



Coulson, Neil S. and Ferguson, Melanie A. and Henshaw, Helen and Heffernan, Eithne (2016) Applying theories of health behaviour and change to hearing health research: time for a new approach. *International Journal of Audiology*, 55 (S3). S99-S104. ISSN 1708-8186

**Access from the University of Nottingham repository:**

<http://eprints.nottingham.ac.uk/39059/1/Applying%20theories%20of%20health%20behaviour%20and%20change%20to%20hearing%20health%20research%20Time%20for%20a%20new%20approach.pdf>

**Copyright and reuse:**

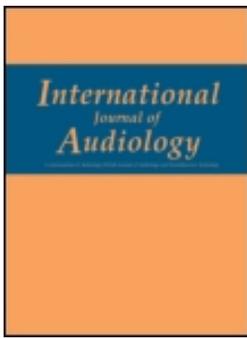
The Nottingham ePrints service makes this work by researchers of the University of Nottingham available open access under the following conditions.

This article is made available under the Creative Commons Attribution Non-commercial No Derivatives licence and may be reused according to the conditions of the licence. For more details see: <http://creativecommons.org/licenses/by-nc-nd/2.5/>

**A note on versions:**

The version presented here may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the repository url above for details on accessing the published version and note that access may require a subscription.

For more information, please contact [eprints@nottingham.ac.uk](mailto:eprints@nottingham.ac.uk)



## Applying theories of health behaviour and change to hearing health research: Time for a new approach

Neil S. Coulson, Melanie A. Ferguson, Helen Henshaw & Eithne Heffernan

To cite this article: Neil S. Coulson, Melanie A. Ferguson, Helen Henshaw & Eithne Heffernan (2016) Applying theories of health behaviour and change to hearing health research: Time for a new approach, International Journal of Audiology, 55:sup3, S99-S104, DOI: 10.3109/14992027.2016.1161851

To link to this article: <http://dx.doi.org/10.3109/14992027.2016.1161851>



© 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 03 May 2016.



Submit your article to this journal [↗](#)



Article views: 311



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 2 View citing articles [↗](#)

Review Article

# Applying theories of health behaviour and change to hearing health research: Time for a new approach

Neil S. Coulson<sup>1</sup>, Melanie A. Ferguson<sup>2</sup>, Helen Henshaw<sup>2</sup> & Eithne Heffernan<sup>2</sup>

<sup>1</sup>Division of Rehabilitation and Aging, School of Medicine, Queen's Medical Centre, University of Nottingham, Nottingham, UK and <sup>2</sup>National Institute of Health Research, Nottingham Hearing Biomedical Research Unit, Nottingham, UK



The British Society of Audiology



The International Society of Audiology



## Abstract

**Objective:** In recent years, there has been an increase in the application of behavioural models, such as social cognition models, to the promotion of hearing health. Despite this, there exists a well-developed body of literature that suggests such models may fail to consistently explain reliable amounts of variability in human behaviours. **Design:** This paper provides a summary of this research across selected models of health-related behaviour, outlining the current state of the evidence. **Results:** Recent work in the field of behaviour change is presented together with commentary on the design and reporting of behaviour change interventions. **Conclusions:** We propose that attempts to use unreliable models to explain and predict hearing health behaviours should now be replaced by work which integrates the latest in behaviour change science, such as the Behaviour Change Wheel and Theoretical Domains Framework.

**Key Words:** Audiology; behaviour change; hearing research; health belief model; theory of planned behaviour; trans-theoretical model

Health psychology, as a discipline, began to emerge in the late 1970s in the United States and concerns itself with the scientific study of psychological and behavioural processes in health, illness, and health care. Specifically, it focuses on understanding how psychological, behavioural, and socio-cultural factors may impact on physical health and illness. Health psychologists are ideally positioned to work with both the public and patients, whether that is on an individual one-to-one basis, group or community setting, or as part of a broader public health intervention. Additionally, there are considerable opportunities to work with other disciplines through the sharing of this body of knowledge generated through scientific research. Indeed, as a discipline, health psychology has contributed much to many other fields, including for example, medicine, nursing, public health, and dentistry.

We have witnessed a growing number of researchers within the field of audiology applying theories and models from health psychology to hearing, hearing loss, and the promotion of hearing health. The application and translation of such theories and models is undoubtedly a positive step forward and arguably will serve to benefit both disciplines. Audiology can benefit from the theoretical

developments witnessed within health psychology over the past four decades. Similarly, health psychologists can test theories and models in a new context. Indeed, the present supplement is testament to how far this synergy and cross-fertilization has progressed.

Nevertheless, for both disciplines to advance we must not simply accept the validity and utility of each and every model. Rather, we must critically reflect on their underlying assumptions, test theoretical predictions, and accrue a robust evidence base, and translate this knowledge into effective interventions (e.g. behaviour change). Furthermore, for these disciplines to be able to work together and learn from each other, we must also share a common language in our reporting of scientific research.

With these sentiments in mind, the aim of the present discussion paper is to briefly identify and critically discuss selected topical issues within the field of health psychology and to consider the implications for their application and translation to the hearing health context. These issues are concerned with: (1) models of health-related behaviour; (2) the design of behaviour change interventions; and (3) the development and adoption of a shared

Correspondence: Neil Coulson, Division of Rehabilitation and Aging, School of Medicine, Queen's Medical Centre, University of Nottingham, Nottingham, NG7 2UH, UK.  
E-mail: Neil.Coulson@nottingham.ac.uk

(Received 12 February 2016; revised 29 February 2016; accepted 1 March 2016)

ISSN 1499-2027 print/ISSN 1708-8186 online © 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.  
DOI: 10.3109/14992027.2016.1161851

**Abbreviations**

BCT	Behaviour change technique
BCW	Behaviour change wheel
HBM	Health belief model
TPB	Theory of planned behaviour;
TTM	Transtheoretical model

common language for the reporting of behaviour change interventions.

**Models of health-related behaviour**

By far, some of the most popular models used in the field of health psychology to understand and predict health-related behaviour are: Health Belief Model (Janz & Becker, 1984), Theory of Planned Behaviour (Ajzen, 1985), and the Trans-theoretical model (Prochaska & DiClemente, 1983), also known as the 'stages of change' model. Each of these models are distinct, multi-component, and have been applied across a range of health-related behaviours (e.g. condom use, exercise, healthy eating) and more recently within the audiology context (e.g. attendance at hearing screening, hearing aid use).

The extent to which such popular models have been able to predict changes in knowledge, attitudes and/or behaviour across health behaviours has varied widely (Taylor et al, 2006). There has been much written about the usefulness (or not) of these models, particularly in the past three decades. It is timely to reflect on the most popular models of health-related behaviour and carefully consider how we should be using them, if at all. The need to act on the latest in health behaviour research is of critical importance in our efforts to apply these models to hearing health. Thus, it is our intention to critically consider three of the most widely used models of health-related behaviour and to briefly consider the evidence base, key issues, and potential usefulness for hearing research in the future. Following this, we will present a brief overview of recent developments within the behaviour change field.

*Health Belief Model*

The Health Belief Model (HBM: Rosenstock, 1966) is a health-specific social cognition model (Ajzen, 1988) that was originally designed in response to the failure of a free tuberculosis (TB) health screening programme. In this context, it was revealed that beliefs held by individuals to susceptibility to the infection and the benefits of screening were strongly correlated with chest X-ray acceptance. From this, the model was applied to other screening activities as well as immunization and compliance with treatments for a range of conditions. In more recent times, it has been applied across a range of topics, including hearing health behaviours (Saunders et al, 2013).

The model consists of five constructs that include: (1) perceived susceptibility (i.e. the subjective perception of the risk of developing a health problem); (2) perceived severity (i.e. the subjective assessment of a health problem and its potential consequences); (3) perceived benefits (i.e. the perceived benefits of taking action to offset a perceived threat); (4) perceived barriers (i.e. the perceived barriers of taking action to offset a perceived threat); (5) Cues to action (i.e. cues that prompt an individual to take action). According to the model, people will be more motivated to engage in a healthy behaviour if they believe they are susceptible to a specific negative

health outcome. Furthermore, the stronger a person's perception of the severity of the negative health outcome, the greater the motivation will be to avoid it. In addition, the individual must consider that the target behaviour will confer strong positive benefits and that any barriers to this can be overcome. Finally, the model includes cues to action whereby the individual may be encouraged to act.

In the original formulation of the HBM, Rosenstock (1966) argued against applying the HBM to cross-sectional data. His reason being that in order for the relationship between the behaviour and the components of the model to have any meaning in the context of a cross-sectional design, it becomes necessary to assume that people's perceptions of these components have not changed since the behaviour was adopted. He argued that once an individual has engaged in a behaviour, their beliefs are likely to change to become consistent with the behaviour (i.e. cognitive dissonance theory). This hypothesis would then predict that cross-sectional datasets would yield inaccurately strong estimates of the relationship between the components and the behaviour. Conversely, Janz and Becker (1984) argued for the opposite, suggesting that some cross-sectional relationships would in fact be weaker. They put forward the argument that once an individual has started to engage in a health behaviour, they would then see themselves as being less at risk (i.e. less susceptible).

There have been several reviews of the HBM including that of Janz and Becker (1984) who reported that barriers, benefits, and susceptibility were good predictors of behaviour but severity was not. This review was not a meta-analysis but was a count of the number of times a component was predictive of the behaviour, as opposed to actually estimating mean effect sizes. In 1994, Zimmerman and Vernberg (1994) reported that the HBM was predictive of behaviour, but only weakly. Harrison et al (1992) undertook a meta-analysis and concluded that retrospective studies yielded markedly larger effect sizes than prospective studies. That said, there were a number of issues related to this latter review and therefore its conclusions must be noted with caution. Specifically, the criteria for inclusion in the review was very strict and therefore the effect sizes are based on the data obtained from only 3515 respondents.

More recently, a meta-analysis of the effectiveness of the HBM components to longitudinally predict behaviour has been conducted. Carpenter (2010) reported the findings of a review of 18 studies and noted that benefits and barriers were consistently the strongest predictors. On the other hand, the effect sizes were minimal for susceptibility and severity. Such findings therefore cast serious doubt on the utility of the four component model of the HBM, which has been the most commonly applied.

In summary, the evidence for the predictive capabilities of the HBM is arguably weak, particularly when considered in relation to other models (i.e. Theory of planned behaviour / Theory of reasoned action). There are likely to be a range of reasons that include (but not limited to), inadequate construct definition and measurement, lack of clarity with regards how the various components should be combined to predict behaviour, and weaknesses in the predictive validity of the HBM's key components (Armitage & Conner, 2000).

*Theory of Planned Behaviour*

The Theory of Planned Behaviour (TPB), an extension of the Theory of Reasoned Action (Fishbein & Ajzen, 1975), has accrued substantially more meta-analytical and systematic review evidence

concerning the predictive capabilities of its components, compared to the HBM. The TPB concerns itself with volitional behaviour that is said to be a function of the intention to perform the behaviour and perceived behavioural control. Intention is argued to be a function of attitudes towards the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1985). Ajzen proposes that the extent to which perceived behavioural control influences behaviour directly (as opposed to indirectly through intention) depends on the degree of actual control over the behaviour. Attitudes, subject norms, and perceived behavioural control are thought to be based on the strength and evaluation (i.e. expectancy  $\times$  value) of accessible behavioural, normative, and control beliefs.

This theory has generated a vast amount of empirical research that has examined a diverse range of health-related behaviours, including hearing health behaviours (Meister et al, 2014). The majority of published studies have adopted a correlational design in order to explore cross-sectional and prospective associations between the TPB components and behaviour (Noar & Zimmerman, 2005). In terms of experimental tests of the TPB, Hardeman et al (2002) concluded in a systematic review of 24 studies that there was insufficient evidence to comment on the utility of the theory. That said, experimental studies since then have found that changes in the cognitions specified by the TPB (i.e. attitudes, subjective norm, and perceived behavioural control) have not subsequently resulted in changes in behaviour (Chatzisarantis & Hagger, 2005; Sniehotta, 2009).

The TPB has attracted considerable criticism in recent years. Perhaps the most commonly cited issue concerning the TPB is in relation to its limited predictive validity. Specifically, the results of several meta-analytical reviews indicate that the majority of variability in behaviour is not in fact accounted for by measures of the TPB (e.g. Armitage & Conner, 2001). Furthermore, we have known for some time that many individuals who form an intention do not actually go on to act on that intention, and this issue continues to be problematic for the TPB. Other concerns levelled at the TPB include its focus on rational reasoning and its exclusion of unconscious influences on behaviour (Sheeran et al, 2013). Similarly, some authors have raised concerns as to whether the hypotheses derived from the TPB can be subject to empirical falsification, or whether they are common-sense statements that cannot be falsified (Ogden, 2003, 2014). As a consequence of these issues, Sniehotta et al (2014) have argued that it is in fact time to 'retire the TPB' (p. 1).

Sniehotta et al (2014) argue that whilst the cognitions specified by the TPB still have a role to play in the understanding, predicting, and changing of health-related behaviour, researchers (as well as the field more generally) would benefit from a broader theoretical approach and that we 'Do not need any more correlational studies of the TPB' (p.4). Rather, Sniehotta et al (2014) suggest that attention should be given to the development of alternative theoretical explanations of health behaviour and behaviour change. For example, action theories, which do not carry overly elaborate assumptions about cognitions but which can be easily tested experimentally (e.g. self-regulation theories; Hagger et al, 2010). Other alternative avenues may come from those approaches that include multiple goals and behaviours in theory (Presseau et al, 2013), or which integrate evidence from a range of theoretical approaches (Hagger & Chatzisarantis, 2014). In addition, other frameworks include dual process models, which assume that behaviour may be influenced by impulsive or reflective

determinants (Hofmann et al, 2008), or sequential models which assume that different processes are involved in motivation formation and the translation of this motivation into action (e.g. health action process approach; Schwarzer, 2008).

In summary, the TPB has arguably been an important and influential theory of health-related behaviour, however, considering the overall state of the literature, there are very serious problems which do not appear to have been addressed. We would support the conclusion of Sniehotta et al (2014), 'The longer we delay the retirement of the TPB, the longer we put off the discovery of a better explanation of health behaviour change' (p.5).

#### *Transtheoretical Model*

The Transtheoretical Model (TTM) is a model of intentional change that considers the decision-making capabilities of individuals and was the result of a systematic integration of multiple theories of psychotherapy, coupled with an analysis of the prominent theories of behaviour change (Prochaska & DiClemente, 1983). Within the model, there are at least fourteen individual components that have been categorized as follows: (1) stages of change (i.e. pre-contemplation, contemplation, preparation, action, and maintenance); (2) dependent variables (i.e. decisional balance, self-efficacy/situational temptation); and (3) independent variables (i.e. ten processes of change).

According to this model of behaviour change, individuals pass through a series of five stages in changing their behaviour. That is, *pre-contemplation*, where an individual is not thinking about engaging in the behaviour of interest, nor are they really aware of the health consequences of their actions. Next, is *contemplation*, where an individual is beginning to think about behaviour change but as yet they have not done so. The third stage is *preparation*, where an individual is starting to prepare for a change in their behaviour. It is not until an individual is consistently engaging in the behaviour of interest that they are considered as being in the *action* stage. Finally, an individual is said to be in the *maintenance* stage when this behaviour has been undertaken for at least six months.

Most work that has claimed to support the TTM has been based on cross-sectional studies that report differences in variables from a range of theoretical frameworks (e.g. decisional balance, self-efficacy), across the five stages of change (e.g. Armitage et al, 2003). However, many studies have raised serious concerns about the staging algorithm proposed. For example, Herzog and Blagg (2007) tested the stages of change algorithm in relation to several measures of motivation to quit smoking in a cross-sectional survey. They found that the staging algorithm underestimated motivation to quit smoking. Furthermore, concerns have been raised about the linear associations that have been found between stages of change and components of the model (e.g. decisional balance, self-efficacy). Sutton (2000), for example, is one of several authors who argue that such cross-sectional data revealing linear associations can only provide *limited* evidence in support of the stages of change construct. An example of this comes from a study of smokers by Armitage and Arden (2008b), which revealed that the stages of change and a measure of behavioural intention were highly correlated ( $r = .78$ ). Given the linear association between these two variables, it is not clear as to why we should have individuals classified into five stages of change as opposed to simply using their behavioural intention scores. According to Sutton (2000) it would be possible to have any number of 'stages' from a continuous measure of motivation by choosing any two points on the

behavioural intention continuum and cite support for any ‘stage’ model.

In terms of prospective or longitudinal studies which have examined whether social cognitive variables (e.g. decisional balance, self-efficacy) can predict the movement between the stages, the evidence does not prove compelling to say the least. In reviewing this body of literature, Armitage (2009) suggests that there appears to be an apparent ‘disjoint’ between the pre-contemplation, contemplation, and preparation stages on the one hand and the action and maintenance stages on the other. As a consequence, he considers whether an alternative theoretical framework would better fit a ‘two-staged’ model and draws attention to Gollwitzer (1993) and Heckhausen’s (1991) model of action phases, which suggests two phases in the performance of a behaviour (i.e. the motivational phase) that culminates in the formation of a behavioural intentions, and a volitional phase that is concerned with the translation of motivation into action.

In summary, whilst the TTM has been the focus of a considerable amount of research attention it has also received unprecedented levels of criticism, with some authors (e.g. West, 2005) arguing that we should abandon the model completely. The vast majority of this criticism has been levelled at the ‘stages of change’ construct within the model, arguing that these stages are in fact ‘pseudo stages’.

### Designing behaviour change interventions: A new approach

At the core of this new approach is a psychological model of human behaviour incorporating the psychological components associated with behaviour change, the COM-B model (Michie et al, 2011). This model posits that there are three inter-related components, namely: (1) capability (C), i.e. the physical (e.g. strength) and psychological skills (e.g. knowledge) needed to perform the behaviour (B); (2) opportunity (O), i.e. the physical and social environment are such that the person feels they are able to undertake the behaviour (B); and (3) motivation (M), i.e. the basic drives and automatic processes (e.g. habit and impulses) as well as reflective processes (e.g. intention and choice).

In combination they can provide the rationale for why the target behaviour is not engaged in, and this then identifies the appropriate components to be addressed to bring about a change in that behaviour. In this way all the components of the COM-B model are interdependent, and work in unison to help change a behaviour, or support the maintenance of a behaviour once an individual has adopted it into their regular pattern of behaviour. Each component of the COM-B model is divided into sub-components that are used to capture the more refined details of the COM-B components that are specific to the target behaviour.

The COM-B model has been developed within the context of a broader framework called the Behaviour Change Wheel (BCW) (Michie et al, 2011). The aim of this framework, grounded in evidence, is to assist those engaged in behaviour change interventions to move from a behavioural analysis of the problem to intervention design.

In addition to the BCW, behavioural experts have developed the theoretical domains framework (Cane et al, 2012), which was designed to assist in the implementation of behaviour change interventions. This framework is a cluster-based tool where the

**Table 1.** The COM-B model and its relation to the theoretical domains framework (adapted from Cane et al, 2012, p.15).

<i>COM-B component</i>		<i>TDF domain</i>
Capability	Psychological	Knowledge Skills Memory, attention, and decision processes Behavioural regulation
	Physical	Skills
Opportunity	Social	Social influences
	Physical	Environmental context and resources
Motivation	Reflective	Social/professional role & identity Beliefs about capabilities Optimism Beliefs about consequences Intentions Goals
		Automatic

behavioural domain that requires targeting is made clear (e.g. knowledge, skills, beliefs about their capabilities, and emotion) and fitted within the BCW (see Table 1). As such, the behaviour that needs to be modified can be described in terms of its individual features.

### Reporting behaviour change interventions

In order to advance our understanding of the development, implementation, and evaluation of behaviour change interventions, it is important that we are able to both understand and communicate explicitly our intervention content. As Michie et al (2015) argue, vague or poorly described interventions within both protocols and published manuscripts mean it is difficult to ascertain the specific content of interventions (i.e. ‘active ingredients’). Furthermore, they argue that even the same label (e.g. behavioural counselling) may be interpreted differently by different researchers. Whilst there has arguably been progress made at specifying and reporting interventions, such as CONSORT (Moher et al, 2003), TREND (Des Jarlais et al, 2004), and TIDieR (Hoffman et al, 2014), there remains a need to develop a shared and standardized method for classifying intervention content (Michie et al, 2011).

To address the challenge of describing and reporting the content of behaviour change interventions, Michie et al (2015) have recently reported on an ambitious suite of studies that have yielded a cross-domain, hierarchically structured and international agreed taxonomy of behaviour change techniques (BCTs). In their BCTv1, they have identified 93 distinct BCTs and provided clear definitions together with examples to be used in the specification of the ‘active ingredients’ of interventions. By their own admission, there are undoubtedly other BCTs yet to be identified and therefore subsequent versions of the BCT taxonomy are likely to appear in the future. In any case, for now, Michie et al (2015) have developed an extremely useful means of classification that will facilitate replication of interventions and assist in the accumulation of evidence (e.g. systematic reviews) as well as their obvious role in the development of interventions.

## Where next for hearing health research?

Before considering what this all means for hearing health research going forward, it is useful to acknowledge and celebrate what has already been achieved. By far, one of the most important developments within the hearing healthcare field has been the fact that there has now accrued a considerable body of research that has been informed by theories of behaviour and behaviour change (e.g. HBM, TPB, TTM). Moreover, a greater number of researchers are now embracing such theories and considering their usefulness in relation to the audiology context. Indeed, there are several excellent examples in this special issue that illustrate how audiologists can understand and conceptualize patients' attitudes, beliefs, motivations, and intentions through theory. Together with the wider body of literature that has been framed in similar ways, we have learnt much about the various factors influencing the very people we are all striving to support (i.e. patients). In short, the adoption of theory to understanding patient behaviour, as well as the use of theory to underpin development and evaluation of complex interventions (see Medical Research Council, 2008) is becoming increasingly prevalent (Greenwell et al, in press), which can only be a good thing for the field.

We must not lose momentum nor remain static but look forward and consider how best we can achieve our collective goals, from both a research and clinical perspective. It is our contention that the answer to the question 'Where next for hearing health research?' is both simple and complex. In terms of the simple answer, we should be continuing to do what we have been increasingly doing over the past decade (i.e. undertaking theoretically informed research). In contrast, the complex answer requires us to take a step back and consider whether we are working with the latest theories in health-related behaviour and behaviour change and what the evidence tells us from those outside the field of audiology who have been grappling with these theories for many decades. As we have seen in this final article, there are some serious issues to consider going forward if we are to continue to build on recent successes. This supplement has been a wonderful example of where we are now but it is important to remember that theories help us to understand how the world works but they can also help us appreciate how it can be improved. As such, we have a duty to consider existing theories of health-related behaviour and behaviour change from an audiology perspective, but we must also be receptive to new and evolving theories and embrace them with the same vitality that audiology has embraced much older theories.

**Declaration of interest:** This paper presents independent research funded by the National Institute for Health Research (NIHR) Biomedical Research Unit Programme. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, or the Department of Health. The authors report no conflict of interest.

## References

- Ajzen I. (1985). From intentions to actions: A theory of planned behavior. Kuhl, Beckman (eds.) *Action-Control: From Cognition to Behavior*. Heidelberg: Springer, pp. 11–39.
- Ajzen I. (1988). *Attitudes, personality and behaviour*. Chicago: Dorsey Press.

- Armitage C.J. 2009. Is there utility in the Transtheoretical model? *Br J Health Psychol*, 14, 195–210.
- Armitage C.J. & Arden M.A. 2008b. How useful are the stages of change for targeting interventions? Randomized test of a brief intervention to reduce smoking. *Health Psychol*, 27, 789–798.
- Armitage C.J. & Conner M. 2000. Social cognition models and health behavior: A structured review. *Psychol Health*, 15, 173–189.
- Armitage C.J. & Conner M. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *Br J Soc Psychol*, 40, 471–499.
- Armitage C.J., Povey R., & Arden M.A. 2003. Evidence for discontinuity patterns across the stages of change: A role for attitudinal ambivalence. *Psychol Health*, 18, 373–386.
- Cane J., O'connor D. & Michie S. 2012. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci*, 7, 37.
- Carpenter C.J. 2010. A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Commun*, 25, 661–669.
- Chatzisarantis N. & Hagger M. 2005. Effects of a brief intervention based on the theory of planned behaviour on leisure time physical activity participation. *J Sport Exercise Psy*, 27, 470–487.
- Des Jarlais D., Lyles C. & Crepaz N. 2004. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement. *Am J Public Health*, 94, 361–366.
- Fishbein M. & Ajzen I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.
- Gollwitzer P.M. 1993. Goal achievement: The role of intentions. *Eur Rev Soc Psychol*, 4, 141–185.
- Hardeman W., Johnston M., Johnston D.W., Bonneti D., Wareham N. & Kinmonth A.L. 2002. Application of the theory of planned behaviour in behaviour change interventions: A systematic review. *Psychol Health*, 17, 123–158.
- Hagger M., Chatzisarantis N., Wood C. & Stiff C. 2010. Ego depletion and the strength model of self-control: A meta-analysis. *Psychol Bull*, 136, 495–525.
- Hagger M.S. & Chatzisarantis N.L.D. 2014. An integrated behavior-change model for physical activity. *Exerc Sport Sci Rev*, 42, 62–69.
- Harrison J.A., Mullen P.D. & Green L.W. 1992. A meta-analysis of studies of the health belief model with adults. *Health Educ Res*, 7, 107–116.
- Heckhausen H. (1991). *Motivation and action*. Berlin: Springer.
- Herzog T.A. & Blagg C.O. 2007. Are most precontemplators contemplating smoking cessation? Assessing the validity of the stages of change. *Health Psychol*, 26, 222–231.
- Hoffmann T., Glasziou P., Boutron I., Milne R., Perera R., Moher D., et al. 2014. Better reporting of interventions: Template for intervention description and replication (TIDieR) checklist and guide. *BMJ*, 348, 1–13.
- Janz N.K. & Becker M.H. 1984. The health belief model: A decade later. *Health Educ Quart*, 11, 1–47.
- Medical Research Council. (2008). Developing and evaluating complex interventions: New guidance. [Accessed 7th February 2016], Retrieved from <http://www.mrc.ac.uk/documents/pdf/complex-interventions-guidance/>.
- Meister H., Grugel L. & Meis M. 2014. Intention to use hearing aids: A survey based on the theory of planned behavior. *Patient Prefer Adherence*, 8, 1265–1275.
- Michie S., Abraham C., Eccles M.P., Francis J.J., Hardeman W. & Johnston M. 2011. Strengthening evaluation and implementation by specifying components of behaviour change interventions: A study protocol. *Implement Sci*, 6, 10.
- Michie S., van Stralen M.M. & West R. 2011. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci*, 6, 42.
- Michie S., Wood C.E., Johnston M., Abraham C., Francis J.J. & Hardeman W. 2015. Behaviour change techniques: The development and evaluation of a taxonomic method for reporting and describing behavior

- change interventions (a suite of five studies involving consensus methods, randomised controlled trials and analysis of qualitative data). *Health Technol Assess*, 19, 99
- Moher D., Schulz K. & Altman D. 2003. The CONSORT statement: Revised recommendations for improving the quality of reports of parallel-group randomised trials. *Clin Oral Investig*, 7, 2–7.
- Noar S.M. & Zimmerman R.S. 2005. Health behavior theory and cumulative knowledge regarding health behaviors: Are we moving in the right direction? *Health Educ Res*, 20, 275–290.
- Ogden J. 2003. Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychol*, 22, 424–428.
- Ogden J. 2014. Time to retire the theory of planned behaviour?: One of us will have to go! A commentary on Sniehotta, Preseu and Araújo-Soares. *Health Psychol Rev*, 9, 165–167.
- Preseu J., Tait R.I., Johnston D.W., Francis J.J. & Sniehotta F.F. 2013. Goal conflict and goal facilitation as predictors of daily accelerometer-assessed physical activity. *Health Psychol*, 32, 1179–1187.
- Prochaska J.O. & DiClemente C.C. 1983. Stages and processes of self-change in smoking: Toward an integrative model model of change. *J Consult Clin Psych*, 51, 390–395.
- Rosenstock M.M. 1966. Why people use health services. *Milbank Q*, 44, 94–122.
- Saunders G.H., Frederick M.T., Silverman S. & Papesch M. 2013. Application of the health belief model: Development of the hearing beliefs questionnaire (HBQ) and its associations with hearing health behaviours. *Int J Audiol*, 52, 558–567.
- Schwarzer R. 2008. Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychol*, 57, 1–29.
- Sheeran P., Gollwitzer P.M. & Bargh J.A. 2013. Nonconscious processes and health. *Health Psychol*, 32, 460–473.
- Sniehotta F.F. 2009. An experimental test of the theory of planned behaviour. *Appl Psychol: Health and Well-Being*, 1, 257–270.
- Sniehotta F.F., Preseu J. & Araújo-Soares V. 2014. Time to retire the theory of planned behaviour. *Health Psychol Rev*, 8, 1–7.
- Sutton S. 2000. Interpreting cross-sectional data on stages of change. *Psychol Health*, 15, 163–171.
- Taylor D., Bury M., Campling N., Carter S., Garfield S., et al. (2006). *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*. London, UK: National Institute for Health and Clinical Excellence, pp.1–215.
- West R. 2005. Time for a change: Putting the transtheoretical (stages of change) model to rest. *Addiction*, 100, 1036–1039.
- Zimmerman R.S. & Vernberg D. 1994. Models of preventative health behavior: Comparison, critique, and meta-analysis. *Adv Med Sociol*, 4, 45–67.