As with other social cognition models the TTM does not normally include objective – defined here as external fact based – measures of health related social, economic and environmental variables. Although it could be used in conjunction with such measures, and so might be able to support action relevant to the reduction of health inequalities, it is not primarily designed to facilitate such approaches. The body of TTM research identified for the purposes of this review contains no evidence directly relevant to the social and economic determinants of individual or population health, or the ways in which such factors might impact on class (or other social/cultural position) related variations in cognition or health related behaviour.

3.2 *Areas of use*

As previously noted, the TTM was initially developed as a vehicle for understanding and actively promoting behaviour change in the context of tobacco smoking. The TTM literature remains in large part focused on this topic. In this review four of the relevant systematic and meta-analytical reviews identified were wholly or in part concerned with smoking cessation and prevention (Spencer et al 2002 **2+A,** Bridle et al 2002 **1++A,** Bridle et al 2003 **1-B,** van Sluijs et al 2004 **2++B).** The other principle areas covered in TTM studies identified during this review were:

- dietary change (Bridle et al 2002, 2005, **1++A,** van Sluijs et al 2004 **2++B);**

- exercise and activity promotion (Marshall and Biddle 2001 **2-A,** Bridle et al 2002, 2005, **1++A,** Adams and White 2003 **2-A,** van Sluijs et al 2004 **2++B);**
- sexually transmitted disease and pregnancy prevention (Horowitz 2003 **2-B);**
- breast cancer screening (Bridle et al 2002, 2005, **1++A);**
- alcohol use control (Bridle et al 2002, 2005 **1++A);** and
- treatment adherence (Bridle et al, 2002, 2005 **1++A).**

The TTM has in addition been employed in virtually all other health behaviour change fields.

3.3 *Effectiveness in predicting and efecting behavioural change*

With regard to smoking cessation, which in avoidable harm terms may still greatly outweigh the burdens being inflicted on the UK population by other behaviours that can realistically be regarded as subject to volitional control, the comparative evidence available as to the effectiveness of TTM based as opposed to alternative interventions is mixed. Spencer et al (2002 **2+A)** systematically reviewed a total of 148 published peer reviewed articles in this area. They reported on 54 validation studies, 73 population studies and 37 intervention studies. Spencer et al concluded that 'evidence for the validity of the TTM as it applies to tobacco use is strong and growing; however, it is not conclusive'. A majority of the stage-matched interventions assessed produced positive results, and were judged to be of better overall quality than those unsupportive of stage matched interventions.

Spencer et al also found that interventions tailored to a smoker's stage were more effective than non-tailored interventions in moving smokers forward to following stages. But as West (2005a, West & Sohal 2006) and others have stressed, forward stage movement should not be confused with successful cessation/behaviour change. To the extent that the TTM staging construct is of doubtful validity, its use in this context is potentially misleading. Spencer et al reported concerns about the staging construct and its measurement – 8 different staging mechanisms were identified in the literature they examined. They also stated that US population validated stage distributions may not apply in other countries or regions.

Bridle et al (2003 **1++A)** conducted a systematic review of 23 studies of stage-based interventions to promote smoking cessation. This study identified 11 trials that had compared stage-based and non-stage-based interventions, only one of which reported statistically significant effect in favour of the SoC intervention. They concluded that limited evidence exists for the effectiveness of stage-based interventions when compared with non-stage-based interventions, or no intervention.

This finding is similar to that previously reported by the same authors in relation to the effectiveness of stage-based interventions to promote individual behavioural change across a range of the health fields (Bridle et al 2002, 2005, **1++A).** Out of the 37 studies that this high quality systematic review included (of which 13 were focused on smoking cessation, and two did not permit comparisons of SoC versus non-SoC behavioural outcomes) 17 showed no significant differences between stage-based and non-stage-based interventions. Eight found mixed effects and 10 showed effects in favour of a stage-based approach. The authors concluded that there is little evidence that stage-based interventions are more effective that non-stage-based interventions, although at the same time their research does not reveal evidence of dis-benefit associated with the application of the TTM or allied models.

Further support for this conclusion is provided by a systematic review undertaken by van Sluijs et al (2004 **2++B)** in the Netherlands. In this research a total of 29 trials relating to life style primary care interventions were selected for inclusion. Of these 14 were aimed at

smoking cessation, 13 included interventions aimed at changing physical activity levels and five included a dietary intervention. Overall, they reported that limited or no evidence was found for an effect of stage-based interventions on either quit rates or further stage change, albeit that the quantitative analysis undertaken by these authors did indicate a small positive effect of stage-based interventions in primary care on smoking cessation rates. Van Sluijs et al concluded that the most effective approach to smoking cessation in primary care is (brief) personal advice from the physician, with subsequent *ad hoc* reinforcement and support. This is consistent with other evidence (Stead et al 2005).

In relation to physical activity van Sluijs et al (2004 **2++B)** found no evidence of an advantageous effect of stage-based interventions as against alternative approaches. This reflects the results reported by Bridle et al (2002, 2005 **1++A)** in this context. In that study one of the seven physical activity trials included lacked data on behavioural change. Of the remainder three trials reported no differences between SoC and alternative interventions. Two showed mixed effects. One reported outcomes favouring the SoC.

Adams and White (2003 **2-A)** undertook a systematic review of the effectiveness of 16 TTM based activity promotion interventions, and reported that 73 per cent of short-term (< 6 month) studies reported a positive effect of TTM studies over 'control conditions'. The equivalent long-term (> 6 months) proportion was 29 per cent. As have others, these authors commented on the heterogeneity of the research analysed, and the fact that several studies noted that at completion the majority of the subjects still involved included tended to be white, middle class and physically active. Subsequently, Adams and White (2005) commented that there is little evidence that individualised stage-based activity interventions are any more effective than (rationally designed) alternatives in promoting long term increases in physical activity levels. In their view the possible reasons for this relate to the complexity of exercise behaviour; the wide range of factors influencing it; inadequate staging; and the possibility that SoC base approaches encourage an unproductive focus on stage progression.

However, Marshall and Biddle (2001 **2-A)** undertook a meta-analysis of the application of the TTM to physical activity and exercise, based on 71 published reports. They by contrast concluded that there are sufficient data to confirm that stage membership is associated with not only different levels of activity, but also significant self-efficacy and decisional balance variances. Yet they too were unable to confirm whether or not physical activity changes can meaningfully be staged, or should rather be regarded as located on a continuum.

Similarly, Horowitz (2003 **2-B)** reviewed 9 intervention studies, 11 population studies and 12 validation studies relating to the use of the TTM in the context of unwanted pregnancy and sexually transmitted disease (including HI V/AIDS) prevention. He too concluded that self-efficacy and decisional balance constructs are related to stage change, and that his research demonstrated the internal consistency of the construct relationships within the TTM. This analysis included 9 stage-matched interventions. A majority (5) of these suggested a positive link between stage tailored interventions and outcomes. However, no firm conclusions about the effectiveness of TTM applications as against alternatives in terms of behavioural change achievement could be drawn.

With regard to dietary interventions, Bridle et al (2002, 2005 **1++A)** found that two of the five trials they analysed that were targeted at dietary change reported significant effects in favour of stage-based interventions. Of the remainder, two showed mixed effects. Similarly, van Sluijs et al (2004 **2++B)** reported relatively favourable outcomes resulting from stage-based primary care interventions in this context, with particular reference to dietary fat reduction. This was found at both in both the short and long-term contexts, although medium term (6 month data). The authors stated that, because of limitations in study sizes and numbers, their positive finding on the relative effectiveness of SoC based interventions

in promoting dietary change should be interpreted with caution.

The remaining studies included in the review undertaken by Bridle et al (2002, 2005, **1++A)** reported no significant findings concerning the relative efficacy of stage-ofchange based interventions in other preventive, or multiple dimension, life style change contexts. One of two studies aimed at increasing mammography uptake reported a significant difference in favour of a stage-based intervention, as did the one included trial on treatment adherence.

Taken in the round, the evidence presented here suggests that it is unlikely that TTM based interventions as currently commonly employed in health promotion have any marked advantages over alternative (appropriate) health improvement interventions. Given the centrality of Prochaska and DiClemente's stages of change construct to the TTM, this finding may be taken as supportive of Littell and Girvin's (2002 **2-B)** conclusions. They systematically reviewed a total of 87 studies, with the objective of ascertaining the degree to which behavioural change stages can be shown to exist as discrete states with sequential transitions between them. They found that the assumption that there are common stages of change across a wide range of HBC fields (and/or in different populations) cannot be validated by the available empirical data. Nor, they reported, is there convincing evidence of discrete stages of change in relation to specific problem behaviours such as substance abuse or cigarette smoking.

Nevertheless, the evidence presented here should not be regarded as constituting any substantive degree of proof that TTM/SoC based interventions are less effective than alternatives of comparable scale and quality, including those based on findings derived from applications of findings derived from the TPB. It is also the case that none of the information gathered for this review provides a definitive answer to the question of whether or not the constructs contained in the TTM would in aggregate terms be likely (if appropriately employed) to be able to predict more or less HBC variance than those contained in alternatives such as the TPB.

3.4 *Impact on health outcomes*

The TTM has been extensively used in health behaviour change programmes in this country and elsewhere. Regardless of their relative efficacy, such programmes appear to have contributed to achieving intermediate health outcomes such as (for example) smoking cessation. The evidence available is also strongly supportive of the view that in the case of smoking cessation improved health outcomes will have in time resulted from such interventions, and that the average cost per quality adjusted life year (QALY) gained is likely to have been modest (Bridle et al 2003 **1-B).** The estimates of the latter reported by Bridle et al are in the order of £200 - £400 2.

Similar health gains could very probably have been achieved via the application of alternative health promotion techniques. Yet this should not be assumed without question. For example, to the extent that use of the TTM and/or the SoC construct it incorporates is of heuristic and motivational value to staff working in health promotion it may, for instance, have contributed positively to outcomes in ways which are difficult to quantify. Such possibilities need to be placed alongside speculation that the use of stage-of-change based approaches could have had detrimental effects. It is also unknown whether or not the use of the TTM/stages-ofchange model has increased or decreased gender, class or ethnicity related health inequalities due to variations in its relevance to differing social groups.

Innovative primary research would be needed to resolve such questions. Looking to the future, the Trans-Theoretical Model ought, its name suggests, be open to adaptation as new theoretical insights and additional information relevant to health behaviour emerge. For example, it might be modified to include more powerful measures of, say, physiological

addiction, social status and/or of relative or absolute economic deprivation. However, because the SoC construct central to the TTM is of questionable validity, some believe that it cannot be improved through the addition of further components (West 2005a, West 2005b, West and Hardy 2006a). Rather, they have called for its abandonment.

3.5 *Overall model evaluation and summary evidence statement*

Although the structure of the TTM is significantly more complex than that of the other models considered in this review, many authors have described it as a popular, intuitively plausible, model of health behaviour change. Its strengths lie in its capacity to integrate a wide range of information and serve as an instrument for the design and management of both individual and community or population level health behaviour change intervention programmes.

In some areas, such as dietary change, its application might have advantages over alternative approaches (van Sluijs et al 2004, **2++B).** Yet the TTM's critics believe that its potential has on occasions been seriously overstated, and that the use of stage change based targets as proxies for health gain can be counter-productive. There have hence been calls for its use to be curtailed in the UK. But commentators associated with the development of the TTM have argued that it should not be discarded in the absence of compelling evidence that practically superior alternatives exist (DiClemente 2005). In this context it would be relevant to consider the impact of any possible recommendation to the effect that the use of the TTM should be discouraged on the motivation and morale of health promotion specialists committed to the application of this model.

Evidence statement

The body of evidence relating to the internal validity of the TTM and the relative effectiveness of TTM based health behaviour change interventions is mixed. A number of substantive analyses have reported findings consistent with hypotheses underpinning the TTM (Marshall and Biddle 2001 2-A, Spencer et al 2002 2+A, Horowitz 2003 2-B). But the evidence available indicates that in behavioural outcome terms the application of TTM/SoC based approaches in areas such as smoking cessation and exercise promotion is no more likely to be effective in achieving desired outcomes than the use of alternative (rationally designed) interventions (Adams and White 2003 2-A, Bridle et al 2002, 1++A, Bridle et al 2003 1-B, Bridle et al 2005 1++A, van Sluijs et al 2004 2++B). The proposition that there are common consistently definable stages of change across a wide range of health behaviour fields and/or observable across many populations cannot be validated by the available empirical data (Littell and Girvin 2002 2-B, Bridle et al 2005 1+++A).