

original article

Health psychology research advances theory by addressing problems: illustrations from theory-based studies of health professional behaviour

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Although problem-driven research needs good theory, such research can also advance theory. While many would agree with this assertion, it is perhaps worthwhile to reflect on how such advances might happen and to consider examples from health psychology that take theory forward. Applied research in psychology is the use of theories and methods of psychology to solve real-world problems, but theoretical problem-driven research is more than that. An important test of whether theories 'work' is whether their assumptions and hypotheses stand up to scrutiny in real-world settings. Some recent and current research investigating the behaviour of health care professionals illustrates some of these tests and advances.

The behaviour of health care professionals as a 'problem'

Health care systems and organizations provide the context in which health care is delivered, but it is individual clinicians and clinical teams who actually deliver care. The clinical behaviour of health care professionals may thus constitute either high-quality (evidence-based) or lower quality (non-evidence-based) patient care. This means that principles of individual behaviour change can inform the problem of differential uptake of evidence-based practice. Some of the specific clinical behaviours for which there is an evidence-behaviour gap are listed in Box 1.



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There are lots of reasons why it may be difficult to change clinical behaviour in the light of new evidence: clinical guidelines that summarise the research evidence may be unclear or not sufficiently specific (Michie & Johnston, 2004); patients may have strong views about their own treatment; or the necessary resources may be unavailable. So addressing the evidence-behaviour gap for a specific clinical action requires a careful exploration of the determinants of the behaviour to ensure that behaviour change interventions target the appropriate determinants.

Box 1. Some 'problem' behaviours (e.g., Walker, Grimshaw, Johnston, Pitts, Steen, Eccles, 2003)

There is evidence that, in order to achieve better clinical outcomes, health care professionals should do –

MORE:

- Applying fissure sealants to children's teeth
- Taking intra-oral x-rays for adult dental patients
- Restoring carious teeth in children
- Prescribing statins for people with diabetes
- Inspecting the feet of people with diabetes
- Prescribing thiazide diuretics in the initial management of hypertension

LESS:

- Prescribing antibiotics for people with sore throat
- Referring people with low back pain for lumbar spine x-ray
- Prescribing blood transfusions in intensive care (given certain clinical indicators)

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How might problem-driven research advance theory?

Of course there are many ways in which theory may be advanced but this paper focuses on three of these: standardizing measurement of a theory's constructs; developing methods for selecting appropriate theories to explore a problem; and interrogating a theory's axiomatic principles.

1. Advancing theory by standardizing measurement of constructs

The advantage of standardized measurement is that it permits direct comparison of data from studies of different behaviours and different samples. An example is the PRIME ('Process modelling in implementation¹ research') project (Walker et al., 2003). The aim of PRIME was to identify predictors of five clinical behaviours that are routinely recorded in health care databases. Box 2 illustrates the parallel forms of one item that were used (with other items) to operationalise attitude.

Analysis of the data from these five studies was complex but, to illustrate, within a framework of the Theory of Planned

Box 2. Standardisation of one attitude item across five studies, each investigating a different clinical behaviour.

"In general the possible harm to the patient of...

280 physicians	...taking a lumbar spine x-ray
228 physicians	...prescribing antibiotics for patients with <i>URTIs</i>
214 dentists	...taking an intra-oral radiograph
116 dentists	...restoring carious teeth in children
106 dentists	...placing fissure sealants

... is outweighed by its benefits"

Note. *URTI* = 'upper respiratory tract infection', or uncomplicated sore throat.

Behaviour, scores from a set of parallel items predicted intention relating to the five behaviours (Table 1).

The standardisation of items used across these five studies permits confidence in interpreting whether differences between behaviours and contexts are associated with patterns of prediction. For example, these differences may consist of disparities in –

- Nature of the behaviours (e.g., differing levels of skill, time, resources required)

¹ Implementation research is the field of research that involves methods to promote the uptake of research findings into healthcare practice.

Table 1. Brief results of multiple linear regressions on intention^a scores for five behaviours.

Behaviour	Predictor variables	Significant (<.05) beta weights	Adjusted R ² (p)
1. Taking a lumbar spine x-ray to investigate low back pain	Attitude Subjective norm PBC	✗ ✗ ✓ (in)	.25 (<.001)
2. Prescribing antibiotics for patients with <i>URTIs</i>	Attitude Subjective norm PBC	✓(d) ✓(in) ✗ ✗	.31 (<.001)
3. Taking intra-oral radiographs of adult patients in general dental practice	Attitude Subjective norm PBC	✓(d) ✓(in) ✗ ✓(d) ✓(in)	.16 (<.001)
4. Restoring carious teeth in children (aged 6-16 years)	Attitude Subjective norm PBC	✓(d) ✓(in) ✗ ✗	.30 (<.001)
5. Placing fissure sealants on the teeth of children (aged 6-16 years)	Attitude Subjective norm PBC	✓(d) ✓(in) ✓(in) ✗	.42 (<.001)

Note. Sample sizes presented in Box 2. PBC = perceived behavioural control. in = indirect measure; d = direct measure (see Section 3 below for explanation).

^a In the PRIME project, recorded behaviour was also measured but as there was a different error profile for each of the five behaviours, for the purpose of this argument direct comparison is more valid at the level of intention.

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- Clinical context (general medical practice for behaviours 1-2 versus general dental practice for behaviours 3-5)
- Age of patient (child for behaviours 4-5 versus adult for behaviours 1-3)
- Direction of desired behaviour change (decrease for behaviours 1-2 versus increase in behaviours 3-5).

The patterns of prediction of intention (Table 1) did not clearly map on to these disparities. A more detailed analysis of the nature of the behaviour may be required. However, the first behaviour – taking lumbar spine x-rays – was unusual in that it was predicted by Perceived Behavioural Control (PBC) but not by attitude. So, for example, an intervention to change PBC would be more likely to change this behaviour than an intervention to change attitude. This process – identifying determinants of the target behaviour within a theoretical framework and then designing interventions to change those determinants – has the potential to advance theories not only by shifting studies from correlational to experimental research designs but also by identifying the most likely mediators of behaviour change.

Using theory in problem-driven research can be challenging to the standardisation of measurement because the behaviours to be investigated are not chosen to be readily accessed by the theory, as would

happen in laboratory studies. Nevertheless, the investigation of multiple behaviours in the PRIME project illustrates the importance of standardised measurement if we wish to explore whether different behaviours are likely to be changed by similar interventions.

2. Advancing theory by developing methods for selecting appropriate theories to explore a problem

Research in psychology often focuses on one theory – or sometimes places two theories in opposition by allowing them to compete in an attempt to demonstrate the superiority of one theory over another. Health psychology research more often focuses first on the problem to be solved and uses an appropriate theory in the service of finding a solution. So it makes sense to explore the features of situations and problems that render some theories more appropriate than others. The PRIME project also advanced theory by addressing this question. Six theoretical frameworks (Theory of Planned Behaviour (TPB); Social Cognitive Theory (SCT); Common Sense Self-Regulation Model (CS-SRM); Operant Learning Theory (OLT); Implementation Intention; Precaution Adoption Process Model (PAPM)) were used. To illustrate for the behaviour 'Placing fissure sealants on children's teeth': the TPB, SCT; OLT and Implementation Intention appeared to apply to this situation but the CS-SRM and the PAPM did not (Table 2).

Table 2. Brief results of multiple linear regressions for six theories: predicting intention to place fissure sealants on children's teeth ($N = 106$ dentists).

Theory	Predictor variables	Significant (<.05) beta weights	Adjusted R^2 (p)
1. Theory of Planned Behaviour	Attitude Subjective norm PBC	✓(d) ✓(in) ✓(in) x	.42 (<.001)
2. Social Cognitive Theory	Risk perception Outcome expectancies Self-efficacy	✓ ✓ x	.24 (<.001)
3. Common Sense Self-Regulation model	Perceived identity Perceived cause Perceived controllability Perceived duration Perceived consequences Coherence Emotional response	x x x x x x x	.00 (= .523)
4. Operant Learning Theory	Anticipated consequences Rewarding/punishing consequences Evidence of habit	✓ x ✓	.57 (<.001)
5. Implementation Intention	Action planning	✓	.16 (<.001)
6. Precaution Adoption Process Model	Current stage of change	x	.00 (= .862)

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This is not to say that the latter theories are flawed, unsupported or inferior. Rather, this was an attempt to explore the boundaries of application of the theories. For example, the project addressed such questions as, "Is it possible to operationalise OLT within a questionnaire format?" (Answer: apparently, Yes) and "Can the CS-SRM inform health care behaviour by using the illness perceptions of clinicians (rather than patients) to predict clinical behaviours (rather than patients' behaviours)?" (Answer: apparently, not for this behaviour). This pushing of theory to – and sometimes beyond² – its logical boundaries is a fundamentally theoretical exercise that has the potential to take theory forward.

In problem-driven research, the aim is often to optimize the prediction and explanation of the behaviour rather than to investigate the theoretical point. Thus, more theories may be used to investigate any one behaviour, with resulting opportunities to compare theories. In PRIME, multiple theories were investigated within each study to identify those that were applicable to each of these five behaviours. Specifying the boundaries of application of a theory is fundamental work. There is more conceptual development to be achieved from this project but, again, it is likely that finding systematic and generalisable ways to describe the nature of the behaviours will be key to advancing the theories in this way.

3. Advancing theory by interrogating its axiomatic principles

A further approach to exploring theory at its boundary consists of interrogating its axiomatic principles by investigating its operational detail. An axiomatic principle in the TPB concerns the manner in which the predictor variables (attitude; subjective norm; perceived behavioural control) are measured. Quite appropriately, advice by Fishbein and Ajzen (1975) has become standard practice in the field. Briefly, this advice is that the predictor variables may be measured in two ways. First, direct measurement involves selecting from a fairly small pool of standard wordings (e.g., *Doing X is good*; *People who are important to me think I should do X*). Such items are applicable to many behaviours and the researcher's task is to specify the behaviour carefully and to insert the specification into the item in place of *X*, for example, *Taking intra-oral radiographs of adult patients is good* (or, in this case ... *is good clinical practice*). Second,

indirect measurement is a more complex process that involves identifying relevant beliefs about the behaviour under investigation. Relevance is operationalised by asking participants to name their 'individually salient beliefs', or (more frequently) by conducting elicitation interviews to identify the 'modally salient beliefs' of people sampled from the target population.

Scores for the direct measure are derived by computing the mean of the scores for individual items. Scores for the indirect measure are derived by multiplying scores for behavioural, normative and control belief items by scores for outcome evaluation, motivation to comply and control power, respectively, and summing these product terms. (The statistical validity of this multiplicative process is somewhat controversial and researchers often simply sum the scores of the unweighted belief items (French & Hankins, 2003).) These indirect scores are proposed in the theory to measure the same constructs as their directly measured counterparts. There are two hypotheses following from this. First, correlations between direct and indirect measures of the same construct should be positive and high; second, in a hierarchical regression to predict intention, after the set of direct measures has been entered, entering the set of indirect measures should account for no further variance in intention scores (because the two sets of measures should be accounting for the same variance in intention).

We would like to add a caveat to the first of these general predictions. If the elicitation work is poor in quality, or if constraints on questionnaire length limit the number of belief items that can be included, then coverage of the construct's content domain may be inadequate. In that case, we would expect lower correlations between the direct and indirect measures. However, even an indirect measure with poor coverage should not explain additional variance in intention after the direct measures have been entered.

However, there are some in-principle reasons why the two types of measure may not follow these predicted patterns because the two measures make different assumptions about how individuals process information. To illustrate, an assumption relating to direct measurement of attitude is that individuals are capable of accessing, synthesising and accurately reporting their global positive or negative evaluation about enacting the behaviour. Given the advances in

² Note that the operationalisation of OLT and the CS-CRM in the manner described is beyond the original intent of these theories and we acknowledge that this may constitute an 'unfair test' of the theories.

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cognitive psychology in the past few decades, e.g., relating to priming effects; 'hot' (emotion-laden) cognitions and attributional bias in social perception, this assumption may not be defensible.

The assumptions relating to indirect measurement are different. They relate to theories of 'cognitive algebra' that were formulated in the 1970s (e.g., Bettman, Capon & Lutz, 1975). The recommended procedure for indirect measurement corresponds to the 'weighted averaging' model within that tradition. Its validity depends on whether people actually do separately weight each individual belief in a linear way according to its perceived importance, and whether they then combine all the weighted beliefs additively to form a global attitude. Competing models may be that one belief is regarded as so important that it overwhelms all other beliefs; or that a curvilinear form of weighting more accurately represents the way each belief influences the aggregate attitude score; or that people process only a small number of individual beliefs unless cognitive resources are plentiful and the behaviour is perceived as very important. In other

words, the evidence base for the assumptions relating to both direct and indirect methods of measurement is unclear. An indirect way of testing these assumptions is to proceed with the suggested analyses (i.e., correlations between direct and indirect scores and hierarchical regression to predict intention). This has been done many times, but one example from the PRIME project will illustrate the issue. For clarity, this argument will proceed using direct and indirect measures of attitude with respect to three clinical behaviours in dentistry (Table 3).

Table 3 demonstrates two points relevant to this argument. First, for all three behaviours, direct and indirect scores for the same construct were positively and significantly related. However, all three correlations were low-to-medium in magnitude ($r < 0.3$), suggesting that either coverage of indirect measures was poor or that the assumptions underlying the measures (as discussed above) are unsupported by these data. Second, for two of the behaviours, the indirect measure of attitude significantly added to the prediction of intention scores in the second step (and

Table 3. Zero-order correlations between Attitude direct and indirect scores and brief results of hierarchical linear regressions on intention scores for five behaviours, demonstrating the unique contribution of indirect measures to prediction of intention.

Behaviour (<i>N</i> analysed)	Direct / indirect attitude scores: <i>r</i>	Significant beta weights, Step 1	R^2 change, Step 1	Significant beta weights, Step 2	R^2 change, Step 2
Taking intra-oral radiographs of adult patients in general dental practice (212)	0.25***	Attitude (dir): 0.27*** Subjective norm (indir): -0.01 PBC (dir): 0.04	0.078**	Attitude (dir): 0.22** Subjective norm (indir): 0.00 PBC (dir): 0.05 Attitude (indir): 0.21**	0.043**
Restoring carious teeth in children aged 6-16 years (129)	0.19*	Attitude (dir): 0.53*** Subjective norm (indir): -0.08 PBC (dir): 0.07	0.300***	Attitude (dir): 0.52** Subjective norm (indir): -0.08 PBC (dir): 0.07 Attitude (indir): 0.15#	0.020
Placing fissure sealants on the teeth of children aged 6-16 years (119)	0.27**	Attitude (dir): 0.36*** Subjective norm (indir): 0.25** PBC (dir): 0.20*	0.224***	Attitude (dir): 0.27** Subjective norm (indir): 0.20** PBC (dir): 0.01 Attitude (indir): 0.39***	0.145***

Note. PBC = perceived behavioural control. Subjective norm was measured using only indirect measures.

* $p < .05$ ** $p < .01$ *** $p < .001$ # $p = .065$

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this pattern was marginally significant for the third behaviour, restoration of carious teeth). Thus these three data sets do not provide evidence to support the principle that direct and indirect measures of attitude explain overlapping variance in intention scores. Of course, it is possible that the constructs in the theory were not operationalised well enough to capture the theory's full intent. However, this would be more consistent with poor prediction of intention from the indirect measure of attitude rather than additional prediction of unique variance in intention after accounting for the direct measures. Interrogation of the axiomatic principles of this theory therefore suggests either that direct and indirect approaches measure different constructs or that it could be fruitful to reconsider our assumptions about the way people process and aggregate attitude-relevant information.

In PRIME, we used both direct and indirect measures of the TPB constructs to answer two questions. First, which variables predict intention? (and therefore might mediate between interventions and behaviour change?); second, for the significant predictors, which specific beliefs discriminate between intenders and non-intenders (Walker, Grimshaw, Armstrong, 2001)? (and could therefore inform the content of interventions). This strategy demonstrated that there is more work to be done to understand the cognitive processes underlying these measures.

General Discussion

In summary, the PRIME project used six theories to predict five clinical behaviours. We believe that this problem-driven work has advanced theory. Briefly, we now address three questions:

1. Does the inconsistency of prediction across the different behaviours threaten the validity of the theories?

No. It is generally accepted that different patterns of prediction will arise for different behaviours. This has been argued explicitly in recent work by Michie et al. (2005) and there is much work to be done in specifying the ways in which behaviours differ.

2. Does the lack of support for the equivalence of direct and indirect measures in the TPB represent a rejection of the theory?

No. It would be inappropriate to reject the theory because it predicts *more* variance in intention than was at first thought. However, it may be appropriate to investigate further the information processing,

memory and attention processes involved rather than to accept uncritically the assumption of equivalence.

3. Does it follow that we should reject the principle of parsimony that makes the TPB so usable and scientifically attractive?

No. It is possible that the *direct* measures of attitude that provide insufficient coverage of the construct (i.e., that individuals are not very efficient at aggregating their beliefs and reporting them accurately) and so it could be fruitful to re-examine the assumptions around measurement, rather than the structure of the theory.

In summary, do these theories 'work' in the context of health care provision? It appears that some do, despite the challenges of using theory to investigate clinical behaviours. In addition, using theories to address problems in this context has provided opportunities for clarifying the theories and asking new questions that may result in advances. We raise these issues with the research community in health psychology and invite comment and further investigation.

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