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## Systematic searching for theory to inform systematic reviews: is it feasible? Is it desirable?

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### Abstract

**Background:** In recognising the potential value of theory in understanding how interventions work comes a challenge – how to make identification of theory less haphazard?

**Objectives:** To explore the feasibility of systematic identification of theory.

**Method:** We searched PubMed for published reviews (1998–2012) that had explicitly sought to identify theory. Systematic searching may be characterised by a structured question, methodological filters and an itemised search procedure. We constructed a template (BeHEMOTH – Behaviour of interest; Health context; Exclusions; Models or Theories) for use when systematically identifying theory. The authors tested the template within two systematic reviews.

**Results:** Of 34 systematic reviews, only 12 reviews (35%) reported a method for identifying theory. Nineteen did not specify how they identified studies containing theory. Data were unavailable for three reviews. Candidate terms include concept(s)/conceptual, framework(s), model(s), and theory/theories/theoretical. Information professionals must overcome inadequate reporting and the use of theory out of context. The review team faces an additional concern in lack of ‘theory fidelity’.

**Conclusions:** Based on experience with two systematic reviews, the BeHEMOTH template and procedure offers a feasible and useful approach for identification of theory. Applications include realist synthesis, framework synthesis or review of complex interventions. The procedure requires rigorous evaluation.

**Keywords:** bibliographic databases; database searching; information retrieval; literature searching; review and systematic search

## Key Messages

- Methods for the systematic identification of theory to inform systematic reviews are poorly specified and underdeveloped.
- The BeHEMoTh framework and accompanying procedure offers a starting point for systematic identification of theory.
- Rigorous research is required to establish how useful it is to identify theory systematically, including the BeHEMoTh framework and accompanying procedure, in enhancing the quality and informativeness of systematic reviews.
- The authors substantiate the inadequacy of methods for identification of theory within published systematic reviews.

## Introduction

As systematic review methodologies become increasingly sophisticated, review teams are able to address more challenging types of review question. Domains such as public health, health policy and social care are frequently characterised by use of complex interventions. In turn, the design of complex interventions will likely be informed by application of one or more theories or models.<sup>1</sup>

A theory is ‘a set of inter-related concepts, definitions and propositions that present a systematic view of events or situations by specifying relations among variables, to explain and predict the events or situations. The notion of generality, or broad application, is important’.<sup>2</sup> A theory is made up of concepts, the ‘building blocks of theory or the primary elements’.<sup>2</sup> A framework is a structure for presenting those concepts, without necessarily preserving interrelationships between individual concepts. We can think of a model as being ‘a generalised or hypothetical description used to analyse or explain something’.<sup>2</sup> Increasingly logic models are used to explain how a complex intervention is thought to work.<sup>3,4</sup>

Identification of theory is important because researchers may use systematic reviews, variously, to generate, explain or test theory.<sup>5</sup> If a review team fails to identify relevant theory, they may be unable to explain how an intervention, demonstrated to be effective, is believed to work. This may make it difficult to replicate an intervention in another context or to customise its active ingredients within a particular setting. Specifically, reviewers use theories<sup>6</sup>:

- To explain how the mechanisms of different interventions are related;
- To guide classification of interventions; and, at a practical level
- To provide a framework against which data from primary studies are extracted, analysed and interpreted.

To illustrate, a review team working on brief interventions for alcohol misuse may identify ‘relapse’ as explaining why interventions are sometimes effective and, under different circumstances, ineffective. A theory that incorporates relapse, for example Bandura’s self-efficacy theory,<sup>7</sup> may help to differentiate interventions that specifically address a relapse phase from those that do not. Subsequently, when extracting data for their review, the review team may use a

framework based on self-efficacy theory against which to extract contextual and effectiveness data, including data on relapse.

Systematic identification of theory has become time-critical given the emergence of review techniques that explicitly seek to identify, explore or validate theory. The prodigious growth in realist synthesis, where theory is used to explore elements critical to an intervention's success, testifies to this phenomenon.<sup>8</sup> Techniques such as framework synthesis are considerably enhanced when reviewers identify an a priori framework against which to extract and analyse data and, then, to organise results.<sup>9,10</sup> As Alderson summarises:

‘The choice of theory, although often unacknowledged, shapes the way practitioners and researchers collect and interpret evidence’<sup>11</sup>

Some commentators contest whether it is feasible to identify theory systematically.<sup>12</sup> However, alternatives lack rigour, feasibility or both.

Alternatives include:

1 Drawing on the backgrounds, experience and resources of the review team and its advisors.<sup>13</sup>

2 Noting ‘formal theories’ referenced in the literature as the reviewer reads each article.

Drawing on the backgrounds, experience and resources of the review team relies disproportionately on theories already known to the review team. The review team may be perceived as ‘magicking’ a theory out of thin air. Alternatively, if a review team only references theories encountered within included studies, they ignore a potential disconnect between the theoretical and empirical literatures. They require authors of empirical studies to identify and report potential connections between theory and practice. Furthermore, relevant theory may not be present in an ‘index’ intervention study but may lie in associated pilot studies, feasibility studies, process evaluations or commentaries (‘sibling’ studies).

To date, we have not identified any published studies detailing search methods for systematic identification of theory. Scoping searches did reveal, however, increasing numbers of published systematic reviews of theory. In the absence of cross-sectional literature survey of published reviews of theory. In surveying current practice within health research, including public health, we considered it neither necessary nor feasible to conduct a systematic review of reviews of theory. We sought to capture typical examples of such reviews. We focused our brief literature survey on the health database with the widest coverage (i.e. PUBMED MEDLINE).

The main objective of the study, therefore, was to explore the feasibility of systematically identifying theory for reviews of health behaviour change interventions. Our principal driver was pragmatic (i.e. we needed a workable method for two reviews in which we were individually involved). Only

subsequently did we identify that our approach might be valuable for other reviews and review teams.

## Methods

### Brief literature survey

Where methodological guidance is not available, it is useful to look at published examples of systematic review practice. We therefore conducted a brief literature survey to:

- (i) Identify reports of any search techniques used by review teams within systematic reviews that featured theory;
- (ii) Compile a cumulative list of search terms used specifically to identify theories, models or associated components
- (iii) Characterise terms or techniques within reviews that have tried to identify theory.

We conducted a literature search on the PUBMED MEDLINE database for reviews published in the last 15 years identifying theory in the context of health behaviour change. Search terms included 'review' in the title, abstract or publication type combined with 'systematic' in the title or abstract. These terms were further combined with one or more of the following terms in the title or abstract fields:

'model\*' or 'theor\*' or concept\* (i.e. review[tiab, pt] AND systematic[tiab]) AND (theories [tiab] OR theory[tiab] OR Theoretical[tiab] OR model [tiab] OR concept[tiab]).

Linked records from PubMed MEDLINE-related Items were followed to identify potential reviews for inclusion.

### *Inclusion and exclusion criteria*

The term 'model' is often used in a non-theoretical context. Specifically, non-theory-related use of the word 'model' occurs for:

- (i) statistical models (including regression, economic and econometric, and Markov models).
- (ii) models of care (e.g. integrated care, interprofessional care, etc.)
- (iii) disease models (e.g. animal models of human disease or pharmacology).

For inclusion in the brief literature survey, studies should be:

- 1 a literature review, either systematic or with identifiable systematic review elements,
- 2 published between 1998 and 2012 and
- 3 identifiable as reviews from title, abstract and/or Publication Type fields.

Reviews were excluded if they:

- 1 described de novo concept analysis or theory development without reference to existing models,
- 2 sought a single named theory identified a priori,

3 represented non-theoretical models, for example Statistical models, Economic Models, Animal Models, Disease Models, etc.

Reviews that sought to identify multiple instances of theories were subsequently examined to establish if:

- 1 They reported at least one search tactic specifically aimed at retrieving theories or models (e.g. the word 'model' in a search strategy);
- 2 They did not simply analyse a set of literature, retrieved using topic-specific search strategies only, for the presence of theories or models.

Reviews that failed to meet these two additional reporting criteria were recorded, together with reasons for final exclusion.

### *Developing a systematic search template*

In devising a search template, we sought to identify components of a search that might be considered 'systematic':

- (1) specification of a structured question formulation,
- (2) use of methodological filters to optimise sensitivity and specificity when retrieval of a subset of literature is required and
- (3) specification of a formal reproducible search procedure

While further components might characterise a systematic approach, these three elements seemed pertinent to the tasks we were undertaking. We drew upon the identified literature to construct a draft template for the systematic identification of theory.

### *Testing the template in two case studies*

Our search template was primarily devised to meet the needs of two systematic reviews with which we were individually associated. Independently we applied elements of the procedure to these two reviews. The first case study was a qualitative evidence synthesis of employees' views of workplace smoking cessation interventions. The review applied 'best-fit' framework synthesis as a method.<sup>10</sup> The framework synthesis method required the review team to generate an a priori framework of themes derived from an existing, published relevant model or theory. The second case study was a participatory systematic review (i.e. involving iterative stakeholder participation) and realist synthesis of community engagement using peer support to achieve health literacy.

## **Results**

### **Brief literature survey**

Searches on the PUBMED database (1998–2012) identified 34 reviews which were examined in full text. Only 12/34 reviews (35%)<sup>14–25</sup> reported a search strategy that included theory-related terms and were therefore eligible for inclusion. We assessed the usefulness of each strategy. Table 1 reports search strategies where papers documented a discrete method for identifying papers containing theory. 19/34 reviews were excluded because they did not report the method by which

their authors had identified theories for inclusion. Typically reviewers did not include search terms for models or theories in their bibliographic search strategy (n = 14) or they manually reviewed full-text papers for the presence of theories at the analysis stage (n = 5). Data were unavailable for three reviews.

Three papers searched only for named theories.<sup>14,20,21</sup> Two papers conducted a search using terms such as 'model' and 'theory' and then followed this up with searches for specific named theories.<sup>18,19</sup> One review team used the single-term 'model'<sup>17</sup>, and another used the single-term 'framework'<sup>25</sup>. One paper used multiple terms 'models', 'theories' or 'concepts'<sup>23</sup> and another used the terms 'theoretical', 'theory' or 'model' together with the subject term 'Models, Theoretical'<sup>22</sup>. Two studies used compound terms including models or theory (e.g. 'cultural competence models'<sup>15</sup> and 'nursing models', 'nursing theory', 'symptom models'<sup>16</sup>) with associated concerns regarding suboptimal sensitivity. A final study used a masterlist of widely used theories and models, supplemented by a search of a specialist database, a search for specific author names and follow-up of reference lists<sup>24</sup>.

As seen from Table 1, even where review teams had used terms to capture 'theory', they employed a suboptimal number of variants. Synthesising these findings, informed by our published experience,<sup>10</sup> suggests that using the terms 'framework\*',<sup>25</sup> 'model\*',<sup>15–17,19,22–24</sup> 'theor\*'<sup>16,19,21–23</sup> and 'concept\*'<sup>23</sup> cumulates existing best practice. Such variants would also retrieve items assigned the specific Medical Subject Heading (MeSH) term 'Models, Theoretical' 22 on MEDLINE.

Our brief literature survey, covering studies published from 1998 onwards, reveals many shortcomings. While some reviews seek a deliberately narrower focus, for example, by focusing only on a single named theory<sup>14</sup> or multiple named theories,<sup>20</sup> the majority do not report how they identified prevalent theory. Even when search strategies are reported, the terminology used by reviewers is limited. Few reviews describe use of supplementary search strategies, for example citation searching.

### **Devising the BeHEMoTh template**

We identified a need for systematic, formalised and pre-specified methods for identifying theories within the journal literature. Collectively, our findings informed development of the BeHEMoTh Framework and an accompanying search procedure. BeHEMoTh was conceived as a structured way of specifying and identifying models/theories for a systematic review.

**Table 1 Reviews describing an explicit search strategy to identify theory**

Reference	Review Type	Search Strategy	Search Terms
Adams & White14	Critical Review	MEDLINE and PsycINFO databases from 1982, when transtheoretical model (TTM) first described, to 2001	Used keywords 'transtheoretical' OR 'stages of change'
Balcazar et al.15	Concept analysis	Databases in social sciences (PsycINFO), Education (ERIC) and Health (PUBMED) as well as Google Scholar for English language journal articles and books from 1991 to 2006.	Used 'cultural competence models' only
Brant et al.16	Description, comparison, and critique of two models and two theories and proposal for new theory or model.	To identify symptom management models and theories (1990–2009), searches of MEDLINE and Cumulative Index to Nursing and Allied Health Literature. Research papers scanned for use of conceptual models and theories.	Used: nursing models, nursing theory, symptom models and nursing methodology.
Lorenc et al.17	Systematic review	PsycINFO, Sciencedirect, Academic search elite, MEDLINE, PsycARTICLES, Elsevier, Biomed, Ingenta connect, CINAHL and Embase.	Used word 'model'
McGlashan & Finch18	Review of Behavioural and social science theories and Models (BSSTM)	24 electronic databases (ACADEMIC SEARCH PREMIUM, AUSPORT, AUSPORTMED, HEALTH SCIENCE CONSUMER, Health Source: Nursing, SPORTSDISCUS with full text, SPRINGERLINK, Web of	Keywords reflecting BSSTM (unspecified), names of common BSSTM (e.g. Health Belief Model) identified from broader injury prevention, health behaviour and health



		Science, Web of Knowledge, JSTOR, PsycARTICLES, PsycINFO, Psychology + Behaviour, Psychoanalytic Electronic Publishing (PEP), CINAHL Plus with Text, Meditext, Wiley Interscience, APA-FT, PUBMED, BMJ Journals online, Electronic Journals (EBSCO), SCIENCE DIRECT, Informaworld and MEDLINE.	promotion literature
Munro et al.19	Systematic review	MEDLINE, CINAHL, PRE-CINAHL, PsycINFO, SCIENCEDIRECT and ERIC databases from start of each database to February 2005. Additional searches of University of Cape Town library, Google and Google Scholar. Citations from included papers. Experts consulted for comments and references. Published articles or book chapters in English, describing a particular theory, and articles presenting a meta-analysis of the theory	1) used keywords 'health and behaviour and (model or theory)'; '(model or theory); (adherence or concordance or compliance)', 2) All databases searched again using names of theories as keywords, with 'meta-analysis' or 'systematic review' in April 2005.
Noar & Zimmerman20	Review	PsycINFO	Searched for major theories discussed in article by name (HBM, TRA/TPB, TTM, SCT)
Pinto & Floyd21	Review	MEDLINE, PsycINFO, CINAHL, CancerLit and Cochrane Controlled Trials Register. Reference lists scanned for additional studies.	Search terms included: 'theories' Includes Transtheoretical Model (TTM), Motivational Interviewing (MI), Social Learning and Social Cognitive Theories (SCT), Theory of Planned Behavior (TPB), Cognitive

			Behavioral Theory (CBT) and others
Scobbie et al.22	Systematic search for review papers	CINAHL; EMBASE; AMED; MEDLINE; ASSIA; PSYCINFO; Cochrane database of controlled trials. Reference lists of retrieved reviews checked for papers meeting inclusion criteria.	7. theoretical.mp. or *MODELS, THEORETICAL/ 8. theory.mp. or *THEORY/ 9. model.mp. 7 OR 8 OR 9
Theunissen & Tates23	Systematic review	PUBMED MEDLINE and Silverplatter Webspirs PsycINFO	'To include models, terms like models, theories or concepts were included. All terms translated into databases' corresponding Thesaurus-based keywords (MESH terms, Major descriptors if applicable). Little agreement in database definitions of keywords.
Trifiletti et al.24	Review	PUBMED and PsycINFO (no dates given).	Combined 'injury filter' with each theory and model from those in Glanz et al.31) – most widely used or 'dominant' theories and models in health education/health promotion. Three additional strategies used to identify potentially relevant articles. Authors reviewed database of PRECEDE PROCEED Model articles (Institute of Health Promotion Research, 2003), searched for specific author names from original search and screened reference lists.
Wilson et al.25	Systematic scoping	12 electronic databases MEDLINE and MEDLINE In-Process and Other Non-	(disseminat\$ adj3 (research or framework or evidence)).ti,ab.

	review	Indexed Citations; EMBASE; CINAHL; PsycINFO; ECONLIT; Social Services Abstracts; Social Policy and Practice; Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Database of Abstracts of Reviews of Effects, Health Technology Assessment Database, NHS Economic Evaluation Database (Cochrane Library)), reference lists of included studies and individual funding agency websites. To be included, papers had to present an explicit framework or plan.	
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### **Formulating the question**

Systematic reviews of effectiveness have benefited from pre-specification of the Population of Interest, the Intervention, a Comparison and Outcomes (embodied in the PICO mnemonic).<sup>26</sup> This structured approach may improve specification of concepts and the specificity of search strategies.<sup>27</sup> Researchers have developed a plethora of structures for question formulation.<sup>28</sup> Just as the PICO structure articulates effectiveness questions, its BeHEMOTH counterpart predefines criteria for retrieval of behavioural change models/theories. The individual elements of BeHEMOTH are shown in Table 2.

### **Use of methodological filters**

The brief literature survey revealed that reviewers used only a selection of possible variants to retrieve published theories. A minimum list of terms would include theor[truncated] for theory/theories/theoretical, concept[truncated] for concept/concepts/conceptual, framework[truncated] for framework/frameworks and model[truncated] for model/models. While this permutation requires systematic evaluation using a gold standard retrieval set, it offered a workable first attempt for our ongoing reviews.

### **Specification of a formal reproducible search procedure**

Where a review team is examining connections between a health topic and existing theory (e.g. Theory of Planned Behaviour and Smoking Cessation) empirical or discursive articles may prove equally valuable. In contrast, when seeking to identify how a theory has been applied, the team requires empirical studies with data with which to explore the theory.

Essentially the BeHEMOTH Procedure constitutes two overarching tasks: (i) to 'surface' the prevalence of theory in the review team's chosen topic, and (ii) to follow up and consolidate initial leads surfaced in this way with systematic searching procedures. For example, a review team may encounter the 'Theory of Planned Behavior' within a research report for their topic of interest. They must now seek more detailed, explanatory mentions of that named theory. Alternatively, a review team may have trawled the literature in their topic using a generic theories filter to identify occurrences of theory within the titles and abstracts. They now seek further, less visible, occurrences submerged within the full text of other relevant papers. The full approach is summarised in Table 3, and the procedures are illustrated in Figure 1 and further explained below:

Following question preparation using the BeHEMOTH question formulation, a team reviews the titles and abstracts (and occasionally full-text) retrieved by the standard searches conducted to identify publications for the evidence synthesis. This can be done either during the standard sift process to identify publications for inclusion in the synthesis or through searching for the terms theor\*, concept\*, framework\* or model\* in the internal REFERENCE MANAGEMENT database, for explicit mentions of theory [Step 1a]. In parallel with this, thus removing any time-critical dependencies, the information specialist conducts theory-related searches on external databases using the BeHEMOTH framework [Step 1b]. They

do this by constructing an initial search strategy that combines the Behaviour of Interest AND Health Context with terms relating to theories (i.e. models, theories, frameworks and concepts). They exclude non-theory based models (e.g. statistical models, models of care and disease models etcetera). If a searcher retrieves too few initial results, then an optional step [Step 1c] allows them to 'drop a concept' (dropping in turn the Behaviour of Interest and then the Health Context) from a search strategy.<sup>29</sup> For example, 'drop a concept' may drop the specific Health Context in favour of multiple Health contexts (e.g. a review of theories related to alcohol dependence might extend to the related area of drug abuse or the broader area of addiction). Essentially Steps 1b and 1c conform to conventional keyword searching. However, their unique contribution comes in using the BeHEMOTH question formulation and in utilising a more comprehensive list of theory-related filter terms than employed in previous systematic reviews.

Step 2 involves compiling a combined list of theories. The aim in preparing this list is to identify documents where either the Behaviour of interest or the Health Context co-occurs with explicit mentions of named theories. The list brings together named models or theories identified opportunistically from the Reference Management topic-specific database in Step 1a with those that feature on a list of common theories. The BeHEMOTH procedure systematically adapts and extends previous methods.<sup>19,24</sup> We extended an initial shortlist by merging separate lists from studies on the prevalence of theories<sup>30–32</sup> (Table 4). Subsequently, we have identified a compendium that features 83 theories of behaviour change<sup>33</sup> that may prove a useful resource for theory searches. Searching for common theories may also identify articles that critique common theories before proposing a novel, alternative, theory. Step 3 thus formalises the search for named theories by working from a pre-specified list.

Steps 4a and 4b involve identifying and then using key citations for named theories, either identified during the review or pre-specified, combined with topic-specific terms, to access theory hidden within reference lists. A review team would locate key source citations for a particular theory (identified from Step 2). They then conduct a citation search for each key citation. At first sight, this Phase may seem to replicate established techniques of citation searching. However, instead of searching exhaustively for all citations to a model, the team combines the resultant set of citing articles with keywords for the Behaviour of Interest OR the Health Context. For example, a result set for all citations to the Health Belief Model (original reference by Rosenstock, 1966<sup>34</sup>) contains a prohibitive number of at least 1420 references (Web of Science, July 2012). However, when the result set for citations to 'Rosenstock (1966)' is combined with a specific topic (e.g. 'alcohol'), the final set numbers 27 references. Instead of merely searching named theories from the titles and abstracts of articles, Step 4b harnesses an article's reference list as an additional entry point for retrieval. The distinctive contribution of this step of the BeHEMOTH procedure is not to search for all citations to a model (resulting in hundreds of irrelevant references), but to

limit citing articles to citations featuring the Behaviour of Interest or Health Context.

Step 4b retrieves 'hidden' occurrences of theory where a title and abstract does not explicitly reference an underpinning theory. BeHEMOTH Step 4b is more feasible now that citation searching extends beyond proprietary databases (e.g. ISI Web of Knowledge) to the publicly accessible Google Scholar. The searcher pastes the title of the reference in quotation marks into Google Scholar, for example to retrieve a reference for 'Why people use health services' for the Health Belief Model,<sup>34</sup> and then clicks on 'Cited by' to create a preliminary result set [1803 References]. Finally, they check the box 'Search within citing articles' and enter topic-specific terms, for example 'alcohol' to retrieve only articles reporting the Health Belief Model in an alcohol context [503 Results].

**Table 2 Elements of the BeHEMOTH framework for specification of theory-related review questions**

Be – Behaviour of interest: Way population or patient interacts with health context, for example access for a service, compliance, attitude to policy.
H – Health context: i.e. the service, policy, programme or intervention
E – Exclusions: To exclude non-theoretical/technical models (depends on volume).
MoTh – Models or Theories: operationalized as a generic ‘model* or theor* or concept* or framework*’ strategy together with named models or theories if required.

\*Indicates use of truncation, for example to retrieve the terms theory, theoretical or theories.

**Table 3 The BeHEMoTh search process**

	<b>Procedure</b>	<b>Elements</b>		
<b>Question Preparation</b>				
Formulating a BeHEMoTh Question	Review Team formulates question in terms of Behaviour of Interest/Health Context.	Be AND H	NOT E	Models, Theories, Concepts or Frameworks
<b>Identifying incidental occurrences of Theory</b>				
Step 1a – Incidental occurrences of theory	Mine internal Reference Management database: Review of titles, abstracts and selective full text of items retrieved from Topic search conducted for the evidence synthesis (either via sift or through internal searches using theor*, model*, concept* or framework*) to compile list (Step 1a) of incidental occurrences of theories/models relating to Behaviour of Interest/Health Context (informs Step 2 below)	Be AND H		Models, Theories, Concepts or Frameworks
<b>BeHEMoTh searches</b>				
Step 1b – Searches specified by formulated BeHEMoTh question	BeHEMoTh search of external databases combining Behaviour of Interest and Health Context with generic theory-related terms (model*, theor*, concept*, framework*) e.g. Smoking Cessation AND Workplace AND (model* OR theor* OR concept* OR framework*)	Be AND H	NOT E	AND Models, Theories, Concepts or Frameworks
Step 1c – Drop a concept from BeHEMoTh search	BeHEMoTh search of external databases dropping either Behaviour of Interest or Health Context combined with generic theory-related	(Be OR H)	NOT E	AND Models, Theories, Concepts or Frameworks



	terms (model*, theor*, concept*, framework*) e.g. (Smoking Cessation AND (model* OR theor* OR concept* OR framework*) OR (Workplace AND (model* OR theor* OR concept* OR framework*))			
Specific Theory searches				
Step 2 – Compile list of named theories	Merge list of theories identified in Step 1a with pre-specified list of most common theories			
Step 3 – Named item searching	Combine list of pre-specified common and identified theories with either Behaviour of Interest/Health Context. Common theories may be compared with less common theories e.g. Whitely and Seyd’s General incentives model. A phrase search using name of theory, ‘General incentives model’, combined with Behaviour of Interest or Health Context identifies further explicit mentions of this theory.	Be OR H		AND combined list of theories identified from Step 2.
Steps 4a and 4b -Citation searching for pre-specified or identified theories combined with topic-specific strategies	Identify key citations for named theories/models identified in Step 2 (i.e. from merging list from Step 1a and Pre-identified list). Combining articles citing a key source citation with Behaviour of Interest or Health Context retrieves instances of theory otherwise ‘hidden’ in the references of an article but where the theory is not named in title or abstract.	Be OR H		AND key Original model citation(s)

Key: Be, Behaviour; H, Health Context; E, Exclusions.


## Testing the template

### *Review One: Workplace Smoking Cessation Programmes.*

For the qualitative evidence synthesis of employees' views of workplace smoking cessation, the review team applied a 'best-fit' framework synthesis method.<sup>10,34</sup> 'Best-fit' framework synthesis requires that a team identifies one or more existing, relevant models or theories as a framework for data extraction. The review team first formulated a BeHEMOTH question (Table 5). Published models or theories were identified using the BeHEMOTH search strategy [Step 1b]. NB. At this time, the project had not compiled a pre-identified list of generic common theories [Step 2]. The search included workplace health promotion (WHP) as well as, specifically, workplace smoking cessation. The strategy was sensitive to identify research that included smoking cessation, but might not actually name smoking in the title or abstract. A combination of PsycINFO, CINAHL and MEDLINE was interrogated to optimise coverage and relevance. Reference lists of all papers satisfying inclusion criteria for theories were checked for additional citations.

Full papers of potentially relevant citations were retrieved and checked for relevance. The search for relevant conceptual models or theories [Step 1b] generated 433 unique citations from three databases. From these citations, five publications reported models that 'fit' both the Health Context and Behaviour of Interest: people's attitudes and responses regarding smoking cessation or reduction interventions in the workplace. Each of the five papers presented a relevant conceptual model adapted from one of three principal models: the Transtheoretical Model (TTM) of Behaviour Change, including related Stages and Processes of Change elements,<sup>35–37</sup> the Theory of Planned Behaviour (TPB),<sup>38</sup> and the Health Belief Model (HBM).<sup>39</sup>

We deconstructed all five models into an amalgamated a priori framework,<sup>40,41</sup> which was used to code data extracted from primary research studies for the systematic review. Step 1b alone was sufficient for identifying five relevant theories. The review team also explored a sensitive strategy [optional Step 1c] using the broader term 'workplace health promotion', as an alternative to 'workplace smoking cessation'. Additional relevant citations for models/theories from workplace health promotion were identified. These generic studies were only excluded once it became apparent that papers describing models/theories of 'workplace smoking cessation' would be sufficient.<sup>40,41</sup>

Question Preparation	Identify clearly-formulated BeHEMOTH question	
Preliminary Stage	Search existing internal topic-specific Reference Management database compiled for the evidence synthesis using standard techniques to identify opportunistic occurrences of frameworks, conceptual models or theories	
		
Step 1	1a) Compile list of theories identified opportunistically from above	1b) Systematically search external databases using BeHEMOTH formulation
Step 2	Merge list of opportunistic theories with standard list of most common theories	<b>Optional:</b> 1c) If BeHEMOTH search does not yield specific theories then repeat search, first dropping the Behaviour concept and then, if necessary, reinstating the Behaviour concept and dropping the Health Context (Drop a Concept)
Step 3	Search external databases using known item searches for merged list of identified and common theories (Known Item)	
Step 4a	Identify key cited references for each known item	
Step 4b	Search citation databases (WoS; GS) for each key cited reference COMBINED WITH (narrowed to) Behaviour AND/OR Health Context (Citation Searches)	
	Select appropriate models/theories/frameworks from full BeHEMOTH, Drop a Concept, Known Item and Citation searches	

**Figure 1 Overview of the BeHEMOTH Search Procedure.**

### *Review Two: Peer support for community engagement in health literacy.*

For the review of peer support for community engagement, the team again started with a structured BeHEMOTH question (Table 5). Before operationalising search procedures for retrieval of theory, the team reviewed references from a topic search for incidental mentions of theory in titles and abstracts [Step 1a]. Identifiable theory was coded on a spreadsheet during a title and abstract sift. The team then compiled a list of candidate theories [To inform Step 2]. As a further cross-check, an information professional searched the reference management database for each candidate theory, for example 'Theory of Planned Behavior' [a variant of Step 3; using internal rather than just external databases]. One or more phrases representing each named theory were combined on Google Scholar with one or more of the three review concepts (i.e. community engagement, peer support or health literacy) [Step 3]. Google Scholar extended retrieval of theory beyond titles and abstracts to include full-text where available.

Seeking each theory in combination with only one, not all, of the review concepts recognises that theories with potential explanatory power may be more general than the review question (which combines all three review concepts). For example, theories underpinning 'peer support' may be relevant even when the outcome of interest is not specifically 'health literacy'. The review team then identified key source citations for each included theory [Step 4a]. The next stage was to combine each set of results representing a seminal cited article for a specific theory with each of the three review concepts in turn (i.e. community engagement OR peer support OR health literacy) [Step 4b]. Step 4b sought to retrieve theory that was present in reference lists but not abstracts. Theory could thus be retrieved by being specifically mentioned in the title or abstract [Step 3], by occurring in Google Scholar as full text [Step 3], or by being cited in the citations of a relevant article [Step 4b].

Use of the BeHEMOTH approach made a discernible contribution to conceptual development of the systematic review. For example, prior to undertaking BeHEMOTH Step 1a, the review team had not detected the pervasive presence of the Diffusion of Innovations Theory in article abstracts. Searching using a list of published models or theories [Step 3], and then following this up with citation searching [Step 4b], confirmed that the Diffusion of Innovations Theory was even more dominant than previously identified. Comparing the Diffusion of Innovations Theory with how it had been implemented in practice, we identified that the concept of 'local opinion leaders' had been misused within the published research. This helped us to understand why peer support had been successful in some case studies but not others.

In a further iteration, we formulated supplementary BeHEMOTH questions for specific health contexts, for example, combining 'Diffusion of Innovations' with narrower Health Context-Behaviour of Interest pairs, for example AIDS AND Health Promotion AND 'Diffusion of Innovations' [i.e. a more specific version of Step 3]. We then combined the key source citation for 'Diffusion of Innovations' with specific Health Context-Behaviour of Interest pairs such as AIDS AND

Health Promotion [i.e. a more specific version of Step 4b]. Both strategies retrieved relevant information on how the theory had been applied. They also enhanced the theoretical richness of the retrieved case studies.

**Table 4 Most widely used or ‘dominant’ theories and models in health education and health promotion (expanded from Glanz et al. 31)**

Cognitive Behavioral Theory	Social Cognitive Theory
Motivational Interviewing	Social Ecological Model
Community Organization Theory	Social Learning Theory
Diffusion of Innovation Theory	Social Marketing
Health Belief Model	Stages of Change or Transtheoretical Model
Organizational Change Theory	Theory of Planned Behavior
Precaution Adoption Process Model	Theory of Reasoned Action
PRECEDE PROCEED Model	
Protection Motivation Theory	

**Table 5 BeHEMoTh question formulation for two reviews**

Strategy	Review One – Workplace Smoking Cessation	Review Two – Community Engagement
Be – Behaviour of interest	Smoking cessation OR health promotion	Health Literacy OR Health Promotion
H – Health context	Workplace	Community engagement
E – Exclusions	Statistical models (Regression, economic, Markov) or Models of care (integrative or integrative care) or Disease models (animals used to study human diseases)	
MoTh – Models or Theories*	Model or theory or theories or framework or concept or conceptual	

Search strategies: (Be AND H AND MoTh) NOT E.

\*In a search context truncation using wildcard characters, for example model\*, theor\*, framework\* and concept\*, would be implemented on a database platform. The relative sensitivity and specificity of the specific individual terms requires empirical investigation.

## Discussion

Systematic methods for information retrieval have been developed over many years. They often involve significant numbers of empirical studies, designed opportunistically to address identified retrieval problems as they occur. As a consequence, there is broad agreement on what is required to make searching more ‘systematic’. This study encourages a strategic approach by first identifying characteristics that make searching systematic (i.e. question formulation, methodological filters and formal search procedures). The potential of such approaches is then explored within two opportunistic case studies. These three elements require further testing in a rigorous way. It is particularly important to evaluate the added value, if any, offered using a particular theory when conducting a review (e.g. as a practical framework for data extraction) or in understanding how a particular intervention might work (e.g. in providing a coherent and convincing explanation for a poorly understood intervention).

The BeHEMOTH Procedure addresses two needs related to the use of theory in systematic reviews. First, reviewers need to identify candidate theories that authors explicitly reference to explain the possible mechanisms by which an intervention, policy or programme may achieve its effect. Subsequently, reviewers need to identify reports where authors have applied a theory in practice.

Our two case studies identify contrasting reasons why an information professional might be asked to identify theory. The workplace smoking review sought a 'good enough' framework for use in organising data from included studies. In contrast, the community engagement review sought a rich, credible interpretation of how the intervention might work. This difference explains why it was sufficient, in the first case, to utilise only part of the procedure, while the second adhered to the entire BeHEMOTH procedure.

These contrasting case studies demonstrate that the BeHEMOTH procedure acknowledges a 'law of diminishing returns' so that each review team decides how far to progress through the procedure. In both cases, the procedure (i) opens up a toolbox of approaches to systematic identification of theory and (ii) provides an external framework for reporting searches for theory (e.g. 'we followed Steps 1a-1c of the BeHEMOTH procedure').

Given that the BeHEMOTH procedure requires supplemental searches, alongside classic Population–Intervention effectiveness reviews, a decision on its use depends upon the role of theory and the complexity of the intervention under review. Nevertheless, even within the prohibitive timescales of a pre-specified commissioned review, there are potential dividends to be gained from a more nuanced understanding of how an intervention works, even from a truncated version of the procedure that targets 'quick wins'. Some reviews have examined whether interventions that are based on an underpinning theory are more likely to be effective.<sup>42</sup> In a systematic review, exploring use of the Internet to promote behaviour change, Webb et al.<sup>43</sup> found that more extensive use of theory was associated with statistically significant increases in effect size. Interventions based on the Theory of Planned Behavior tended to have substantial effects on behaviour. Such findings imply that it is important to identify theory and, in particular, to isolate specific named theories, when synthesising complex evidence. However, such investigations are subject to many potentially confounding factors.

As information specialists, we recognise that citing a theory/model imperfectly reflects whether researchers have used a theory in practice or, indeed, whether they have used it appropriately. As a profession, we are familiar with inappropriate and tokenistic citation. Clearly, a review team must examine the context in which theory is used and whether such use is appropriate. Appraisal of 'theory fidelity' lies outside the remit of the searcher. Nevertheless, information professionals should be aware that the review team needs to differentiate a 'plausible' explanation for the choice of intervention from close and faithful

adherence to a specific named theory.<sup>44</sup> Michie and Prestwich have produced a Theory Coding Scheme for use once papers reporting theory have been identified.<sup>45</sup>

We have confirmed the poor standard of reporting of theory.<sup>46,47</sup> In this study, we propose a systematic and transparent strategy for identifying papers that use theories of behaviour change. By providing an auditable, transparent mechanism, the BeHEMoTh method allows systematic reviewers to explain how they have identified theories that underpin a particular intervention, its implementation or differential rates of success. We offer embryonic procedures to allow reviewers to exploit the potential of theory both procedurally, as in framework synthesis, and interpretively in generating theory for realist syntheses. In doing so, we acknowledge the ongoing debate as to whether it is practically useful to search for theories separately from studies for inclusion in a review and, subsequently, whether it is valid to engage with theory if not specifically referenced within an included study. More intuitive methods of identification of theory may appear to challenge the proceduralism of systematic review methods as well as commanding acknowledgement that systematic reviews require creativity and imagination.

We conceive the BeHEMoTh procedure as a ‘supplementary search’ for identifying papers that explicitly describe or use theory. Such a search extends a review beyond theories invoked by included papers or already known to members of the review team. The suggested procedures address the ‘disconnect’ between experimental and theoretical studies. Experimental studies frequently omit reference to underlying relevant theory. In turn, review teams commonly exclude theoretical studies when sifting titles and abstracts for inclusion in a review. Painter et al.<sup>48</sup> report that only 35.7% of 193 health behaviour change studies mention theory. Our systematic, transparent and auditable BeHEMoTh procedure extends the likelihood of identifying theory, from sibling studies, theoretical or empirical work or study antecedents. We look forward to hearing from other researchers and practitioners who are involved in searching for theory, especially to inform reviews of complex behavioural interventions.

Systematic reviews are a resource-intensive endeavour. Any proposal to extend search procedures must be regarded with circumspection. Arguments on adding a theoretical element to an intervention review must be framed in terms of added value, not simply cost. Inconclusive reviews, where an intervention only works under certain circumstances, may be illuminated by an underpinning theory. Where heterogeneity of interventions precludes meta-analysis reviews may benefit from identifying a theoretically informed ‘active ingredient’. Empty reviews, with no included studies, may benefit from theoretical principles when designing future studies. Initial ‘leads’ to theoretical articles may be present in a typical Population–Intervention result set. Subsequently supplementary searches looking for the occurrence of theory with either the Population or the Intervention separately may be required. However, additional searches may yield



collateral benefits for other review elements – for example in identifying relevant qualitative research.

Our results found no single expansive search strategy used for searching for theory. Keyword only approaches are manifestly inadequate given that theory is often not identifiable from titles and abstract alone but requires examination of full text or retrieval from citations to theory in reference lists. Future research could investigate the relative yield of a structured question formulation approach, performance of search filter terms<sup>49</sup> and the added value of time and effort versus yield of the formalised BeHEMOTH procedure.

## Conclusion

The next few years are likely to witness increasing engagement with theory, within systematic reviews and when designing behavioural interventions. Are existing tools for identification of theory adequate for meeting this future challenge? Our conclusion is a qualified ‘No’ in that the field remains immature, especially when compared to other retrieval domains. Closer scrutiny of the role of theory within systematic reviews is likely to improve the quality of reporting, and hence retrieval, of theory in primary studies. We believe that the BeHEMOTH procedure offers a feasible starting point for identifying theory. We look forward to working with information specialists and researchers alike in meeting the challenges of rigorous evaluation.

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