

ANALYSIS



Towards evidence based research

To avoid waste of research, no new studies should be done without a systematic review of existing evidence, argue **Hans Lund and colleagues**

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Whether or not today's medical researchers, like Isaac Newton, see themselves as "standing on the shoulders of giants," they might still be expected to build systematically on previous research when planning new studies. Even though this issue was highlighted as early as 2005,^{1 2} numerous studies indicate that researchers do not use a systematic methodology to identify and refer to earlier research when justifying, designing, or discussing new research.³⁻¹¹ This is true, even in high quality clinical studies published in the most prestigious medical journals.⁴⁻¹² Rather, medical researchers select studies to cite based primarily on preferences and strategic considerations.¹³⁻¹⁸ The term "evidence based research" was coined in 2009 to indicate the approach that is needed to reduce this practice, which is an important source of research waste¹⁹ and risks unnecessary harm for patients and study participants.

In view of the easy access to both electronic research databases and high quality systematic reviews—spearheaded by groups such as the Cochrane Collaboration, and numerous evidence synthesis centres worldwide—there is little excuse for researchers failing to refer to current systematic assessments of previous research. Nevertheless, authors seem to get away with being very selective,^{13 14} preferentially citing studies with results that support the intervention they are evaluating.¹⁵⁻¹⁸ Some research funders have already taken action. For example, the National Institute for Health Research in England now requires that applicants for primary research funding justify any proposed research by referencing a current systematic review of relevant existing research to show that they have taken account of the knowledge from previous studies.²⁰ However, much remains to be done.

It was against this background that a group of researchers decided to initiate an international network (EBRNetwork, <http://ebrnetwork.org>) to raise awareness of and confront this problem within health research. The network aims to reduce waste in research by promoting no new studies without systematic review of existing evidence and the efficient production, updating, and dissemination of systematic reviews.

No new studies without systematic review of existing evidence

The methodology for systematic reviews requires predefined research questions, inclusion criteria, search methods, selection procedures, quality assessment, data extraction, and data analysis, with no relevant studies excluded without explanation and the results of each study contributing to the review's conclusions.^{21 22} Basic scientific training for researchers must include an understanding of the need for a systematic review of the existing evidence^{21 23} and the skills to critically assess, interpret, and use these reviews. For scientific, ethical, and economic reasons, current high quality systematic reviews need to be seen as an essential component of decisions about whether further studies are justified, the design of new studies, and the interpretation of new study results.¹⁻²⁴

Figure 1↓ shows the process of evidence based research, from initial research question to the final decision to proceed using an optimal study design. The proposed process aims to support researchers, not to constrain them or pretend to provide all the answers: a systematic analysis is only one of many considerations when framing a research question. Researchers

may draw on clinical experience, innovation, and serendipity—similar to the large range of considerations during a journal's editorial review process.²⁵

The number of published systematic reviews has increased steeply over recent years²⁶ so (in principle) researchers in most areas should be able to identify at least one relevant review. However, even if systematic reviews are available, researchers still face several challenges. For example, the identified systematic reviews may be out of date or of inadequate quality, necessitating additional work (requiring relevant skills, time, and resources) before the primary study. Alternatively, a lack of common measures and definitions in included studies may preclude a statistical synthesis of results, making it difficult to integrate new results.


Taking account of relevant ongoing studies when preparing systematic reviews and planning new studies presents a further challenge for evidence based research. Although registration of new trials has now become standard,²⁷ there has been less progress in the registration of other types of study.

Efficient production, updating, and dissemination

Conducting systematic reviews is resource and time consuming, and many clinical researchers are not trained to do it. Integration of systematic reviews within the research context not only challenges researchers to acquire the required skills but to make sure that any attempts to accelerate the underlying processes do not impair quality. This necessitates changes to training curriculums; close collaboration between researchers and librarians, information specialists, and IT experts; and focused investment to optimise and automate the processes.

Various initiatives in recent years have started to tackle the problem. Most prominently, a series of articles dealing with how to avoid waste in research,²⁸⁻³⁴ led to the REWARD (Reduce Waste and Reward Diligence) initiative (<http://researchwaste.net/>). Other important initiatives have been launched to prepare, update, and disseminate systematic reviews more efficiently, such as the Cochrane Collaboration.³⁵ The realisation that many of the tasks of preparing a systematic review could be automated led to the International Collaboration for the Automation of Systematic Reviews being established in 2015. New ways to prepare and update systematic reviews have been developed, such as “living systematic reviews”³⁶⁻³⁷. Cumulative meta-analyses and other methods have been used to identify whether new research is needed.³⁸⁻⁴¹ Of particular interest to researchers planning to conduct a systematic review are new user friendly software solutions (<http://systematicreviewtools.com/>). To avoid duplication of effort and ensure all reviews are published, it is now possible to register systematic reviews in PROSPERO,⁴² with another registry dedicated to systematic reviews of animal studies (<http://www.syrcl.nl/>).

Responsibilities for evidence based research

Our evidence based research statement sets out the responsibilities of everyone involved in research (box). As shown in figure 1 , the researcher's responsibility is to plan and conduct new research informed by all former and ongoing research relevant to the proposed new research. It is unnecessary to prepare a new systematic review if adequate reviews are already available. All researchers should be able to search for, critically appraise, and interpret systematic reviews in the context of new study results. Conducting or updating a

systematic review can be outsourced, although it has been suggested that all health researchers should begin their training by preparing at least one systematic review to ensure sufficient understanding.²³

It is crucial that not only researchers but all other key stakeholders in the scientific process—such as patients, research funders and regulators, ethical committees, and publishers—acknowledge their responsibility for evidence based research. Research waste and unnecessary harm to patients can be prevented by granting approval only to proposals informed by a current systematic review. Demanding references to systematic reviews that synthesise all relevant earlier studies needs to become a guiding principle for all those safeguarding the research process up to publication.

Senior researchers and educators need to ensure that new researchers are taught how to conduct research that is evidence based.²³ Information specialists and librarians have a crucial role in teaching students to perform a systematic search for systematic reviews, and in preparing and publishing research about improved ways to perform literature searches.

Last but not least, research and adequate investment in the automation of systematic reviewing is crucial to achieve and maintain evidence based research, as the growing size of the healthcare literature and increasing complexity of studied interventions²⁶ make it impossible to keep up with the workload using traditional manual methods of reviewing.

Invitation to action

The task of identifying and addressing the challenges for all stakeholders can only be confronted efficiently through international collaboration. The EBRNetwork has prepared a road map for publications (including a systematic review into the current status and effects of evidence based research itself) to raise awareness of the challenges for different stakeholder groups (implication papers) and to suggest how to deal with the tasks identified in or implied by the evidence based research statement (how-to papers). For more details, see ebrnetwork.org.

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The evidence based research statement

To embark on research when there are no systematic reviews showing that a genuine uncertainty exists, particularly when the research involves people and animals, is unethical, unscientific, and wasteful. Researchers, research funders, research regulators and research ethics committees/institutional review boards, publishers of research, research institutions/educators, and information specialists often fail to use earlier research systematically when preparing to initiate, fund, or publish the results of new studies.

Below we set out stakeholders' responsibilities to meet the aims of evidence based research:

- No new studies without adequate systematic review of existing evidence showing new research is justified, and
- Efficient production, updating, and accessibility of systematic reviews

Aim 1: No new studies without adequate systematic review of existing evidence showing new research is justified

Researchers

- To prioritise research questions after taking systematic account of the totality of relevant earlier research and ongoing research
- To know how to search efficiently for relevant systematic reviews and ongoing studies. If the search indicates that there are no relevant, up-to-date systematic reviews, researchers should be aware of the options for preparing or updating the review needed
- To be able to assess the risk of bias in systematic reviews
- To be able to supervise students studying for higher degrees in using and preparing systematic reviews

Funding agencies

- To evaluate whether applicants for funds have used systematic reviews of prior research to identify and help to prioritise research questions or agendas
- To evaluate whether applicants have demonstrated adequate support for their proposed research by reference to systematic reviews of prior research
- To evaluate whether the designs of proposed new studies have been informed by systematic reviews of prior research

Research regulators, including research ethics committees/institutional review boards

- To evaluate whether applicants have shown adequate support for their research questions by reference to systematic reviews of prior research. This expectation extends beyond randomised trials
- To evaluate whether the designs of proposed new studies have been informed by reference to systematic reviews of prior research

Editors and reviewers

- To assess whether the rationale and design of studies are adequately described within the context of systematic reviews of prior research
- To evaluate whether description of earlier research is sufficient to enable interpretation of the results of submitted studies within the totality of relevant evidence
- To evaluate whether proposals for further research take account of earlier and ongoing research
- To evaluate whether proposals for further research include clear descriptions of target populations, interventions, comparisons, outcome measures, and study types

Educators

- To teach the importance of an unbiased approach to knowledge synthesis (systematic review)
- To teach how to seek or prepare and use systematic reviews when planning and interpreting additional research

Patients and consumers

- Before agreeing to participate in research, patients should demand that research projects have been informed by systematic review of what is already known

Aim 2: Efficient production, updating, and accessibility of systematic reviews

Systematic review specialists

- To participate in research and developmental activities to:
 - a. Improve the preparation and updating of systematic reviews
 - b. Develop automation of the preparation of systematic reviews
 - c. Develop tools for preparing systematic reviews more efficiently

Information specialists and librarians

- To help develop methods to increase the quality and currency of literature searches
- To participate in teaching researchers how to perform high quality searches for relevant studies
- To participate in research and developmental activities to:
 - a. Improve the production and updating of systematic reviews
 - b. Develop automation of the preparation of systematic reviews
 - c. Develop tools for preparing systematic reviews more efficiently

Information technologists, programmers, and artificial intelligence engineers

- To participate in research and developmental activities to:
 - a. Improve the production and updating of systematic reviews
 - b. Develop automation of the preparation of systematic reviews
 - c. Develop tools for preparing systematic reviews more efficiently

Funding agencies

- To support development and research to:
 - a. Improve the production and updating of systematic reviews
 - b. Develop automation of the preparation of systematic reviews
 - c. Develop tools for preparing systematic reviews more efficiently

Recommendations

- Instructions for authors should include requirements for evidence justifying the research for which publication is sought
- Systematic reviews should be recognised as research in their own right, comparable with other types of research activity
- A clear definition of a high quality systematic review should be prepared, agreed, and promoted

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Key messages

- Embarking on research without reviewing systematically what is already known, particularly when the research involves people or animals, is unethical, unscientific, and wasteful
- A systematic review of relevant evidence can establish whether the proposed research is truly needed
- Some research funders now require applicants to refer to a systematic review of existing research
- Research waste can also be reduced by efficient production, updating, and dissemination of systematic reviews

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Figure

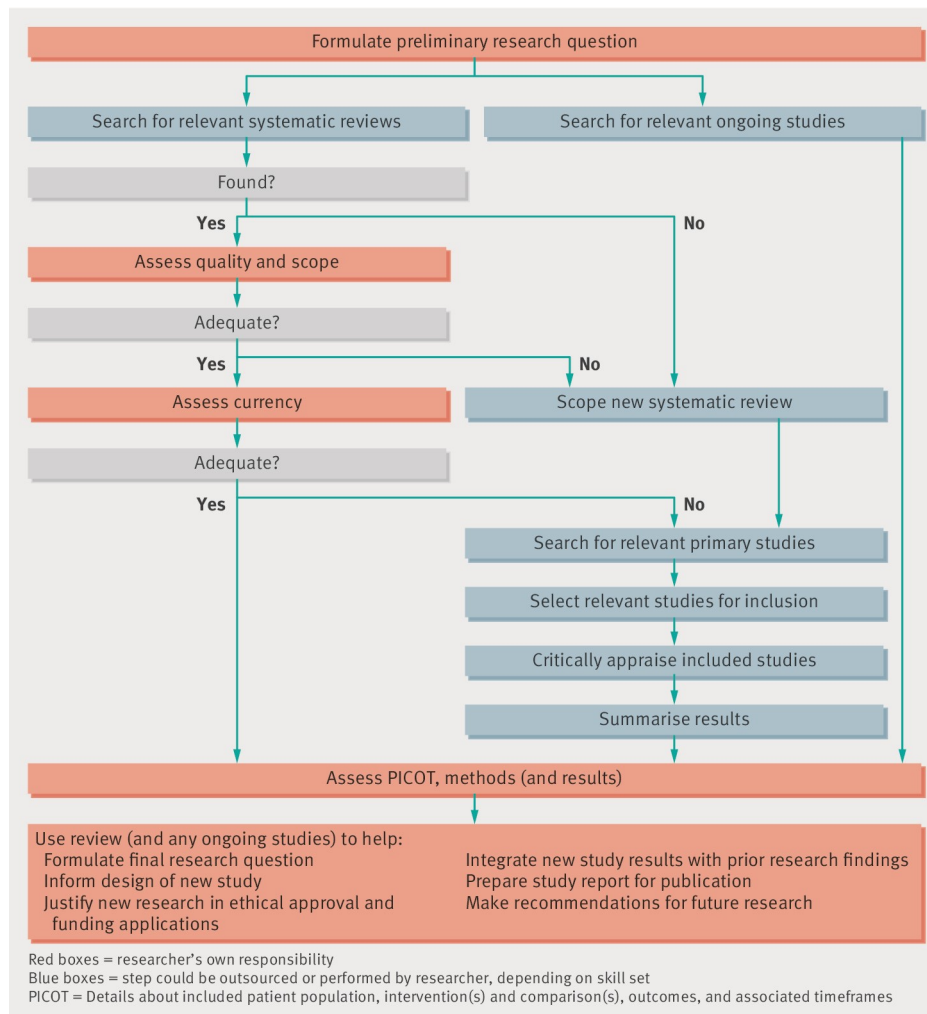


Fig 1 Flow chart for evidence based research