
Systematic reviews in health psychology: How and why they should be conducted

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Introduction

The biomedical literature has grown exponentially since the latter half of the 20th century. In an attempt to reduce information overload and increase efficiency, many researchers summarise the evidence on a particular topic. These summaries, or traditional review articles, are of low scientific quality, are non-reproducible, and increase the likelihood of biased conclusions being drawn. Systematic reviews, in contrast, are of high scientific quality, are reproducible, and permit the drawing of evidence-based answers to empirical questions. This paper describes systematic review methodology and highlights criteria by which systematic reviews can, like other pieces of research, be critically appraised.

Background

Reviews in the psychological literature are almost as old as the discipline itself. However, attempts to collate existing knowledge or synthesise research have often failed to be methodologically rigorous. This is demonstrated by the fact that different reviewers reviewing the same evidence-base often reach very different conclusions.

One initial problem is that traditional literature reviews are written by authors who rarely begin with an open mind as to the likely recommendations to flow from the review. For instance, authors of reviews may conduct a review, or may have been commissioned by journal editors to conduct the review, precisely because of their accumulated experience, knowledge and professional opinion. Clearly, strong prior beliefs may impede an objective, dispassionate review of the evidence.

More worryingly, reviews may be systematically biased by strong prior beliefs, with reviewers actively developing an argument to support their own beliefs and research position through the selective use of evidence. Indeed, this raises another problematic issue, traditional review articles do not report the methods by which studies are

identified, appraised, and synthesised. Under such conditions it is impossible for the reader to determine the extent to which prior beliefs or other biases may have influenced the review process.

Traditional literature reviews are widespread and continue to be influential. However, such reviews can justifiably be criticised for a lack of transparency regarding the methodology employed, and their very considerable potential for bias. The conclusions drawn from traditional reviews may thus derive from, or be influenced by, factors other than the evidence upon which they purport to be based. It would be beneficial if reviews of the literature were subjected to the same scientific rigour as that applied to the conduct of primary studies. Systematic reviews satisfy the need for scientifically rigorous methods of research synthesis.

Systematic reviews

In contrast to traditional literature reviews, systematic reviews employ explicit methods to locate, appraise and synthesise research evidence. In this way systematic reviews demand the same scientific principles as those required for primary research, e.g. a reproducible methodology. Thus, two systematic reviews conducted on the same topic by different reviewers should reach the same conclusions. Similarly, just as primary research is subject to critical appraisal, so too are systematic reviews. Methods for high quality evidence syntheses in biomedical research are well established, as are criteria for appraising the quality of systematic reviews (e.g. CRD Report 4, 2001). These methods and criteria include the following six essential points: defining an appropriate question, comprehensive literature search, critical appraisal of primary studies, extraction of relevant data, appropriate data synthesis, and the drawing of evidence-based conclusions. Each of these issues is discussed below.

Defining an appropriate question

The need for a systematic review is indicated wherever there is uncertainty concerning an empirical question. Traditionally systematic reviews in the biomedical and related literatures have been limited to evaluating the effectiveness of health interventions. These interventions have often involved pharmacological intervention (e.g. Bridle, Palmer, Bagnall, Duffy & Riemsma, 2003), and occasionally interventions that use alternative or complementary medicines, such as those falling under the rubric of homeopathy (Bridle, O'Meara, Wilson & Kleijnen, 2002). Increasingly, however, some researchers have sought to apply the principles of evidence-based medicine to the evaluation of behavioural interventions.

Systematic reviews of behavioural, or health psychological interventions, have focussed on evaluating the evidence related to specific health issues, such as childhood obesity (Bridle, O'Meara, Wilson, Rogers & Kleijnen, 2002) or reducing unintended adolescent pregnancy (DiCenso, Guyatt, Willan & Griffith, 2002). Other systematic reviews have evaluated the effectiveness of theory-driven interventions, such as those informed by the theory of planned behaviour (Hardeman, Johnston, Johnston, Bonetti, Wareham & Kinmouth, 2002), or interventions based on stage theories of behaviour change (Riemsma, Pattenden, Bridle, Sowden, Mather, Watt & Walker, 2002), whilst other reviews have informatively evaluated theory-driven interventions for specific health behaviours, such as stage-based interventions for promoting smoking cessation (Riemsma, Pattenden, Bridle, Sowden, Mather, Watt & Walker, 2003).

When the need for a systematic review has been identified (i.e. when there is uncertainty concerning the effects of an intervention), an appropriate question must be formulated. Formulating an appropriate question requires a clear statement concerning such criteria as the type of intervention to be evaluated, the population, condition and outcome(s) of interest, e.g. how effective are stage-based interventions for promoting smoking cessation? The type of intervention (stage-based), the condition (smoking) and outcome of interest (smoking cessation) are all detailed within the review question. The population criterion was not specified, but could have been limited to, for example,

adolescents, e.g. ... promoting smoking cessation among adolescents? A well-formulated question serves to focus the review and facilitate the identification of relevant primary studies, as well as making the review findings more meaningful.

Locating relevant research

Once an appropriate review question has been formulated, it is important to identify all evidence relevant to the question. An unrepresentative sample of primary studies included in a systematic review is a major threat to the validity of the review. It is important that substantial efforts are made to locate all relevant research, both published and unpublished. In practice this is often inadequately performed. The first step should be an exploration of electronic databases, which should not be limited to one or even two databases. Research relevant to health psychology can be found distinctively on databases dedicated to psychology, such as PsychInfo, as well as such databases as CINAHL, EMBASE, ERIC, MEDLINE, NTIS, and the Social Science Citation Index. Moreover, patient groups are increasingly developing condition-specific databases, which may contain additional useful information. Although all of these databases may contain unique references to relevant research, seldom do researchers attempt to identify research for review purposes by searching multiple databases. Electronic searching should be supplemented by handsearching of relevant journals, as well as searching the bibliographies of articles retrieved for the review, both of which have been shown to increase the inclusiveness of research relevant to the review (Dickersin, Scherer & Lefebvre, 1994).

Identification of unpublished or grey literature is important as publication bias, the selective reporting of research based on the strength or the direction of results, has been well documented (Dickersin, Min & Meinert, 1992; Easterbrook, Berlin, Gopalan, & Matthews, 1991; Stern & Simes, 1997). Although handsearching of bibliographic details of published research will facilitate identification of unpublished research, additional strategies can be used. There are databases dedicated to referencing unpublished research, such as Conference Papers Index, Dissertation Abstracts and, in particular, the System for Information on Grey Literature in

Europe (SIGLE). Another useful strategy for identifying unpublished research is direct contact with authors.

The review should report the search strategy employed, including details of electronic databases (e.g. names, search dates, search terms, etc.), handsearching, and contact with authors. Failure to report adequately the search strategy prevents the reader from determining the thoroughness of attempts to locate all relevant research. Once searches have been completed, it is necessary to determine the relevance of studies to the review. Inclusion criteria should be drawn directly from the review question, and relate to such factors as participants (e.g. adolescents), interventions (e.g. behavioural), condition (e.g. obesity) and outcomes (weight loss). Inclusion criteria may also be limited by study design (e.g. randomised controlled trials).

Critical appraisal

The studies included in a review will vary in terms of methodological rigour, thus making quality assessment important. Many reviews in health psychology fail to take account of the quality of the research to which they refer, and from which they draw their conclusions. This is important because studies of lower methodological quality tend to report more beneficial intervention effects than studies of higher quality, and that exclusion of poorer quality studies from meta-analyses often leads to substantial changes in treatment effects (Egger, Juni, Bartlett, Holstein & Sterne, 2003).

Critical appraisal allows reviewers to grade studies according to the reliability of their results, thus enabling them to be given appropriate weight in the synthesis and when drawing conclusions. Studies of high methodological quality are likely to be least biased; bias in this context refers to the extent to which the observed intervention effects are due to factors other than the named intervention. Critical appraisal of included studies allows for results and conclusions to be interpreted in relation to the quality evidence.

Many reviews grade studies into a hierarchy determined by design, with systematic reviews first, followed by randomised controlled trials (RCTs), followed by controlled trials without randomisation, followed by cohort studies, and so on. In this way reviewers attempt to take account of study quality by restricting study inclusion criteria,

to, for example, RCTs. However, use of a hierarchy of evidence is a very crude method of 'ensuring' quality, not least because there will be much quality variation among trials of the same design.

Ideally the quality of included studies should be assessed systematically against predefined criteria. There are numerous published checklists available to assess the methodological quality of different study designs and, for RCTs for example, common criteria include whether an appropriate method of randomisation was employed, whether outcome assessment was blinded, the completeness of follow-up, and whether drop-outs, withdrawals, and missing data were adequately explained and appropriately handled in the analysis, e.g. intention-to-treat analysis. The criteria used in quality assessment should be clearly reported, thus maintaining the transparency and reproducibility of the review.

Data extraction

Data extraction refers to the process of systematically recording important study details, usually into structured tables. Extracted data should include information on study design, sample size per condition, participant characteristics, description of the intervention, setting, outcome measures, follow-up, attrition, results, and author conclusions. A comprehensive approach to data extraction is important because it provides, for both the reviewer and the reader, a snap shot of all of the key features concerning all of the included studies, and can be usefully used as a reference source, as well as providing an easy format for exploring potential sources of heterogeneity (discussed below). In addition, it allows the reader to make a judgement of the appropriateness of the author's decisions to include particular studies in the review.

Study synthesis

Study synthesis refers to the process of combining the studies included in the review. The aims of study synthesis are threefold: (1) to determine, where it is meaningful to do so, an estimate of the effect of the intervention, (2) to establish whether the effect approximates across different studies, and, if not, (3) to investigate differences in intervention effectiveness, i.e. sources of heterogeneity. In broad terms, these aims can be achieved

through a qualitative (narrative) or quantitative (statistical) synthesis.

The first step of study synthesis is to determine which method of synthesis is appropriate. Decisions concerning which method of synthesis to employ are influenced by several factors. Use of a statistical method, or quantitative synthesis, is likely to be inappropriate if data are very sparse, when necessary data are unavailable, or when there is much heterogeneity between studies. Heterogeneity between studies may be indicated when participants are very different, when delivery of interventions differ, when different outcome measures are employed, or when differences in study quality exist. Under these circumstances a narrative or qualitative synthesis is more meaningful and more useful for exploring how differences between studies relate to effectiveness.

Unfortunately systematic reviews appear to be bound inexorably in people's minds with the concept of meta-analysis. This is problematic because whilst it is always desirable to systematically review a body of research, it may sometimes be inappropriate and misleading to combine results statistically. Compare for example meta-analyses of RCTs and observational studies. With a set of high quality RCTs, which examine the same intervention in comparable participant groups, each study will provide an unbiased estimate of the same intervention effect. Under these conditions, any variability between trials can be attributed to random variation and the meta-analysis will provide an equally unbiased and more precise estimate of the intervention effect (Egger, Ebrahim & Davey-Smith, 2002).

A very different situation occurs in the context of observational studies, such as case-control, cross-sectional or cohort studies. The effects of confounding and bias associated with observational studies may produce estimates of associations that deviate from true causal effects beyond that which can be attributed to chance. Combining statistically studies under these conditions may thus produce artificially precise and biased estimates of associations (Egger, Schneider & Davey-Smith, 1998). Decisions concerning what method of synthesis to employ rest with the reviewer, but the reasoning underlying that decision should be explained and justified so that the reader is able to make a judgement about the appropriateness of the method.

Careful consideration concerning method of synthesis is necessary.

Once studies have been combined, it is important to determine to what extent studies are similar in terms of intervention effect. If differences exist, it is important to investigate potential sources of heterogeneity. In systematic reviews where a meta-analysis is conducted, a formal statistical test of heterogeneity can be performed, such as chi-square, likelihood ratios, and ANOVA. These tests have low statistical power for detecting differences unless a large number of studies are included in the meta-analysis (Thompson, 1994). If statistical heterogeneity is not detected, it is still important for reviewers to examine the results for evidence of any non-random differences. Differences between studies can also be investigated by sub-group analysis, sensitivity analysis or regression models. Potential sources of heterogeneity that may influence intervention effects include, among others, participant characteristics, setting in which the intervention is delivered, and methodological quality. For reviews that employ a narrative synthesis, reviewers may investigate potential sources of heterogeneity by grouping studies within the narrative according to the same differences as examined in quantitative synthesis, e.g. studies recruiting children discussed separately from studies recruiting adults. Sensible investigation of sources of heterogeneity increases both the scientific and applied relevance of review findings.

Conclusions and implications

Once included studies have been synthesised and appropriately examined for potential sources of heterogeneity, the findings need to be discussed in relation to the evidence. Discussion of the results will need to take account of such factors as quality, heterogeneity, the potential for bias and chance, as well as the applicability of findings. Whilst the reviewer's expression of judgement, experience and expertise are not precluded entirely by the rigour of systematic reviews, such potentially subjective processes are reduced in impact and made more explicit. Conclusions, therefore, should reflect a balanced and impartial summary of the findings with appropriate consideration given to any flaws in the evidence.

A well conducted systematic review on a topic characterised by empirical

uncertainty will necessarily generate implications for both practice and research. These should be highlighted and, where possible, discussed separately. Given that systematic reviews focus almost exclusively on health interventions, there will inevitably be implications for practice, though the extent to which ‘implications’ can be discussed in terms of ‘recommendations’ for change in health practices will depend on the reliability of the evidence, as determined by such issues as quality and heterogeneity.

In providing an unbiased and critically assessed summary of all the available evidence relevant to a particular topic, systematic reviews offer a unique opportunity to identify implications for future research. Although the precise implications will vary according to the review topic, three broad issues dominate. The first concerns whether sufficient evidence exists. Having conducted comprehensive literature searches and identified few relevant studies, systematic reviews can justifiably recommend the need for additional research.

The second issue reflects the fact that specific gaps in research may exist in an otherwise reasonably well investigated area. For example, in a recent review examining stage-based interventions for smoking cessation (Riemsma et al, 2003), 23 RCTs were identified, yet only one trial examined intervention effectiveness in adolescents (Pallonen, Velicer, Prochaska, Rossi, Bellis & Tsoh, 1998). Clearly, although in terms of quantity there is a fairly sufficient evidence base, a specific gap exists in terms of this participant group. Careful examination of study characteristics often reveals specific and potentially important gaps in the research literature.

The final issue concerns quality. Simply put, the strength with which review conclusions can be made is dependent upon the quality of studies included in the review. Identifying a lack of high quality studies in a particular field is itself an important finding. However, one particular advantage that systematic reviews have over other pieces of research is that, precisely because included studies are critically appraised within the review process, specific recommendations can be made, highlighting the need for studies to be designed with an *a priori* need to satisfy specific quality criteria. Rather than making an ambiguous reference to a need for ‘good quality’ research, reviewers are able to specify

a need for studies that, for example, employ appropriate randomisation procedures, conceal treatment allocation, blind participants and outcome assessors, specify participant inclusion criteria, and / or studies that conduct intention-to-treat analysis. Such recommendations strengthen existing areas of weakness. By identifying both gaps and areas of weakness in the evidence base, systematic reviews can be used to strengthen bids for research funding.

The review process

Although not strictly a key component of a systematic review, the way in which the review is conducted is important and merits explanation. Given that a key aim of systematic reviews is to reduce the potential for bias, it is important that two or more reviewers are involved in the review’s conduct. The need for at least two reviewers is especially important when selecting studies for inclusion from all studies identified through the searches, the critical appraisal of included studies, and the extraction of relevant data. Regarding study selection and critical appraisal, the process should be completed independently by at least two reviewers who compare their results and resolve discrepancies through discussion or referral to a third reviewer. Because there is limited potential for bias, the process of data extraction can be completed by one reviewer and checked for accuracy by another. Systematic reviews should report how many reviewers were involved in the process, whether the process was independent, and how discrepancies were resolved, thus enabling the reader to determine the potential for bias in the review process.

Assessing the quality of systematic reviews

Systematic reviews top the hierarchy of evidence, reflecting the fact that, when conducted well, they provide the best estimate of intervention effect. However, caution must be taken before accepting the findings of any systematic review because, like other pieces of research, systematic reviews can be conducted poorly. Although there are different checklists of criteria to be used in the quality assessment of systematic reviews, all refer to the key components outlined above. Thus the quality of a systematic review can be assessed by asking a series of questions. Was the question well defined in terms of intervention, participants, condition, and outcomes? Was a

comprehensive literature search undertaken? Was the methodological quality of included studies critically appraised? Is sufficient information provided about important characteristics of included studies? Was an appropriate method of synthesis employed? Were sources of heterogeneity investigated? Do conclusions accurately reflect the presented evidence? Was the review process free from bias? And so on. Answers to these questions will help to not only assess the quality of a systematic review, but also determine the extent to which a review, which authors may describe as systematic, actually employs systematic review methodology.

Some controversies and solutions

Although systematic reviews use explicit, reproducible methods, and are widely regarded as topping the hierarchy of evidence, some controversy surrounds their conduct. For example, systematic reviews have been criticised for relying too heavily on the use of RCTs, at the neglect of other study designs that may contribute to our understanding. RCTs are typically given preference in systematic reviews because they offer the best, or least biased, evidence regarding the effects of an intervention. In a very clear demonstration of the superiority of the RCT, Deekes and colleagues (2000) cleverly constructed randomised and non-randomised comparisons from the same dataset, and concluded that non-randomised designs introduce serious and unpredictable biases that can lead to both over- and under-estimates of intervention effectiveness. Other study designs may offer insights, but the reliability of their results is clearly limited given their increased potential for bias. If RCTs exist there seems little utility in including trials of weaker design. This does not necessarily preclude the inclusion of other study designs, but reasons for doing so must be clearly explained and justified, and they should be treated separately in both the analysis and discussion.

Another issue concerns the necessity and resultant implications of conducting a thorough literature search. Specifically, a recent study found that trials that are difficult to locate tend to be of lower methodological quality, which raises the possibility that rather than reducing bias through extensive literature searches, such searching may introduce bias into the review through the inclusion of methodologically weak trials (Eggar, Juni,

Bartlett, Holstein & Sterne). Under these circumstances, it seems most appropriate to suggest that a comprehensive literature search should be undertaken but, after critical appraisal of included studies, greater emphasis should be given to studies of better quality in the synthesis, discussion and conclusions. Thus quality assessment and the examination of quality as a potential source of heterogeneity are especially important.

Studies within health psychology are very often assessed as methodologically poor, regardless of the method used for critical appraisal. If one rejects the notion that health psychology researchers fail to produce methodologically rigorous research, then two explanations seem more or less plausible. It is true, for example, that intervention studies within health psychology present unique challenges in their design and conduct, yet this seems unlikely to account sufficiently for the 'poor' quality of studies. A more plausible explanation is that poor methodological quality may be an artefact of poor or insufficient reporting, as opposed to poor conduct.

As health psychology studies are increasingly being evaluated for the purpose of informing national and international health care decisions, it is important that this research is regarded and appraised as being reliable, e.g. of high methodological quality. Improving the quality of reporting will serve to enhance the perceived status of research within health psychology from the perspectives of national health care decision making bodies, such as the National Institute of Clinical Excellence, as well as independent assessors of health care interventions, such as the Centre for Reviews and Dissemination at the University of York. One way to address this issue is to engage in an active programme to develop reporting guidelines for studies in health psychology, similar to the Consolidation Standard for Reporting Trials (CONSORT) (Altman, Schultz & Moher, 2001). These guidelines highlight the need to routinely report specific aspects of methodology, such as method of randomisation, which is very rarely reported in the context of behavioural interventions. Such guidelines are necessary to facilitate increases in the assessed quality of health psychology intervention research, and will be useful for not only researchers involved in systematic reviewing, but also for editors of, and referees for, health psychology journals.

Health psychology journals, or perhaps more accurately, journal editors, have not yet committed to the important move towards systematising the review process. This is surprising, since in many other domains of health research guidelines for conducting reviews are well documented, and editors of journals actively encourage their submission. In contrast, health psychology journals fail to provide an agreed set of instructions to authors on the specific components of review articles they aim to publish. In this regard health psychology lags behind the related research communities in public health and biomedicine.

Conclusions

Systematic reviews are typically conducted to assess the effects of an intervention where uncertainty exists. By using explicit, reproducible methods to identify, evaluate and synthesise evidence, systematic reviews employ a scientific rather than subjective approach to summarising what is known on a particular

topic. This method of research synthesis serves to minimise inaccuracies resulting from bias and thus provides more reliable evidence. For this reason systematic reviews are widely regarded as toping the hierarchy of evidence.

Good quality systematic reviews are systematic in their attempts to identify all relevant studies, to individually assess the quality of included studies, to use appropriate methods of synthesis, and to draw conclusions that directly reflect the nature of the available evidence. Systematic reviews thus achieve two goals: they provide a methodological assessment of a particular field and, depending on the status of the former, the relative effectiveness of a specific intervention. Systematic reviews thus serve to focus and direct methodologically superior research and provide evidence-based answers to empirical questions. Health psychology would benefit from the use of systematic review methodology.

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