Guideline Adaptation: Conducting Systematic, Exhaustive, and Reproducible Searches

Amanda Ross-White
Patricia Oakley
Craig Lockwood

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This series of concise texts is designed to provide a "toolkit" on synthesizing evidence for healthcare care decision-making and for translating evidence into action in both policy and practice. The series seeks to expand understanding of the basis of evidence-based healthcare and brings together an international group of scholars to describe, discuss, and debate critical issues in the field.

Incredible developments in the synthesis and use of evidence in healthcare over the last several years have occurred, but the accompanying science and emerging practices that underpin evidence-based healthcare are often poorly understood by policy makers and health professionals. This is unfortunate because several emerging and exciting developments have much to offer this group. First, new, deeper understandings of the nature of evidence and of ways to appraise and synthesize it have led to the development of more sophisticated methodologies for synthesis science. Second, the realization that the rapid increase in the availability of high quality evidence has not been matched by increases in the translation of this evidence into policy and/or clinical action has spurred on developments in the science of knowledge implementation and practice improvement.

The burgeoning publications in this area – particularly books on evidence-based healthcare – can go only so far in informing responsible and conscientious policy makers and healthcare practitioners. This new series, Lippincott/Joanna Briggs Institute, "Synthesis Science in Healthcare," is devoted to communicating these exciting new interventions to both researchers and clinicians who are on the front line of practice or influencing policy.

The books in this series contain step-by-step detailed discussions and practical processes for assessing, pooling, disseminating and using the best available international evidence. In all healthcare systems, there is growing consensus that evidence-based practice offers the most responsible course of action for improving health outcomes. All clinicians and health scientists want to provide the best possible care for patients, families, and communities. In this series, our aim is to close the evidence to action gap and make that possible.

About the Authors

Patricia Oakley MLIS, works for the National Research Council of Canada. She has worked as a librarian at Queen's University Bracken Health Sciences Library, Canadian Partnership Against Cancer, and has consulted with the Queen's Johanna Briggs Collaboration. For the past ten years, she supported the work of the National Research Council first as an information specialist and most recently as a PMP certified project manager.

Amanda Ross-White MLIS, AHIP, is an Associate Librarian at Queen's University and the library scientist for the Queen's Joanna Briggs Collaboration. Her research interests include the role of evidence, information and knowledge in patient safety and how problems with the evidence base can interfere with the provision of optimum decision-making in healthcare. She is particularly interested in how patients engage with research evidence and is currently writing a support guide for women pregnant again after a prior pregnancy loss.

Dr. Craig Lockwood RN, BNurs, MNSc, PhD, is Associate Professor and Director of Implementation Science in the Joanna Briggs Institute, Faculty of Health Sciences, the University of Adelaide, Australia. Craig's interests are in the development of resources and systems for the implementation and evaluation of evidence-based practice from a multi-disciplinary perspective (Translational Health Science). Craig has interests in systematic review methodology, qualitative synthesis methodology in particular, and supervises higher degree by research students as well as conducts synthesis science projects of qualitative, quantitative, and mixed method research findings.

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SECTION 1

Introduction to Clinical Practice Guidelines

Evidence-based guidelines for clinical practice

Clinical policy regarding the treatment and management of health conditions has historically been both driven by and rested upon the knowledge and experience of medical practitioners. However, evidence-based practice posits that a healthcare practitioner must include and combine knowledge from the most up to date scientific research with their own professional expertise and experience, as well as with the preference of the individual patient they are treating when deciding on a course of action for treatment or management of a patient's health condition (The Joanna Briggs Institute, 2014).

The evidence to directly inform practice can be derived or accessed via a variety of avenues. One of the common means to inform clinical practice includes continual professional education. The content and curriculum requirements of health professional continued education are often driven by national regulatory agencies that dictate standards and requirements for accreditation as a healthcare professional across various fields of practice including medicine, nursing, and across the allied health fields. Another common, though passive, means of informing clinical practice is through dissemination of information relevant to practice through publication in scientific periodicals. Medical research has been disseminated and published in scientific journals for well over 100 years now, and the history of evidence-based healthcare can trace its beginnings to well beyond this time frame with to mention two well-known examples: the appearance of Avicenna's manual of pharmacopeia around 400AD and the conduct of one of the first identified clinical trials by James Lind aboard the HMS Salisbury (Sutton, 2003). With the advent of the internet and online journals access to information has never been easier, however the sheer volume of information available and speed with which it can be published and the collective knowledge in a particular field can change has raised challenges of its own for healthcare professionals attempting to make evidence-based decisions. In response to these challenges, this transfer of published and available research evidence and information has been facilitated over recent years by the advent of point of care clinical decision making information systems such as JBI CoNNECT+ (http://connect.jbiconnectplus.org/Default.aspx) or Up-to-date (http://www.uptodate.com/home) for example, which are provided by health services and systems to facilitate the access and usability of research evidence to inform the clinical decisions made by their practitioners. These systems provide scientific, research based information in a readily retrievable and useable format for clinicians to facilitate their ability to practice in an evidence-based manner. Skills, knowledge and ability to locate, view research critically, and understand how best to incorporate research evidence in decision making are some of the recognized attributes of an evidence-based practitioner (Tilson et al., 2011). Provision of accessible information and ideally easily accessible information by the use of these systems is the hallmark of an evidence-based organization in healthcare today.

Beyond continuing professional education and the use of published research evidence and presentation of evidence-based information in easily accessible formats by clinical decision information systems, another way of supporting evidence-based decision making in clinical practice is through evidence-based clinical practice guidelines (Haynes, 1998; Turner 2008). Clinical practice guidelines are one component of good decision-making in healthcare, which takes into account patients' preferences and values, clinicians' values and experience, and the available resources. A clinical practice guidelines'

main purpose is to achieve better health outcomes by improving the practice of health professionals and providing consumers with better information about treatment options.

What are clinical practice guidelines?

Clinical practice guidelines are "systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances" (Council NHMRC, 1998, p.9). In general, clinical practice guidelines provide a framework for clinical decision making within which is detailed, for a specific condition, a plan of expected care and the likely outcomes of that plan (Vijayananthan & Nawawi, 2008). With this is mind, it is clear that clinical practice guidelines evolved to improve processes in healthcare and health outcomes. Their development has also been driven by other benefits their use can promote, namely maintaining transparency in decision making and consistency in practice and minimizing inappropriate variation in practice (Harrison et al., 2013). Clinical practice guidelines also, importantly for the health system, promote optimal utilization of resources, and can also be used to support quality control within the health system including for benchmarking for audits of clinician or health service practices (Fox, Patkar, Chronakis, & Begnet, 2009; Grol & Wensing, 2001; Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999). Furthermore, clinical practice guidelines also offer a means to provide guidance for consumers of healthcare and an avenue to inform and empower patients by arming them with clear expectations of the type and quality of care they should receive (Fox et al., 2009; Grol & Wensing, 2001; Woolf et al., 1999).

As with other forms of clinical decision support tools, including other means of using evidence in clinical decision making, clinical practice guidelines are not intended to be a cookbook approach to clinical decision making; they do not remove the need for clinician discretion and application of their own expertise and clinical wisdom. Clinical practice guidelines do not claim, nor attempt to provide in depth, background information to a disease that can be readily found in a medical or nursing text. Furthermore, clinical practice guidelines, along with clinical pathways and other forms of guidance are designed to promote improved process and health outcomes for typical or uncomplicated patients and do not claim to be appropriate for all specific patients under all specific circumstances (Fox et al., 2009; Grol & Wensing, 2001; Woolf et al., 1999).

The term *guideline* is used rather broadly and may be inclusive of document types such as, algorithms, clinical pathways, protocols, practice parameters, and practice policies, to name a few. Despite this broad use of the overarching term, these types of guidance often differ dependent on their ultimate purpose. For example, their focus may be linked to a variety of specific, detailed processes that are encountered in the health system or important administrative processes. Clinical pathways or algorithms are often derived from clinical practice guidelines for a specific condition or disease. The former are commonly used to organize and sequence the care provided to a typical patient. Algorithms are, as the name suggests, logical sequences of decisions and their consequences addressing a specific area of care.

The purposes of clinical practice guidelines have been widely discussed and debated, with roles as varied as the numerous methods for their development (see next section on types of guidelines). However, there is a general consensus that clinical practice guidelines are to:

- provide guidance for health professionals;
- assist patients to make decisions about their healthcare;
- identify gaps in knowledge and prioritize research activities; and
- inform public policy.

Regardless of the purpose of a guideline development, or what resources are available to support supplementary resource development, evidence-based clinical practice guidelines should be characterized by transparency at all decision making points in the development process, a high level of rigor and auditable documentation of methods and process, and a multi-disciplinary approach where synthesis of the literature to inform the guideline questions has been undertaken as part of the

development cycle. While these characteristics inform de novo guideline development, the literature indicates that all guidelines should be identified as methodologically rigorous before being considered for clinical application (Harrison et al., 2013).

These broad purposes and resource requirements are contingent upon the guideline development group having set an explicit purpose for the guideline, and being careful to follow International standards for guideline development. Many guideline development projects now include not only a guideline document with recommendations for practitioners, but also supplementary quick reference guides for consumers, algorithms for specific aspects of practice, economic data related to costs and benefits of the interventions included in the guideline, and policy related implications. Development of such a broad suite of resources may be costly, and require substantive input from experts in a range of fields across the health sciences, including safety and quality, economics, patient advocacy, specialist practitioners, policy makers, and researchers. However, when searching for guidelines, these additional document types can facilitate a more targeted search strategy, thus the more comprehensively and transparently a guideline development project is documented, this creates multiple entry points for a search to find the source guideline.

Given the confusion that may surround the varied purposes, terms used to describe guidelines, and terminology associated with guideline development, an overview of the differing characteristics of some of the key formats involved is worth considering (see Table 1) Analysis of guideline development group methodology has shown consistency with regard to clinical practice guidelines, with Turner and colleagues identifying the provision of guidance on forming multidisciplinary groups, involvement of consumers, identification of clinical questions and topics, systematic searches for evidence, and systematic methods for managing the evidence, a detailed process for drafting the guidance with a particular emphasis on the recommendations, and the role of consultation beyond the development group as well as ongoing review and update of materials over time (Turner, Misso, Harris, & Green, 2008).

Table 1: Types of Guidance and Distinguishing Features

	Clinical Practice Guideline	**Clinical Pathway**	**Algorithm**
Purpose	Achieve better health outcomes by improving the practice of health professionals and providing consumers with better information about treatment options.	To standardize the quality and continuity of care within a discrete organizational context.	To visually illustrate the steps involved in a care process where multiple options exist for treatment choice and outcomes from treatment choice.
Definition	Systematically developed statements to assist practitioner and consumer decisions about appropriate health or disability care for specific circumstances, taking into account evidence for effectiveness and competing claims, …and form a fundamental basis for planning	Standardized, evidence-based multidisciplinary management plans, which identify an appropriate sequence of clinical interventions, timeframes, milestones and expected outcomes for an homogenous patient group	A visual quick reference guide to key decision points, actions and outcomes while providing specific care interventions to a pre-defined group of patients

Structure	Comprehensive development map, multiple output types, standardized international expectations for evidence-based guidelines	Timeframe or patient pathway based flow. May or may not include considerations arising from evidence.	A text format that is particularly suited to the presentation of a sequence of clinical decisions
Output	A series of recommendations for practice, each graded according to the strength of evidence that informed the recommendation.	A clinical tool that describes a similar pathway for similar patient interventions.	A decision matrix with differing choices visually presented in a cascading flow chart to account for variations in treatment and/or patient responses.

Guidance for health professionals

Purposes of Clinical Practice Guidelines

As a form of guidance for health professionals, clinical practice guidelines are an outcomes focused document. The standardization of care represented in a guideline is intended to facilitate closing of the gap between evidence and current practice (Grol & Grimshaw, 2003). There is good evidence that many patients receive inappropriate care, or care that is unnecessary and potentially harmful rather than beneficial (Grol & Grimshaw, 2003).

Guidelines that are kept up to date have been described as the innovation that reduces barriers to good practice. Evidence-based guidelines include an updated synopsis of critically appraised evidence and this assists individual health professionals to keep up to date with research evidence, while also enabling organizations to standardize care processes to reduce inappropriate variation, manage costs and to provide more consistent direction for health professionals (Buchan, Currie, Lourey, & Duggan, 2010; Grol & Grimshaw, 2003; Grol & Wensing, 2001). However, few (if any) of these claims have led to the consistent delivery of better quality, more appropriate healthcare, with significant improvements in guideline methodology currently not represented in significant gains to patient care or healthcare outcomes. The view that production of clinical practice guidelines will lead to improvements has, for quite some time been replaced with the view that guidelines are one aspect of a strategy that organizations need to implement in order to improve not only the provision of guidance to health professionals, but also the uptake of recommendations for care (Council NHMR, 1998).

While the notion that guidelines will improve care processes and outcomes may yet to be broadly realized, the theoretical basis (provision of up to date evidence to inform the appropriate standardization of care) is widely supported as part of a broader group of interventions or strategies. However, the initial claims associated with the development of guidelines for health professionals included:

- Ensuring that care is provided based on the best available evidence.
- Facilitating decision making with regard to resourcing areas of care that will provide the best return.
- Ensuring clinicians practice according to recognized standards of care.

The move to embrace an evidence-based approach to guideline development was to have the added benefit of facilitating clinician's access to up to date evidence for clinical practice. This is evident in claims that the development and use of clinical practice guidelines based on evidence of clinical and cost effectiveness has been the single most important development in ensuring patients receive the full benefits of clinical research (Chidgey & Leng, 2007). While these claims were met with skepticism in 2007, by 2009 they had been thoroughly rejected as too simplistic given analysis of impact of guidelines found outcomes did not match the rhetoric (Fox et al., 2009). Fox and colleagues highlighted that

clinical care was a complex environment, where few guidelines were able to integrate factors outside the clinical problem that impact on outcomes, while Ian Chalmers in the 2007 issue of the same journal was questioning the claims, highlighting that uncertainties in care have a direct impact on adherence to guideline recommendations and that therefore, not only should guidelines include capacity for individual clinical reasoning, but that implementation was more complex than provision of a guideline (Chalmers, 2007).

Assisting patients in decision making

In spite of the uncertainties surrounding the extent of guideline impact on practice outcomes, that they do confer benefit is not disputed, and a number of additional benefits have been identified. The potential for benefits to patients from implementation of clinical practice guidelines extends beyond the impact on the quality of care received by patients. Guidelines that are accompanied by consumer information may inform patients and health consumers' expectations across the health continuum (Woolf et al, 1999). This includes what the health system should be offering, what their GP should be providing, and how clinicians in acute care services should be practicing, and what reasonable alternatives exist for treatment choices. Guidelines that address the information needs of consumers empower them to ask more relevant questions, to make better informed decisions, and to understand how to differentiate between treatment choices (Woolf et al, 1999). Shared decision making has become part of the fabric of healthcare, with informed consumers empowered co-participants in their own healthcare decision making, the emergence of guidelines around how to implement shared decision making across a range of healthcare issues is indicative of the role guidelines play in all aspects of healthcare. The extent to which provision of guidance related to patient decision making has become embedded in care provision is well illustrated by the availability of guidelines on how to guide patients in becoming informed, empowered members of their healthcare team (Galla, 2000).

Identify gaps in knowledge and prioritize research activities

Guideline development based upon questions that address issues or problems in clinical practice have been described as assisting to identify gaps in the existing knowledge base (Woolf et al., 1999). The ability to identify gaps in current knowledge rests on the notion that a clinical practice guideline development project includes multi-professional groups who input in to the clinical questions the guideline will seek to address. This engaged discovery process is what leads the raising of important local contextual issues. Identifying issues to be resolved through the guideline development process is a ground up clinician based approach rather than one directed by existing published resources, and this allows for the identification of context specific issues or problems experienced in clinical care to be highlighted.

Evidence-based clinical practice guidelines may begin with clinical questions, but there is a second element to them that very demonstrably highlights gaps in knowledge and assists to prioritize research activity. As has been described earlier in this chapter, guideline development includes a comprehensive and systematic search for existing research literature related to each clinical question the guideline group identifies. The systematic reviews that are then used to inform the guideline development represent a critical compendium of the existing research on a topic. From this resource a guideline group is able to establish whether or not the research they have identified through systematic reviews addresses the key information needs, or whether their key information needs represent a gap in knowledge. Such gaps analysis may also inform research prioritization projects and programs. The Institute of Medicine (IOM) in the United States of America describes a process of research prioritization arising from systematic reviews and the development of trustworthy clinical practice guidelines. The IOM further suggests that reviews are the basis of research priority setting as they provide evidence related to benefits, harms, alternate methods of intervention (intervention includes prevention, diagnosis, treatment and ongoing evaluation of healthcare outcomes). The significance of this association is highlighted in the decision to allocate $1.1 billion US dollars to research on initial national priorities, with an emphasis on systematic reviews (Medicine Io, 2009).

Informing public policy

Publication of guidelines may flag under recognized healthcare problems, highlight inadequate or lacking services, and bring to health professionals attention areas where new interventions are available but yet to be implemented (Woolf et al., 1999). The needs of policy makers in relation to evidence have been a subject of ongoing interest; although clear conclusions are difficult to establish. The role of evidence-based guidelines in relation to public policy is characterized by complexity, both in terms of the evidence of effects for impact on policy, and in terms of how the transfer of knowledge can or should occur. Given the focus of this text is on searching for evidence to support guideline development or adaptation. While the mechanisms by which evidence can inform policy will vary substantively across jurisdictions, in a book which is focused on the comprehensive identification of all relevant information to inform guideline development, it seems reasonable to suggest that where there is intent for a guideline development to inform policy, that the same principals should apply to how the evidence is prepared as would apply in the conduct of a high quality systematic review. The evidential base that therefore informs a guideline development should be rigorous, transparent and demonstrate an auditable trail of decision making, regardless of the guidelines intended target audience and purpose. Such an approach is consistent with a first principal's perspective.

Development of Practice Guidelines

Traditionally, guidelines have been based on consensus among experts. But this method has its limitations. Expert opinion does not always reflect the state of current medical knowledge. And, even where guidelines are supported by literature surveys, if the medical literature has been analyzed in an unsystematic way biased conclusions can result. In the past this has led to unnecessary delays in the recommendation of effective interventions and delays in the withdrawal of ineffective or harmful treatments (Grol & Grimshaw, 2003). It is now acknowledged that guideline recommendations should be based on systematic identification and synthesis of the best available scientific evidence (Council NHMR, 1998; Buchan et al, 2010). Given the extensive research activity in some healthcare areas, identifying and synthesizing the available evidence can be a major undertaking (Harrison et al., 2013).

The process for guideline development should be aimed at identifying interventions that will ensure the best possible health outcomes. A health outcome has been defined as a change in the health of an individual, a group of people or population which is attributable to an intervention or a series of interventions. Outcome measures can range from survival rates to quality-of-life attributes. Outcomes can be positive or negative and may differ according to population group; for example, socio-economic group, gender, or current health or risk factor status (Council NHMR, 1998).

The purpose of clinical practice guidelines is to encourage treatment that offers individual patients maximum likelihood of benefit and minimum harm and is acceptable in terms of cost. Recommendations contained in guidelines should be based on the best possible evidence of the link between the intervention and the clinical outcomes of interest. The evidence on which a recommendation is based can be graded according to level, quality, relevance, and strength (Excellence NIfHaC, 2006).

Ideally, recommendations should be based on the highest level of evidence, preferably a systematic review of high-quality randomized controlled clinical trials that measure relevant outcomes and demonstrate a strong, clinically important, beneficial effect of the intervention. It is important, though, to recognize that this ideal may be difficult to attain in the case of public health and social science interventions: these important areas of healthcare should not be disadvantaged by the rigid application of a hierarchy of evidence (Council NHMR, 1998; Excellence NIfHaC, 2006; Medicine Io, 2009).

Clinical practice guidelines are appropriate only if the problem or objective is related to clinical decision-making or decisions about the organization of health services. Guidelines may be developed, for instance, in response to an identified variation in treatment among practitioners for the same condition. If this variation is caused by lack of knowledge or information, the development of evidence-based guidelines is an appropriate response (Chalmers, 2007; Chidgey & Leng, 2007). But variations in

clinical practice may be based on patients' needs and sound evidence: such legitimate variation can result from variations in morbidity rates and variations in consumer preferences for different outcomes (Chalmers, 2007). Guidelines may not be necessary in such situations. Nor are they an appropriate response to variations caused by unreliable data sources and random variations in data. Furthermore, guidelines may not be needed if practice variations are a consequence solely of resources or supply constraints (beds, technology, facilities, specialists, and so on) or if clinical decisions are based on sound, up to date evidence.

Workshops for members of guideline development working parties may be beneficial in bringing together multidisciplinary groups as well as consumers to consider the need for clinical practice guidelines and the methods to be used in their preparation, dissemination, implementation, evaluation, and revision. A recent analysis of Australian guidelines found problems, flaws or limitations in relation to specific guideline attributes. These were identified through a review of 313 clinical practice guidelines published 2003-2007. Of the identified guidelines, only 60 described a transparent search and appraisal process that could be replicated; 23% of the guidelines made no reference to evidence; more than 50% did not include statements about sources of funding; 14 of the 313 included guidelines had passed their expiry date, yet had no documented strategy for update; there was a lack of transparency in relation to ethics and competing interests and; it was generally unclear what factors may have influenced the development of recommendations with the included guidelines (Buchan et al., 2010). Given the potential impact on recommendations for practice, guideline development groups should seek to work to best practice standards relevant to where the guidelines will be implemented.

Evidence for Clinical Practice Guidelines

An early systematic review found evidence of benefit from experimental studies on the effectiveness of guidelines in allied health professions (Thomas, Cullum, McColl, Rousseau, & Soutter, 1999). The review findings were based on eighteen studies with nearly 500 participants, the outcomes were confounded by poor reporting of methods in some studies, yet the authors concluded there was sufficient evidence related to:

- decreasing inappropriate variation in clinical practice; and
- changing practice and practice related outcomes (Thomas et al., 1999).

The findings have been widely used in support of clinical practice guidelines as a method of changing practice and improving outcomes. With support for the role of guidelines (albeit not strong evidence) the literature of evidence for the role of guidelines in improving practice has been explored in relation to a widening range of interventions in more recent years. This book has thus far positioned clinical practice guidelines within a broader context that of getting evidence in to practice to inform healthcare decision-making, we now focus in more specifically on searching for guidelines and the role of a health service librarian in planning and implementing a search.

Considerations in Planning to Search Clinical Practice Guidelines

Planning for a search to identify clinical practice guidelines should include consideration of existing international guidelines, not just local sources, or those developed by regional peak bodies and professional associations. As stated earlier, guidelines developed by larger national bodies tend to have more funding and more resources, therefore sources of guidelines that include these high level documents can greatly facilitate the identification of existing guidelines. Searching for guidelines will invariably result in identifying multiple guidelines that address the same topic; the latter sections of this book describe how to work systematically through the processes of resolving duplication. Duplication has been widely addressed in the literature, and is perhaps best characterized by a review of guidelines for schizophrenia that found at least 27 guidelines had been published internationally on the same aspects of management (Excellence HIfHaC, 2006; Gaebel, Weinmann, Sartorius, Rutz, & JS, 1999). The authors of the evaluation paper were able to critically evaluate, then create a list of the best quality guidelines from those included, with those rated highest tending to be those that were centrally funded

by national government agencies (Excellence HIfHaC, 2006; Gaebel et al., 1999). Given the costs, the resource requirements (both human and material, including the engagement of experts who would otherwise be providing care, the need for systematic reviews, and consumers to participate in guideline development groups), perhaps the key message from the comparative analysis of schizophrenia guidelines is to ask why there are at least 27 different guidelines on the one topic. Previously developed guidelines may be applicable to current circumstances or can be adapted, saving significant time, and allowing resources to be directed to other activities (Harrison et al., 2013). It is important, however, to assess the previously developed guidelines particularly in terms of the quality of the evidence on which they are based. If the guidelines have been implemented, establish whether they were effective. Although they may be high quality and have undergone a thorough development process, it may still be necessary to take steps to evaluate their effectiveness in clinical practice. This process is greatly facilitated by a search strategy that is targeted to identifying existing guidelines, both in terms of the search terms used, and in terms of the sources that are searched.

While searching for guidelines presents as an economically sound alternative to de novo development, there is a science that should be followed when searching. This includes the need to search not only for all existing guidelines on the topic area, but also to consider searching for systematic reviews that may have been published since the original guideline/s (Harrison et al., 2013). In either scenario a range of expertise is necessary for a group to achieve a high quality result. One such area of expertise and the focus of much of the rest of this book is that of the Information Scientist, or health sciences librarian. This first chapter has sought to establish evidence for the role of guidelines, and the need for a comprehensive search strategy in order to ensure all relevant guidelines are identified, and that the search strategy can be subject to peer review of its rigor and transparency; the remainder of this book focuses on the kinds of information and resources that expert searchers will be required to consider.

Role of Information Scientists, Librarians, and Expert Searchers in Clinical Practice Guidelines

Searching for clinical practice guidelines is an iterative process that will preferably be based upon a clearly defined scope. Having a clearly constructed scope based on local practice needs assists to establish the topic, the relevant clinical questions associated with the topic, and whether the guideline information needed will be for a continuum of care or part thereof. Clearly scoping the project before searching commences also assists in identifying which health professions an organization requires to have representation within the guideline itself. As guidelines are identified and compared against the project scope, the questions may change, be expanded, new questions be added or some questions removed (Harrison et al., 2013). Getting started and setting direction is therefore not a static process, and changes in direction often require either a return to the evidence for confirmation, or adjustment of the search parameters and terms – which also requires returning to the evidence. Having an expert searcher involved in the project ensures the scoping phase can be managed in such a way as to reduce the degree of revision that may be required. An information scientist has the skills and knowledge to prepare search strategies, run and update them, and keep record of all decision trails involved in the search process, including these skills in the project team from the outset.

Comprehensive, systematic, transparent searching, or information retrieval is integral to clinical practice guideline development, and also to the identification of clinical practice guidelines. While guidelines were previously written on the basis of consensus and/or experience, evidence-based clinical practice guidelines necessarily involve either the conduct of systematic reviews, or the systematic and comprehensive identification of published systematic reviews and other relevant research that can inform gaps in existing published guidelines. This link with clinical practice guidelines, and the supporting documentation and records that are associated with a project is a significant role for expert searchers. Involving the same profession in, or

drawing on advice from expert searchers therefore is pragmatic and in the search for existing clinical practice guidelines.

The requirement for skilled participation in identifying evidence has been described in the Joanna Briggs Institute Reviewers Manual. This guide to systematic reviews includes considerations involved in topic development, crafting questions and establishing comprehensive, transparent and auditable search strategies that seek to identify all relevant literature on a review topic (The Joanna Briggs Institute, 2011). There are analogous steps in any guideline identification project, as the core requirement across these types of documents is the same; reliable access to evidence. The science required in order to achieve these goals is specific to how to best identify and access evidence, and yet is only one part of an integrated, iterative process. Both the 2011 and 2014 Joanna Briggs Institute Reviewers Manuals highlight the need to ensure the project team has the right balance of knowledge and skills, with task delineation less important than recruitment of persons with the right skills and knowledge for the topic (The Joanna Briggs Institute, 2011; 2014). The need for specialist information skills, knowledge and expertise in document identification and retrieval is also highlighted in the Centre for Reviews and Dissemination guidance for systematic reviews, and the Institute of Medicine White Paper on reviews of effects and comparative effectiveness as well as the Agency for Healthcare Research and Quality (Dissemination CfRa, 2009; Medicine Io, 2011; Quality AfHRa, 2014).

Across each of these major groups with a longstanding history of involvement in the conduct of high quality evidence synthesis, the development of methodology and the integration of reviews in to evidence-based guidelines there is a clear consensus that having expertise in the core skills attributable to expert searchers is highly desirable, and contributes to the rigor and validity of the end product (Dissemination CfRa, 2009; Medicine Io, 2011; Quality AfHRa, 2014; The Joanna Briggs Institute, 2014).

When considering topics that require a search to identify relevant clinical practice guidelines, there are considerations and requirements that make developing the topic area and defining the clinical questions at the start of the project. Primarily this involves ensuring consideration is given to establishing teams have the right persons with relevant knowledge and skills, and preparatory requirements for large, complicated projects such as guideline searching and selection (Harrison et al., 2013). Bringing in expert searchers at the planning phase allows for better preparation, as knowing the most relevant sources to search, how to search and what kinds of words and terms need to be considered from the start is more helpful than adjusting methods once the project is underway (Medicine Io, 2009). Having access to findings from a scoping review of the literature can inform a project and assist in further planning if for example, it becomes clear that there are no existing guidelines on the topic, thus requiring planning to search for systematic reviews to fill the knowledge gap within the proposed topic. Scoping reviews can also inform how the clinical questions develop, by identifying relevant characteristics of the types of participants, the varied interventions or diagnostic approaches available, highlighting the kinds of outcomes the literature reports on, and providing expertise in the documentation of the initial scoping searches.

Crafting search strategies for identification of existing guidelines, systematic reviews and other evidence is clearly within the domain of expert searchers. While most practicing health professionals have at least a modicum of knowledge and technical know-how for database searching, but lack a substantive theoretical knowledge base and detailed technical knowledge required to operationalize a search of international literature that is comprehensive in scope, exhaustive in reach and transparent in terms of auditability of the decision and results trail. The broad requirements for rigorous searching continue from the set up and scoping reviews to

inform question development, and have been highlighted as an area where expert searchers can make a valuable contribution (Mead & Richards, 1995). Review or guideline projects that include expert search skills will benefit from concept maps relevant to the topic inclusion criteria, and comprehensive search strategies that include both free text and thesaurus based terms. Expert searchers assist in selecting databases to search, plan, test, and optimize the search strategy per database to ensure a search is as sensitive and specific as feasible for the topic. The Institute of Medicine's standards for systematic reviews gives a broad overview of the role of an expert searcher in identifying evidence; however, the detailed processes and strategies are evident in the Joanna Briggs Institute guides on searching for reviews, with expertise in use of database thesauruses, sources of black and grey literature, and optimal knowledge of Boolean operators just some of the benefits of working with librarians being equally applicable to searches for guidelines and other evidence (The Joanna Briggs Institute, 2014). Further considerations include the central importance of transparent and detailed reporting requirements embedded in the PRISMA statement (http://www.prisma-statement.org/), and also required for de novo or adaptation of guidelines by ADAPTE (http://www.g-i-n.net/document-store/working-groups-documents/adaptation/adapte-resource-toolkit-guideline-adaptation-2-0.pdf/view) and the AGREE trust (http://www.agreetrust.org/resource-centre/agree-ii/).

With so much information at our fingertips, it is easy to overlook the importance of having a health sciences librarian on the panel. Many people are not aware that health science librarians have a graduate degree in information and library science and frequently have additional post graduate training. Taking advantage of a health science librarian's expertise in searching and citation management can save time, prevent duplication of effort, and ensure a process that is systematic, comprehensive and replicable. Librarians can also help with tracking down sources that may be available to your team.

If it is possible to have a librarian or information science specialist on your panel, it is important to have him or her involved at the question development stage. By understanding the context in which your question was developed, the librarian can create a search best suited to your needs. The librarian can also help the group understand the benefits and limitations of databases being considered for use. Your institution may have a librarian or information specialist on staff that can assist with the search and documentation process or provide training.

Running search strategies, managing updates and/or changes to searches, checking relevance of results, and implementing strategies to keep appropriate, detailed records of what searches were run, the dates they were run and the dates included in the search per database are some of the practical technical skills an expert searcher such as a health sciences librarian, can bring to a guideline project (or any project that requires expert information retrieval) (Chidgey & Leng, 2007; Dissemination CfRa, 2009; Quality AfHRa, 2014).

Arranging delivery of papers from grey (unpublished) and black (published) searches and reference checking (sometimes called *pearling*) are analytic skills made easier and more certain when undertaken by appropriately qualified, expert searchers. Grey literature sources in particular often lack the structures that assist in searching for black literature (The Joanna Briggs Institute, 2014). As literature is brought to the group, gaps in the identified guidelines become clear, new questions arise and the process of managing citations becomes more complicated. The use of bibliographic software to facilitate citation management is an important strategy and one that is familiar to expert searchers.

There is clearly a substantive role for persons with expertise in all aspects of preparing a comprehensive search, running search strategies across databases, and managing the entire

process in a transparent and auditable approach while also being able to implement changes and extensions of searches. Expert searchers fill this important role and are able to continue to contribute over the life of the project as they tend to gain an increasing detailed and comprehensive grasp of the literature in the topic area. This book sets up an understanding of the role for expert searchers, and in the following chapters, provides resources and information to facilitate them in this specialized role (Harrison et al., 1999; The Joanna Briggs Institute, 2014; Turner et al., 2008).

SECTION 2

Planning a Systematic and Transparent Search

Jessica is the professional practice leader for nursing at a mid-size hospital. One of her roles is to ensure that the hospital's policies and procedures manual is current, although having to manage so many different areas of nursing, she finds it a real challenge. Even though her background is as a cardiac care nurse, she finds herself having to review policies in many different areas, some of which are completely unfamiliar to her. She's lucky to have a great, stable staff, but when one of the nurses from obstetrics/gynecology comes to her with a specific request, she's a little flummoxed.

"Hey, Jessica, I know you're responsible for the policies manual, and I just wanted to let you know that we could use an update on one of our policies. We had a patient who has developed a molar pregnancy and our policy hasn't been updated since 1999!"

"1999! Yeah, okay, I'll look into it. I guess that isn't something that happens too often."

"No, we only get a case every couple years or so. I'm sure there's a good guideline available, maybe from the Society of Obstetricians of Canada? We can just use that one?

The need to identify and locate clinical evidence can occur from a number of circumstances. In some cases it may be necessary to simply locate a recent guideline. In other instances it may be necessary to work with a team to develop a guideline while at other times evidence may be required to adapt a guideline. Depending on the nature of the guideline project, the search process can become complex. Searching systematically will help with deconstructing this complex process and documenting each of the search process will ensure that the search is exhaustive, transparent and reproducible.

As the search for guidelines and evidence updates proceeds, there will be a need to manage the potentially large number of citations retrieved. There are bibliographic software tools on the market that can help with citation management. The most popular ones include Reference Manager®, Endnote®, and RefWorks®. Your health sciences librarian can confirm if these resources are available to you through your local institute. You can also use Microsoft Excel® spreadsheets to manage your citations.

There are many guides and tutorials available on the Internet which provides additional help in using these tools. Often health-sciences libraries will offer training session in the use of these tools. Contacting your local health science library for support is highly recommended.

While Reference Manager®, Endnote®, and RefWorks®, are unique programs, the basic functions they perform to support guideline development are the same: the creation of databases of citations, annotation of citation records, and export of references into documents or spreadsheets.

It is important to decide who will be responsible for conducting the search and planning on how to document the search early in the process. If possible contact your librarian or information specialist early in the guideline project.

Jessica is not sure what her next step should be. Jessica contacts Tom Smith, her hospital's health sciences librarian for help with planning the search. Tom recommends RefWorks® for tracking resources. He tells Jessica there is a guide for using RefWorks® on the virtual library website. He also points out to her that it is important to decide who will be responsible for tracking decisions made during the search process.

Table 2: Checklist For Planning A Literature Search.

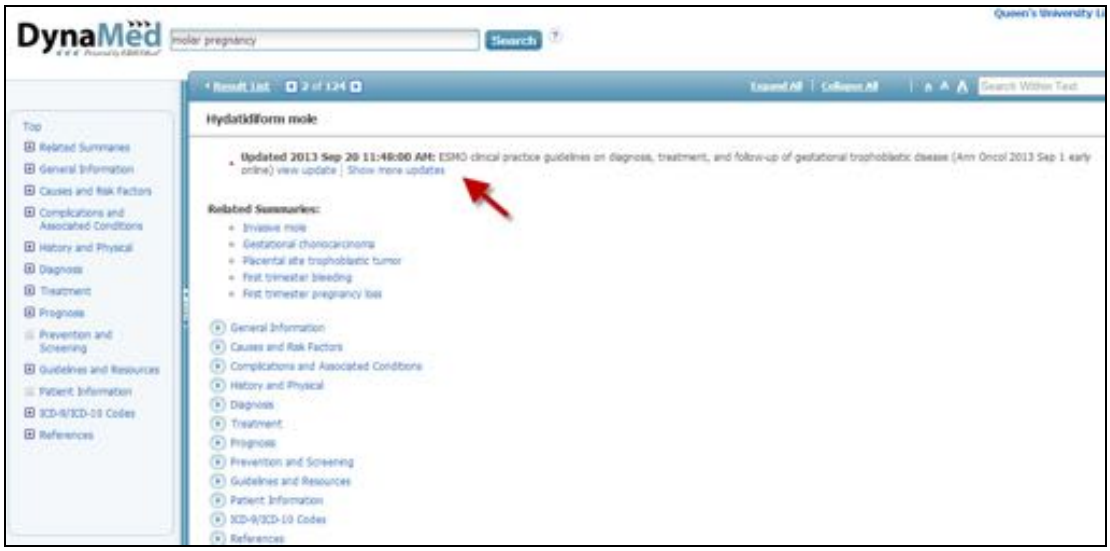
Checklist – Planning the Search
✓ Do we have expertise do conduct the search?
✓ Do we need additional training?
✓ Can we get the help of a health sciences librarian or information specialist?
✓ Do we need to pay for this service?
✓ How will we track the search?
✓ How will we track the resources used for the guideline project?
✓ Do we have access to a bibliographic management tool such as RefWorks?
✓ Do we need to purchase a bibliographic management tool?
✓ Who is going to be responsible for managing citations?
✓ Do we have expertise to use the bibliographic management tool?
✓ Do we have expertise in using spreadsheets to track decisions made regarding inclusion and exclusion of resources.

Molar pregnancy is not something Jessica knows a lot about. Jessica's decides to do some background reading on the topic. She consults some of her nursing textbooks but is concerned that the information is very dated. She begins Googling for information but she is overwhelmed by the information she is finding. Also, she is not 100% confident that she is finding the best information. She contacts her health sciences librarian, Tom. He identifies a number of sources she could use to help her better understand molar pregnancies including nursing textbooks and point-of-care tools.

Identifying Background Information

Regardless of the circumstance, the search for evidence will often begin with the need to perform a background literature review to help update yourself and colleagues on current research on the topic. Background research will also help identify alternate terms or names for the concept that you researching. Good sources for background information include textbooks and point of care tools, such as DynaMed™ that are available through online sources (see Figure 1 [Web.b.ebscohost.com, 2014]. A good place to start identifying these resources is virtual library of your healthcare facility.

Figure 1: Screen capture of a search result in DynaMed



Jessica starts with reading a couple clinical summaries from point-of-care tools. At the hospital where she works, they subscribe to two: DynaMed™ and BMJ Best Practice™. The summaries from DynaMed™ and BMJ Best Practice™ both lead her to several existing clinical practice guidelines. She also learns that Molar Pregnancy is often found in textbooks or guidelines related to "Gestational Trophoblastic Neoplasms" and will want to keep that alternate name for future reference in her searching. Some other tools, among others, that might be available to you are UpToDate® The Joanna Briggs Institutes web portal on OVID or ACP Smart Medicine℠.

She also reads a chapter from a current nursing textbook, Chapter 11 from Patient Care Standards: Collaborative Planning & Nursing Interventions, 7th ed., which is available to her through Mosby's Nursing Consult.

Table 3: Checklist for Identifying Background Information

Checklist – Identifying Background Information
✓ Do we know enough about the topic?
✓ Is our knowledge of the topic current?
✓ Do we need to do some background reading to update our knowledge?
✓ What resources are available that will help us to update our knowledge about the topic?
✓ Have we contacted our health sciences librarian for suggestions?

Locating Guidelines

After reading some background material, Jessica's decides her next step is to find evidence-based guidelines on molar pregnancies, Jessica is not sure how to do this and begins Googling for guidelines but she is overwhelmed by the information she is finding. Also she is not 100% confident that she is finding the best information. Jessica contacts Tom for help. Tom suggests she start her search by looking at guideline clearing houses and points to several useful sources, including the national guideline clearing house and International Guideline Library.

Guidelines can be located through a variety of resources. A guideline clearinghouse provides information on published guidelines from guideline producers. They may or may not have the full text of the guidelines available, but will either provide links to the guidelines or citation information so you can obtain copies.

Guideline clearing houses are specific to identifying guidelines. Searching a guideline clearing house is often easier than searching bibliographic databases such as PubMed®, as it is likely a much smaller database with far fewer records. Keyword searching usually does create an unwieldy number of results. PubMed® identifies a number of publication types in addition to clinical guidelines and contains over 23 million records. By contrast the MIDIRS database, a midwifery database produced by The National Childbirth Trust, has only about 200,000 records (http://www.midirs.org/our-services/reference-database-rd-online/ date accessed August 4th, 2014).

National Guideline Clearing House

One well known guideline clearinghouse is the National Guideline Clearinghouse (NGC) available at www.guideline.gov (Guideline.gov, 2014). The NGC is considered a public resource for evidence-based practice guidelines produced and maintained by the Agency for Healthcare Research and Quality (AHRQ), part of the US Department of Health and Human Services. While it is an American organization, guidelines are included are from all over the world.

Beginning from 2014, guidelines that are submitted to the NGC must meet strict criteria to be included. For example, they must include recommendations for patient care that are specific and designed to assist healthcare practitioners in clinical decision making. The systematic review that informs the clinical practice guideline must be explicit in the search strategy used, the inclusion and exclusion criteria for studies, the number of studies retrieved and included, and a synthesis of the evidence and a summary of that synthesis. NGC guidelines must be in English, have been conducted or reviewed within the past 5 years and produced by an organization not an individual (such as a medical specialty association, government agency, private funding organization, etc.).

Guideline developers submit their evidence-based guidelines to the NGC where searchable records are created that describe the guidelines and make it easier for users to search for and compare different practice guidelines on the same topic. NGC staff also regularly search bibliographic databases for published guidelines that meet their inclusion criteria.

The *Basic Search Help* (Figure 2 [Guideline.gov, 2014]) screen can help provide instructions on how to conduct a search employing such techniques as truncation, phrase searching and Boolean operators (Figure 3 [Guideline.gov, 2014]). You can also check the template of guideline attributes, to see how the AHRQ categorizes the guidelines they include in their database. These strategies can be used to maximize precision and recall. It is also possible to browse for guidelines by disease or condition. The National Guideline Clearinghouse uses the Medical Subject Headings (MeSH) classification. Additional information on keyword searching can be found on page 30.

Figure 2: Screen Capture of the NGC search results showing linkage between search terms and MeSH.

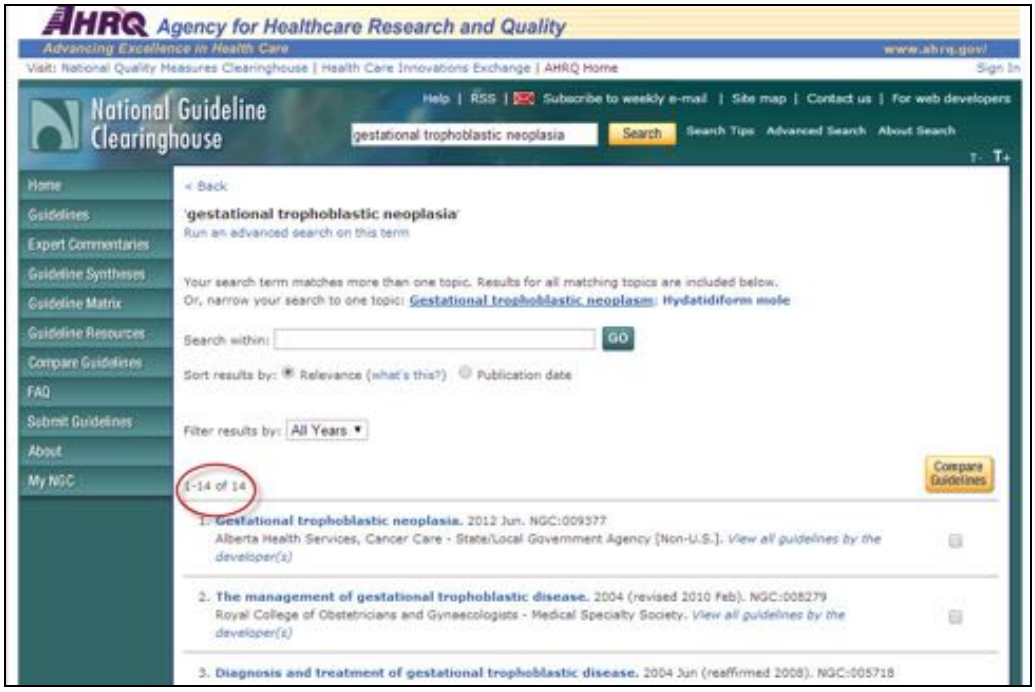


Figure 3: Screen Capture of the NGC search results showing narrowing of terms within a search.

Guidelines International Network

The Guidelines International Network (www.g-i-n.net) is another clearinghouse site for practice guidelines (Guidelines International Network. 2002. *welcome to G-I-N - Guidelines International Network*. [ONLINE] Available at: http://www.g-i-n.net/. [Accessed 14 July 14].). Unlike AHRQ's National Guideline Clearinghouse, it includes guidelines published in languages other than English. It is a not-for-profit charity and guidelines in their searchable database are those

produced by their member organizations. They also include additional information besides the guidelines, such as patient education materials and the systematic reviews on which the guidelines are based. Their guidelines have voluntary standards criteria.

While searching the database is open to anyone (Figure 4, (G-i-n.net, 2014)), viewing the records is only available to members. However, each entry gives a title, the date the guideline was published, the authoring organization and country and the current status of the guideline (such as, published, in development, planned, or under review) (Figure 5, (G-i-n.net, 2014)). This information is usually sufficient to find the document on the publishing organization's website, or through existing publications. Like NGC, the database can be searched using both simple keywords and using a controlled vocabulary. G-I-N also uses MeSH. Additional information about Mesh can be found later in the following pages of this book.

Figure 4: Screen shot of the G-I-N search page with illustrative search terms.

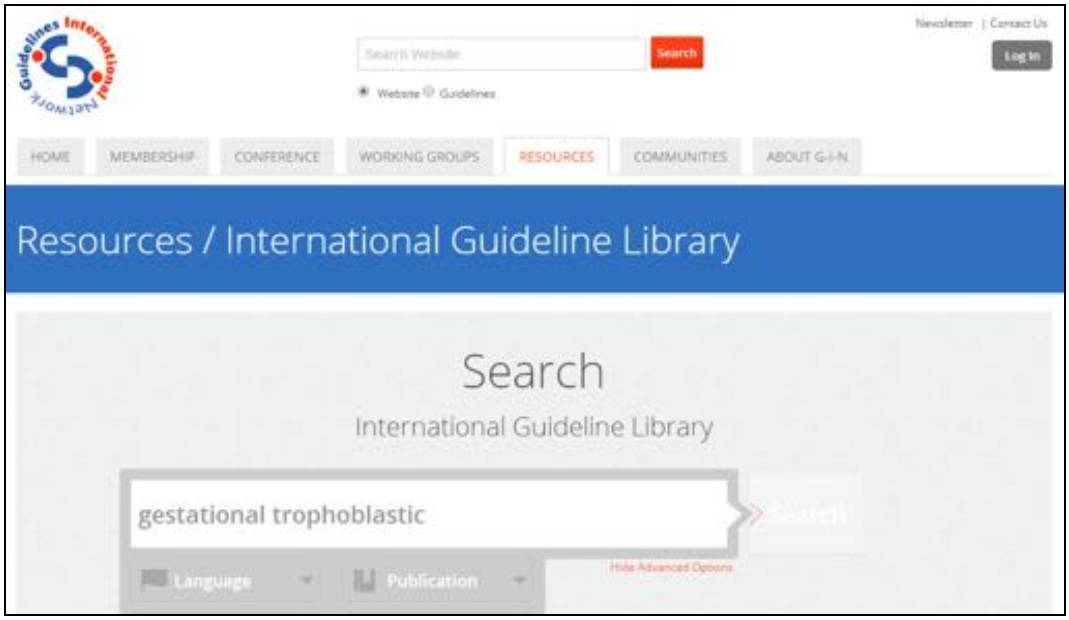


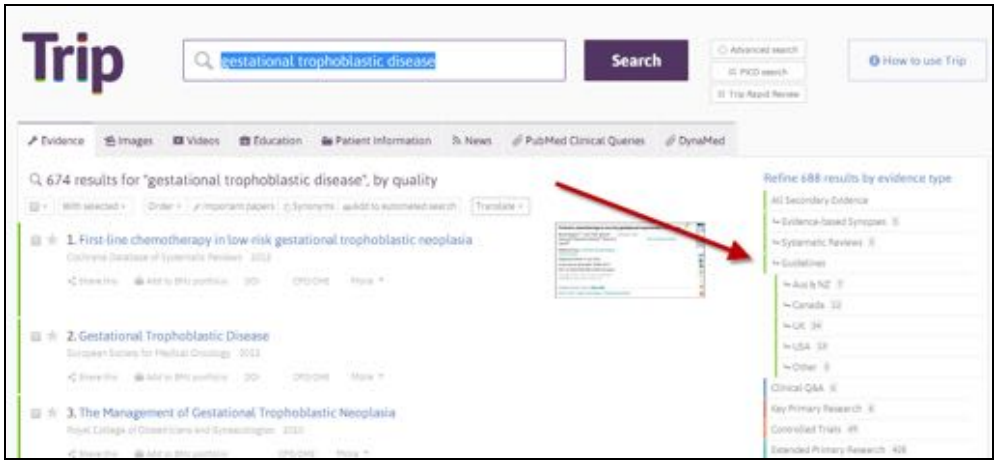
Figure 5: Screen shot of the G-I-N search page with results demonstrating the output from a search.

Searching the TRIP Database

The TRIP Database is another source for practice guidelines that is freely available on the web. TRIP (which originally stood for Turning Research Into Practice), is a private, not-for-profit company. The TRIP database has a simple interface with the ability to filter results by document type. Because it doesn't use a controlled vocabulary like the National Guideline Clearinghouse or G-I-N, it is best to search this one after you've established the possible search terms using the other two databases. Figure 6 (Tripdatabase.com, 2014) illustrates the key features of the search interface on the TRIP database.

TRIP also has an algorithm for search results that is described in the *ABOUT* page. Results are filtered by quality, so that articles from higher quality sources are higher placed than lower quality sources. Unfortunately, the creators of the site are not explicit in how quality is determined. However, if you're using the site to find practice guidelines only, that is not an issue as the quality of the guideline will be determined later.

Figure 6: Screen capture of the TRIP search interface and results layout.



Jessica visits the National Guideline Clearinghouse website, where she does two searches. The first is a simple keyword search using the term "molar pregnan*" (Fig 3). She's added the truncation symbol * to get any records with pregnant as well as pregnancy. Note that the guideline retrieved using Dynamed™ isn't here. What are some reasons it might not be here?

She then searches again by browsing the subject terms for gestational trophoblastic neoplasia. She gets a few more guidelines this way, saves both the search strategy and downloads her results so she can compare these guidelines later. Jessica goes to the Guidelines International Network and Trip database to see if she can find any additional practice guidelines.

At this time, Jessica feels she has exhausted the resources freely available on the web. Jessica has looked at the practice guidelines and has decided to take three of them back to her colleagues in the obstetrics department. Because she lives in Canada, she chose to bring the guidelines published in 2002 by the Society of Obstetricians and Gynecologists of Canada, even though these were the oldest guidelines found. She'll also bring the 2013 guidelines published by the European Society for Medical Oncology (ESMO), because those are the most recent and would provide a good comparison to the older Canadian guidelines and lastly, she'll bring the American College of Obstetricians and Gynecologists' guidelines published in 2004.

Table 4: Checklist for Correct Searching the Guideline Clearing House

Checklist Searching Guideline Clearing Houses
✓ Have we used the browse feature to identify guidelines?
✓ Have we used the advanced search feature to identify guidelines?
✓ Have we truncated keywords correctly?
✓ Are keywords spelled correctly?
✓ Have we combined terms with Boolean operators?
✓ Have we recorded our search strategy?
✓ Have we recorded the number of guidelines retrieved from each source?
✓ Have we noted the number of duplicate guidelines retrieved in our search history?
✓ Have we downloaded the actual guideline where possible?

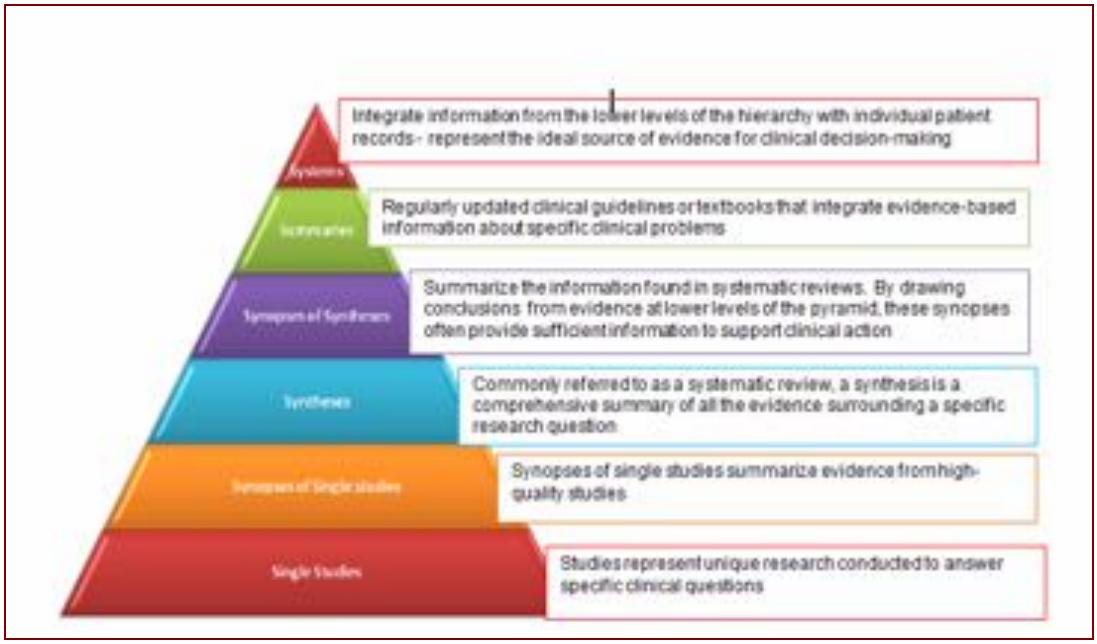
Updating Evidence with a Literature Search

Jessica meets with the practice team in obstetrics. Upon meeting with her colleagues, they would like her to do a literature search to find out what on the topic might have been done since the 2002 Canadian guidelines. They would also like to know what is new in the literature that might have informed the 2013 ESMO guidelines and are they relevant to their situation. Jessica is not sure how she will go about completing a literature search to update the evidence. She decides to contact Tom for help. He suggests that she takes a course that he is teaching next week on search techniques for evidence-based practice. Jessica signs up for the course. At the beginning of the course Tom introduces is the concept of the evidence pyramid and formulating the literature search question.

Evidence Pyramid

Oftentimes, once a guideline has been identified for adoption or adaptation, it will still be necessary to update the evidence with additional literature searches that look for recent evidence related to the guideline topics. The highest levels of evidence should first be considered when updating evidence and usually systematic reviews, randomized controlled trials or clinical trials. Another example of updating the evidence might be to look for specific studies done in your population group. The types of evidence that will be used to update or adapt a guideline will usually be decided on by the group updating or adapting the guideline and should be documented (see Figure 7).

Figure 7: The Hierarchy of Evidence Pyramid.



Formulating the Question for a Literature Search

Structuring the Question

There are benefits to structuring your question prior to beginning your search, even if your question seems relatively straightforward. Structuring the questions helps to point you in a specific direction. In the action of thinking about what your question really includes, you will be thinking about what types of literature might contain the answer to your question – having a structure for your question in advance makes it easier to do this. Lastly, by having a clear question structure, you'll be in a better position to evaluate the results you retrieve. You'll have a better understanding of why the results list included some documents and not others, why certain results should be included or excluded and ensure that everyone on the team is thinking along the same lines. There are a number of established ways of structuring a question for a literature search.

PICO

One of the classic ways of structuring a question and search is remembered by the mnemonic PICO. PICO stands for **P**atient/**P**opulation, **I**ntervention(s), **C**ontrol, **O**utcome(s) (Stone, 2002). The PICO mnemonic is useful for many types of clinical questions because all four of the attributes can be interpreted broadly. You can provide as much or as little detail as you like, depending on the needs of your question. However, not every type of question suits the PICO format well. There are other question structures with other mnemonics that can help to guide your search and help to define your information needs. Here are a few that you might want to consider:

PIPOH

PIPOH is similar to PICO, but places a greater emphasis on the healthcare setting. In this structure, the P, I and O are the same: **P**opulation, **I**ntervention(s) and **O**utcome(s). The second P stands for **P**rofessionals and includes what professionals might be involved in the care. The last is H for **H**ealthcare Setting. This might be type of facility, such as a long term

care home, or acute care (Lou & Durando, 2008). It might be the geographical setting, such as in an urban or rural area. An example of this type of question might be: Is a physiotherapist-led fall prevention program more effective than education upon discharge from acute care in decreasing the incidence of falls in elderly clients who live independently at home (Lou & Durando, 2008)? See Table 2.

Table 5: Example of PIPOH Mnemonic Being Operationalized

P = elderly clients **I** = fall prevention program **P** = occupational therapists **O** = reduction in number of falls **H** = acute care setting	Is an occupational therapist-led fall prevention program more effective than education upon discharge from acute care in decreasing the incidence of falls in elderly clients who live independently at home?

SPICE

SPICE is similar to PIPOH as it also emphasizes the healthcare setting in the question formulation. SPICE stands for **S**etting, **P**erspective, **I**ntervention, **C**omparison, and **E**valuation (Booth & Brice, 2003). It was designed to work with questions outside healthcare, particularly in evidence-based librarianship, although due to the more generic nature of the components it works well in many contexts. The other difference is in the perspective component which seeks to answer from whose perspective the evaluation will be conducted. An example SPICE question might be: In an online-only Master's degree program, do one-on-one tutorials in information literacy with students better serve the learning needs of the students compared with a group webinar, as measured by faculty (Booth & Brice, 2003). See Table 6.

Table 6: Example of SPICE Mnemonic Being Operationalized

S = online learning environment **P** = faculty perspective **I** = one-on-one tutorial **C** = group webinar **E** = higher facility with information literacy objectives	In an online only Master's degree program, do one-on-one tutorials in information literacy with students better serve the learning needs of the students compared with a group webinar, as measured by faculty.

PICO+

PICO+ is also very similar to PICO, but includes a parameter for the client's values or setting. In PICO+, the first four elements are the same as PICO. An example for this question might be: For a client with hypertension and a desire to reduce the number of medications currently being taken, does a monthly meeting with a dietician result in better adherence to the DASH (**D**ietary **A**pproaches to **S**top **H**ypertension) diet?" See Table 7.

Table 7: Example of PICO+ Mnemonic Being Operationalized

P = hypertensive patient **I** = monthly meeting with dietician **C** = current treatment **O** = better adherence to the DASH diet **+** = desire to reduce number of medications taken	For a client with hypertension and a desire to reduce the number of medications currently being taken, does a monthly meeting with a dietician result in better adherence to the DASH (Dietary Approaches to Stop Hypertension) diet?

PESICO

PESICO is very similar to PIPOH, as the ICO elements remain the same, while adding two new elements to consider the stakeholders and the environment in which the intervention is taking place. The elements are as follows: **P**erson/**P**atient/**P**opulation, **E**nvironment, **S**takeholders, **I**ntervention, **C**omparison, **O**utcome (Schlosser, Koul, & Costello, 2007). PESICO might be considered more complex than PIPOH and better suited for when either the stakeholder situation or environment is particularly complex or has multiple elements. An example of a PESICO question might be: In a 4-year-old child with autism and some vocal limitation skills in need of acquiring linguistic communication who is placed in a segregated preschool (disabled peers) seeking to move to an inclusive preschool (nondisabled peers) and whose preschool teacher and SLP are primarily concerned with communication, whereas his parents wish to enhance his speech as well will the use of certain AAC approaches in comparison to other AAC approaches enhance natural speech production while increasing communication skills (Schlosser, Koul, & Costello, 2007)? See Table 8.

Table 8: Example of PESICO Mnemonic Being Operationalized

P = 4-year-old autistic child **E** = inclusive preschool **S** = parents, speech language pathologist, preschool teacher(s) **I** = particular Alternative and Augmentative Communication approaches **C** = other Alternative and Augmentative Communication approaches **O** = improved communication (generally) and speech production (specifically)	In a 4-year-old child with autism and some vocal limitation skills in need of acquiring linguistic communication who is placed in a segregated preschool (disabled peers) seeking to move to an inclusive preschool (nondisabled peers) and whose preschool teacher and SLP are primarily concerned with communication, whereas his parents wish to enhance his speech as well will the use of certain AAC approaches in comparison to other AAC approaches enhance natural speech production while increasing communication skills?

In this example, especially as compared to the PIPOH example, the stakeholder and outcomes are particularly complex. We have multiple stakeholders: the parents, the speech language pathologist and the preschool teachers. Each of these stakeholders will be expected to participate in the intervention (AAC approaches), but has varying degree of facility with that intervention, so when deciding which articles to include we'll need to consider the role each of them play in providing that intervention. Lastly, we have differing outcomes: the parents wish to improve speech facility within an inclusive preschool setting, while the SLP and preschool teachers are more concerned with improving broader communication skills. All these complexities are captured in the complex PESICO framework.

ECLIPSE

ECLIPSE is a more dramatic departure from the PICO format. It works well with health policy or management questions. (Wildridge & Bell, 2002).

The components of an ECLIPSE question are: **E**xpectation, or what do you hope to do with the results of your query. For example, will this result in a policy change? **C**lient group, which can be individual patients or populations. **L**ocation, or where will the intervention or activity be taking place. **I**mpact, which is similar to outcome and looks at how success might be measured. This includes what **P**rofessionals would be affected by the change and **S**ervice, which would be the department or setting where the change will take place. There is no final E in the ECLIPSE model, but it is added to make the mnemonic easier to recall. (Wildridge & Bell, 2002).

An example of an ECLIPSE question might be: There is a lack of continuity of care in my area for people with head injuries who are discharged from hospital to the community rehabilitation service. I would like to improve the discharge procedure to avoid this problem. The service involves both community health staff and social services. Has anyone else experienced similar problems and how have they overcome them?" See Table 9.

Table 9: Example of ECLIPSE Mnemonic Being Operationalized

E = I would like to improve the discharge procedure for this client group **C** = persons with head injuries **L** = community care **I** = improved continuity of care, patient satisfaction, sense of teamwork among the professionals delivering the service **P** = hospital nurses and rehabilitation therapists and home care nurses and rehabilitation therapists **S** = Community rehabilitation service	There is a lack of continuity of care in my area for people with head injuries who are discharged from hospital to the community rehabilitation service. I would like to improve the discharge procedure to avoid this problem. The service involves both community health staff and social services. Has anyone else experienced similar problems and how have they overcome them?"

SPIDER

Another departure from PICO, the SPIDER framework for question development is designed to optimize retrieval of qualitative studies (Cooke, Smith, & Booth, 2012). The components of SPIDER are: **S**ample, **P**henomenon of **I**nterest, **D**esign, **E**valuation, **R**esearch type. Sample is somewhat similar to Patient or Population in PICO and refers to the sample population in the research studies and is reflective of the more limited size of study groups in qualitative research. PI is for Phenomenon of Interest, which also is more reflective of qualitative research designs than Intervention, as qualitative research may not be looking at explicit interventions *per se*. Design refers to research design and can include the theoretical framework in which the studies might have been conducted or other aspects of study design, for example, if focus groups are the means of data gathering or if feminist theory research is sought. Evaluation compares roughly to Outcome in the other question development frameworks and recognizes that in qualitative research outcomes are indeed sought, they may be broader in definition or subjective in nature. Lastly, Research Type is an optional component that can include searches for quantitative, qualitative or mixed methods research (Cooke, Smith, & Booth, 2012). An example of a SPIDER question might be: What are young parents' experiences of attending prenatal education? See Table 10.

Table 10: Example of SPIDER Mnemonic Being Operationalized

S = young parents **PI** = prenatal education **D** = questionnaires, focus groups, surveys, interviews, case studies, observational studies **E** = lived experience, opinion, attitudes, perception **R** = qualitative or mixed methods	What are young parents' experiences of attending prenatal education?

When trying to determine which question framework best suits your information needs, you can consider Table 11. You may also try one or two in a brainstorming session to see which fits better.

Table 11: Questions to Help Determine Information Needs

Is it a clinical question with immediate patient implications?	PICO
Are the patient values unique or particularly critical?	PICO+
Is the healthcare setting or context uniquely critical?	PIPOH
Is there are particular perspective from which you want to measure the outcomes?	SPICE
Is it a complex stakeholder situation?	PESICO
Is it a health policy or management question?	ECLIPSE
Is it best answered by qualitative research designs?	SPIDER

You might think about what kinds of research methods will be found in the studies you'll be looking at, such as whether they will mostly be quantitative studies like randomized controlled trials, or qualitative studies, such as those that use grounded theory. Structuring the question in this way also helps to build the literature search strategy. You'll be paying attention to what keywords and subject heading terms you'll want to use and what ones you want to exclude. This will also help to improve your retrieval when conducting the search.

Key Concepts and Boolean Operators

Once the health questions have been specified, it is important to examine the key concepts that are contained within each question. It is worth it to consider carefully each of these concepts and what is actually meant by them. This may seem evident in many questions, but when working with a large team, you'll be amazed at how often a concept may have many different meanings to people around the table.

In this instance, all the practice guidelines Jessica found were not specifically about molar pregnancy alone, but about the broader concept of gestational trophoblastic disease. When seeking to update the practice guidelines, are we interested solely in information related to molar pregnancies or would we be interested in looking at the broader concept? What exactly is included in therapy? Are there specific therapies we might wish to ensure are covered in our search?

Boolean operators are specific words that describe how you want to combine your search concepts and are based on the work by mathematician George Boole. Luke Mastin. 2010. *Boole - 19th Century Mathematics - The Story of Mathematics*. [ONLINE] Available at: http://www.storyofmathematics.com/19th_boole.html. [Accessed 07 July 14]. The three Boolean operators are OR, AND, and NOT. A logic grid demonstrating how Boolean operators bring terms and concepts together is illustrated in Table 12. A self-guided checklist of key issues to evaluate before finalizing a search strategy is provided in Table 13.

OR

Once you have identified the key concepts in the question, you will need to develop a list of alternative words that could be used to describe the concept(s). The collective experience of the group is useful for developing a list of synonyms or alternate concepts. The list of words should include alternate spellings, as well as other synonyms such as molar pregnancy / hydatidiform mole.

OR is used to combine two or more similar search concepts together, such as a search for (molar pregnancy) OR (hydatidiform mole) will retrieve records which contain either word or both words. These words may or may not be found adjacent to each other, or even in the same field in the database record. Brackets are used to group concepts together.

You will use the OR operator to search for all the subject headings and keywords you used to describe an individual concept. In the following example, you would tell the data base search engine to find all records that have the word molar pregnanc* or hydatifiform mole*. You should also consider truncation at the end of concepts to allow for alternative endings. Generally the truncation symbol is an * but it varies from database to database

AND

The Boolean operator AND is used to combine two or more different search concepts together, e.g., a search for (molar pregnancy) AND (guideline) will retrieve records which include both concepts molar pregnancy and guideline. These words may or may not be found adjacent to each other or even in the same field in the database record. If only one of those words is in the record, it will not be in included in your search results.

NOT

The Boolean operator NOT is used to exclude a search term. This can be useful for excluding a set of results that are not relevant to your topic, for e.g. searching for (guideline*) NOT (systematic review*) will take any records that contain 'systematic review*' in them and subtract them from your results. Note: When using NOT, be aware that you might unintentionally exclude articles that you may actually wish to include. Be very cautious when using this operator.

Limits

In addition to what kinds of research methods you would like to consider, you should also determine what types of limits you would like to apply to the search. Typical limits include gender, age, date of publication**,** and language**.**

Jessica invites Tom to meet with the practice group. Collectively they decide on the following the following question

What is the best **therapy** for women with a **molar pregnancy**?

Jessica suggests that they begin the search by looking for the highest level of evidence – systematic reviews followed by randomized clinical control trials. The group agrees.

Jessica highlights the key concepts in the question. Remembering what she learned in her search strategy course Jessica asks the group to brainstorm on alternate words for the key concepts in the question.

Tom suggests they consider what types of limits they might want to apply to the search such as gender or age. They decide they want to limit their search to only what has been published on therapies for molar pregnancies, not the larger concept of gestational trophoblastic disease at this time, because those would likely be referred to a larger oncology center. They also are only interested in articles published in English, because they don't have the resources to translate articles from other languages. Lastly, they only want articles published since the 2002 Canadian guidelines.

"Should we include limits on gender and age, or is that pretty obvious from the topic?" asks Jessica. The group weighs this opinion and decides not to limit to gender or age, because it would seem redundant.

"But we should probably limit to studies done in humans. I'm not sure if animals would have molar pregnancies, or if they'd be treated, but I suppose any mammal might have this issue." points out Dr. Claire.

After consulting the group Jessica feels she is ready to structure her search. Jessica uses a search strategy template to structure her search. She notes the limits discussed during the discussion with the practice group. She applies Boolean operators to structure her search in her template.

Table 12: Example of Boolean logic across search concepts and terms.

	AND			
OR	Key Concept 1	Key Concept 2	Key Concept 3	Key Concept 4
	Molar Pregnancy	Therapy	Female Humans of reproductive age	In English since 2002
	Definition	Definition	Definition	Definition
	"A rare form of gestational trophoblastic disease in which there is overproduction of chorionic villi normally destined to develop into the placenta." Includes both partial and complete moles. (Definition from Taber's Cyclopedic Medical Dictionary)	Any type of treatment, including but not exclusive to surgery, drug therapy, medical management, post-surgical rehabilitation, counseling, etc.	Adult Female Approximate age 15-50	Published in English since 2002. Research may have been conducted earlier.
	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms
	Molar pregnancy(cies) Hydatiform mole(s) Complete mole(s) Complete hydatidiform(s) Partial hydatidiform mole(s)	Drug therapy Drug Treatment Surgery Surgical treatment Counseling Post-abortive Counseling Genetic Counseling Etc.	Woman	X
	Truncation	Truncation	Truncation	Truncation
	(Molar or Mole*) pregnan* Hydatiform mol*	Therap* Treatment* Therap* Surgical Surger* Counsel* Psychotherap*	Adult* Wom*n Female* Adolescent* Young Adult*	X

Table 13: Checklist For Self-Screening Of Question Development And Design.

Structuring the Search Question Checklist
✓ Have we structured the question to identify key concepts?
✓ For each key concept have we identified alternative terms?
✓ Have we identified alternative spellings for each concept?
✓ Have we truncated our concepts correctly?
✓ Have we used the correct Boolean operators to structure our search question?
✓ Have we identified limits and applied them to our question?
✓ Has the group reached consensus on the key question, concepts and limits?

A Note on Systematic Reviews

A systematic review is a formalized literature review. It is an attempt to summarize all the available research on a chosen, predefined question, according to previously prepared criteria that have been developed in such a way to minimize bias. While bias can never be completely eliminated, methods used in systematic reviews have been created so as to reduce the chance for bias as much as possible. Unfortunately, systematic reviews have become a buzzword, and the term can be misused. Ideally, a high quality systematic review has been done in order to inform any clinical practice guideline. One of the key words in the phrase is "systematic": all steps of the review and all decision making must be recorded so the methods can be reproduced and are open to scrutiny from other academics and clinicians.

When searching for clinical practice guidelines, a search for systematic reviews is often done hand in hand. Three of the most well-known systematic review creators are the Cochrane Library, the Joanna Briggs Library and the Campbell Collaboration. Both the Cochrane Library and the Joanna Briggs Library are discussed in more detail elsewhere in this document. The Campbell Collaboration is a research network that produces systematic reviews of the effects of social interventions, the methods are based upon Cochrane systematic review methodology, (Bjørn Tommy Tollånes. 2008. *About US: The Campbell Collaboration*. [ONLINE] Available at: http://www.campbellcollaboration.org/about_us/index.php. [Accessed 07 July 14]). Much in the same way that Cochrane and Joanna Briggs seek to deliver the best available evidence for healthcare interventions, the Campbell Collaboration does the same for social issues, such as criminal justice, education and social welfare interventions. Some examples of recent reviews they have published reveals the scope of their work:

- *Kinship Care for the Safety, Permanency, and Well-Being of Children Removed from the Home for Maltreatment: A Systematic Review (Winokur, Holtan, & Batchelder, 2014)*,
- *Home Visits for Prevention of Impairment and Death in Older Adults: A Systematic Review (Grant, Parsons, Burton et al, 2014),*
- *Forensic Nurse Examiners versus Doctors for the Forensic Examination of Rape and Sexual Assault Complainants: A Systematic Review (Toon & Gurusamy, 2014).*

If your topic is likely to have important social service implications, you will want to consider searching the Campbell Collaboration as well as the Cochrane and Joanna Briggs Libraries.

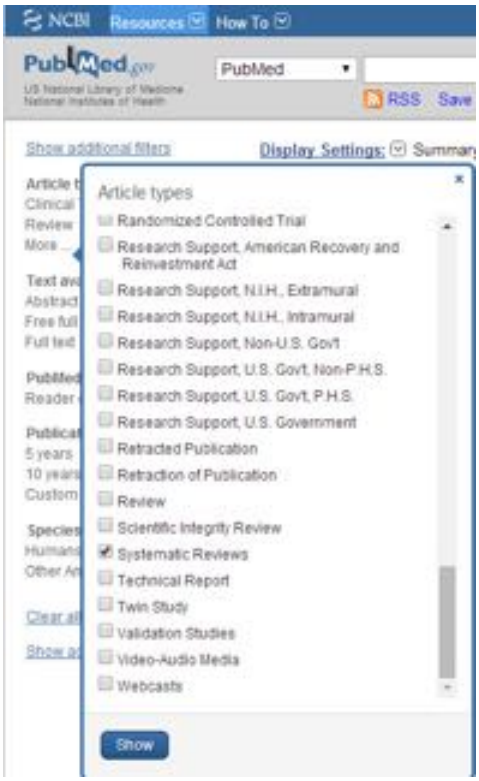
Several bibliographic databases, such as Medline© and Embase©, among others, have an option to limit your search to systematic reviews or reviews. It is not always clear how they

define that term or what you'll be getting when you use them, so you'll want to still perform your own quality check. Some questions to ask when reviewing a systematic review (Lau et al., 2014):

- Who is on the systematic review team? The Institute of Medicine has developed standards for systematic reviews that suggests a minimum of three persons on every systematic review team: a subject specialist, which changes depending on the topic at hand; an expert searcher, such as a librarian and; an expert in research methodology, both systematic review methods and either quantitative or qualitative research depending on the type of review. Most reviews will have much larger teams than that. Certainly any systematic review with only one author is suspect, as it is unclear how selection bias was avoided (Lau et al., 2014).
- Is the systematic review protocol publically available and has it been peer reviewed? A systematic review protocol should include many details about how the review is to be conducted, what databases will be searched and how they will be searched, what the inclusion and exclusion criteria are for items retrieved, whether it will be limited to the published literature and other information. The protocol should be published as a separate document so it can be reviewed prior to undertaking the review and so comparisons can be made between the protocol and the final document. Did the researchers set out to do what they planned to do (Lau et al., 2014)?
- Were the studies critically appraised prior to inclusion? How? What steps have been taken to minimize the biased reporting of research results? Studies with positive outcomes are more likely to be published (Lau et al., 2014).

To find systematic reviews in many databases, you will find a limit under publication type. You can also do a keyword search for "systematic review." Examples of the limits by publication type and how they can be activated in Pubmed are illustrated in Figure 8 (Ncbi.nlm.nih.gov, 2014).

Figure 8: Image Taken from Pubmed as an Example of Publication Type Limit.



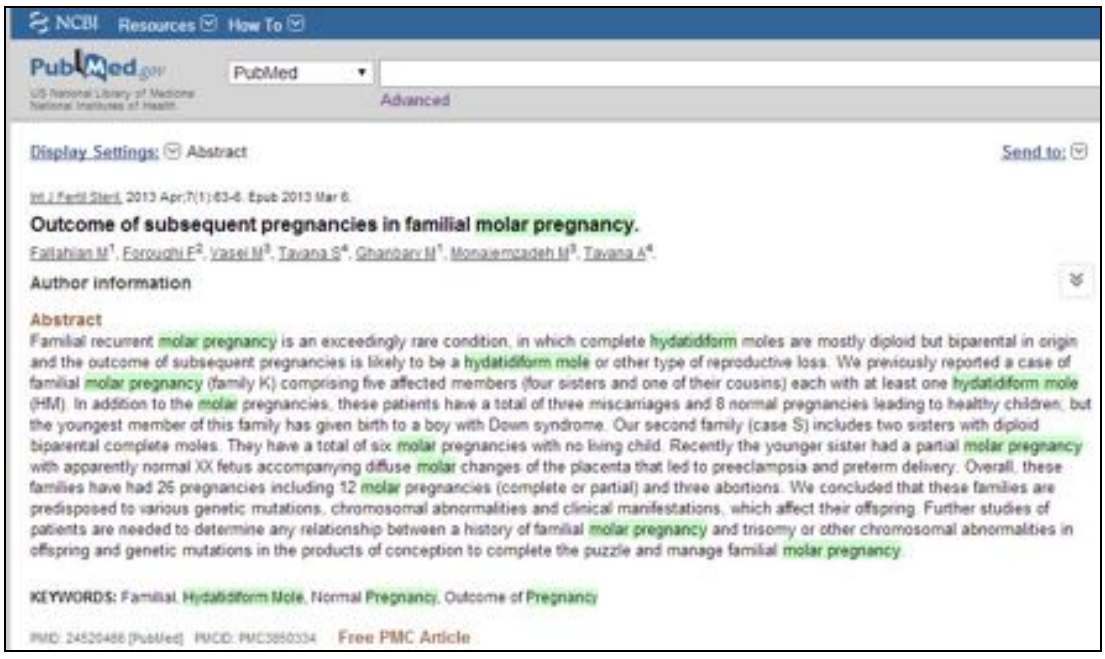
Searching Bibliographic Databases

Jessica is ready to conduct a search to find information to inform her guideline project. She decides she will begin the search by using the bibliographic databases identified during her course with Tom. Tom explained to her that she will be able to find some of the articles through her library but it other cases she may need to use the document delivery system to get the article. She reviews her notes about saving search strategies and results in order to make the search reproducible and transparent. Jessica decides to start her search with PubMed®. She also decides that she will supplement her search with other databases and the grey literature. Tom has agreed to review Jessica's search strategies and offer ideas during the process to improve recall and precision.

Bibliographic Databases

Bibliographic databases are collections of records. Each record in the bibliographic database describes a particular item (eg. an article published in a journal, an abstract from a conference proceeding, a patient education pamphlet, an editorial opinion in a newspaper, etc). Pubmed® is an example of a bibliographic database. While PubMed® is freely available, most other bibliographic databases require a subscription, figure 9 (Ncbi.nlm.nih.gov, 2014) illustrates the layout of a Pubmed® citation. You also will likely need a subscription to view the full text of any records that are found. Your local health sciences library will often provide access to subscription-based bibliographic databases.

Figure 9: Search result from Pubmed® showing the citation and abstract layout.



Each record in a database is broken down into fields where each field describes something about the individual item such as its authors and title. This is often called the metadata. Because databases are organized into these fields for easy access and retrieval, they have powerful capabilities for searching. For example, you can search for the author's name, or by the title, or by the major subjects discussed in the article. Figure 10 (Ncbi.nlm.nih.gov, 2014) below illustrates what the record above looks like with all the metadata.

Figure 10: Illustration of Pubmed® metadata for a citation.

```
PMID- 24520466
OWN - NLM
STAT- PubMed-not-MEDLINE
DA  - 20140212
DCOM- 20140212
LR  - 20140214
IS  - 2008-076X (Print)
IS  - 2008-0778 (Linking)
VI  - 7
IP  - 1
DP  - 2013 Apr
TI  - Outcome of subsequent pregnancies in familial molar pregnancy.
PG  - 63-6
AB  - Familial recurrent molar pregnancy is an exceedingly rare condition, in which
      complete hydatidiform moles are mostly diploid but biparental in origin and the
      outcome of subsequent pregnancies is likely to be a hydatidiform mole or other
      type of reproductive loss. We previously reported a case of familial molar
      pregnancy (family K) comprising five affected members (four sisters and one of
      their cousins) each with at least one hydatidiform mole (HM). In addition to the
      molar pregnancies, these patients have a total of three miscarriages and 8 normal
      pregnancies leading to healthy children; but the youngest member of this family
      has given birth to a boy with Down syndrome. Our second family (case 8) includes
      two sisters with diploid biparental complete moles. They have a total of six
      molar pregnancies with no living child. Recently the younger sister had a partial
      molar pregnancy with apparently normal XX fetus accompanying diffuse molar
      changes of the placenta that led to preeclampsia and preterm delivery. Overall,
      these families have had 26 pregnancies including 12 molar pregnancies (complete
      or partial) and three abortions. We concluded that these families are predisposed
      to various genetic mutations, chromosomal abnormalities and clinical
      manifestations, which affect their offspring. Further studies of patients are
      needed to determine any relationship between a history of familial molar
      pregnancy and trisomy or other chromosomal abnormalities in offspring and genetic
      mutations in the products of conception to complete the puzzle and manage
      familial molar pregnancy.
FAU - Fallahian, Masoumeh
AU  - Fallahian M
AD  - Department of Obstetrics and Gynecology, Infertility and Reproductive Health
      Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
FAU - Forughi, Forough
AU  - Forughi F
AD  - Department of Pathology, Shahid Beheshti University of Medical Sciences, Tehran,
      Iran.
FAU - Vasei, Mohammad
AU  - Vasei M
AD  - Department of Pathology, Tehran University of Medical Sciences, Tehran, Iran.
FAU - Tavana, Shahrzad
AU  - Tavana S
AD  - Department of Natural Sciences, University of Texas, Austin, USA.
FAU - Ghanbary, Maryam
AU  - Ghanbary M
AD  - Department of Obstetrics and Gynecology, Infertility and Reproductive Health
      Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
FAU - Monajemzadeh, Maryam
AU  - Monajemzadeh M
```

Bibliographic databases can be used for several useful purposes, including identifying background information, such as review articles. You can also use them to find guidelines published in established journals. When adapting guidelines, bibliographic databases may also be consulted to locate current evidence to update existing recommendations. You will also want to look at bibliographic databases when your patient's preferences or values do not match those of the guidelines, when patients have multiple co-morbidities not taken into account in the guideline development, or if the recommendations do not meet your criteria.

Other bibliographic databases besides PubMed® exist, and should be searched as well to ensure you have been thorough. Which ones you choose will depend both on your topic of interest and on the availability of database subscriptions at your institution. What follows is a listing of several of the most common databases and a description of their contents. You can use many of the same techniques to search these databases. They will often have their own

terminology and have varying degrees of ability to refine the search. They are also often available on more than one platform, which means that there may be features of the platform that allow you to refine your search in different ways. You can check the user manual for each one for more details, or ask assistance from your librarian.

Those that may be used during guideline adaptation will depend on the topic of the guideline, availability and access to specific databases, and the time and resources and available to you. Your health sciences librarian can assist in determining what is available to your group in terms of licensed databases and journals.

The Cochrane Library

The Cochrane Library is more than just systematic reviews. It is a collection of five databases, including the Cochrane Database of Systematic Reviews. This database is a continually updated collection of systematic reviews and systematic review protocols published by the Cochrane Collaboration. The Database of Abstracts of Reviews of Effects (DARE) consists of structured abstracts of systematic reviews published outside the Cochrane Collaboration. These structured reviews include both a summary of the review itself as well as a statement about the quality of the review. The Cochrane Central Register of Controlled Trials contains information about controlled trials as described in the published journal literature. These abstracts come from either PubMed® or Embase©. The Health Technology Assessment Database© is a collection of these types of documents that measure the overall impact of new health technologies. Information for this database comes from International Network of Agencies for Health Technology Assessment (INAHTA). HTAs are usually conducted by government agencies. Lastly, the NHS Economic Evaluation Database© contains economic evaluations for the NHS in the UK. The economic evaluations included are global.

Joanna Briggs

The library of content available from the Joanna Briggs Institute© includes several types of documents. Systematic reviews and systematic review protocols are the plans for conducting a review as well as the completed review. Evidence summaries and evidence-based recommended practices condense current international research, usually on a particular procedure or practice. Also available are best practice information sheets and consumer information sheets. These are condensed documents that provide a brief summary of the available research on a topic, designed with either the front line healthcare professional or the patient or family member in mind. These documents can be particularly helpful when conducting training and a shorter version of a review is required.

Embase©

Embase© is a medical database developed by the for-profit company Elsevier. It covers a wide range of journals in the biomedical sciences and is particularly useful for locating drug information, as it indexes many drug journals not covered by PubMed®. Also, it uses a more focused terminology for many drug terms, compared with PubMed®, for example, allowing you to differentiate by routes of drug administration (for example, orally or intravenously). Embase© indexes conference proceedings as well as journal articles, which are not covered by PubMed®. According to their website, approximately 20% of the content is unique to Embase©, although this number may be greater depending on the topic of interest.

CINAHL®

CINAHL® stands for the Cumulative Index of Nursing and Allied Health Literature. Originally produced by a private company in California, it was bought by EBSCO in 2003. CINAHL® indexes close to 3,000 English-language journals covering nursing, biomedicine, health

sciences librarianship, alternative/complementary medicine, consumer health and 17 allied health disciplines (e.g. respiratory technology, x-ray technology, etc.). In addition to journal articles, CINAHL® indexes healthcare books, nursing dissertations, selected conference proceedings, standards of practice, educational software, audiovisuals and book chapters. CINAHL® also uses its own terminology for indexing articles which is more sensitive to nursing and allied health topics. For example, while PubMed® has a subject heading for Nurse Practitioners, it places all nurse practitioners in the same category. CINAHL® allows you to choose from the broader category as well as: Acute Care Nurse Practitioners, Adult Nurse Practitioners, Emergency Nurse Practitioners, Family Nurse Practitioners, Gerontologic Nurse Practitioners, OB-GYN Nurse Practitioners, Pediatric Nurse Practitioners, or Neonatal Nurse Practitioners. There are several different versions of CINAHL®, with varying degrees of full text access depending on price point, so it is difficult to determine exactly how much overlap there is with PubMed®.

PsycInfo®

Produced by the American Psychological Association, PsycInfo® is a database that focuses on psychological topics, as well as any behavioural aspects of disease. It indexes approximately 2500 journals, as well as books, book chapters, dissertations, and technical reports. Like CINAHL® and Embase©, it uses its own thesaurus to index topics with unique features for searching this subject area. For example, it has a tests and measures field, so if you wanted to find studies that used the Edinburgh Postnatal Depression Scale test, you would be able to search in that way. PsycInfo® is also one of the oldest databases, with coverage going back as far as the 1880s.

Global Health©

Global Health© is a public health database, produced by the not-for-profit Commonwealth Agricultural Bureaux International (CABI). Unlike PubMed®, Global Health© places an emphasis on non-English language publications, particularly from the developing world. It has an emphasis on subject areas such as communicable diseases, parasitology, impact of agriculture on health and other topics. According to their web site, 60% of the content is unique to their database. In addition to journal articles, Global Health© indexes conference proceedings, government documents and other grey literature, and books.

Web of Science®

Web of Science® is a large database consisting of five components, which can be searched separately or together. These include three journal citation indices divided by discipline: the Science, Social Science and Arts & Humanities Citation indices. There are also two conference proceeding citation indices, also divided by discipline, one for pure sciences and one for social sciences. Dates for each of these databases vary. Some of the content for the science journal citation index comes from Medline©. It is produced by Thomson Reuters.

Scopus

Another large database of citations, Scopus claims to be the largest scientific bibliographic database, with 50 million records, regularly indexing 21,000 journals. It is produced by Elsevier. Close to half of that comes from patent documents. EMBASE© records are also included in Scopus.

Searching Pubmed®

PubMed® is an example of a bibliographic database with over 23 million records describing various items in journals that cover the field of biomedicine. You may also have access to

Medline at your institution, and it is available through multiple suppliers, so we will not go into detail on how to search it here, although many of these same concepts can be used when searching Medline as well. While these databases are slightly different, for most topics it is not necessary to search both. The bulk of citations contained in PubMed® are found in the Medline database as well (approximately 20 million of the 23 million records as of February 2014) (PubMed®, 2014). The National Library of Medicine (NML) describes what is found in PubMed® but NOT Medline©:

- In-process citations. Because every article is given a record before it goes through the NLM's quality control and indexing process, this means that records can be found in PubMed® that have not yet gone through this process. Some of these records will eventually get added to Medline© and have subject headings and other metadata added to the record. Some of these records will be determined to be out of scope, or be off topic for what is considered appropriate for Medline©, and will later be deleted.
- Citations to articles that are out-of-scope (e.g., covering plate tectonics or astrophysics) from certain MEDLINE© journals, primarily general science and general chemistry journals, for which only the life sciences articles are indexed with MeSH.

  Some journals have a broader scope than just what might be normally considered on topic for Medline©. In this case, citations for other articles within the journal would be included in PubMed®, but not Medline©.
- Ahead-of-Print citations that precede the article's final publication in a MEDLINE© indexed journal.

  Sometimes journals that publish online have articles that they call Ahead-of-Print. These articles might be published to the journal web page several months before appearing in the print edition. As an example, the article "Frequent emergency department use by individuals seeking mental healthcare: a systematic search and review." was published by the journal Archives of Psychiatric Nursing in their August 2013 issue, but was published on their website on April 17, 2013. For the period of April to August of 2013 the record would have been in PubMed®, but not Medline©.
- Citations that precede the date that a journal was selected for MEDLINE© indexing (when supplied electronically by the publisher).

  NLM has a rigorous selection process to determine which journals are included in their indexing and which are not. They do not want fly-by-night journals, journals that are off topic to their coverage areas or low-quality predatory publishers included. As such, some journals have been established for several years before they qualify to be included in Medline©. In this instance, the journal's back issues are not indexed for Medline©, but may be found in PubMed®, if the journal's publisher chose to send them records for those back issues.
- Pre-1966 citations that have not yet been updated with current MeSH and converted to MEDLINE© status.

  The PubMed® database was first created in 1996 as a way to put Medline on the internet, although Medline has been around since the 1960s and the practice of indexing and categorizing the medical literature began in the 1870s! Even as NLM staff are continuously adding new content to PubMed® and Medline©, they are also adding old content by creating records for historical articles, right now as far back as 1946. PubMed® currently contains some of these records which as of yet have not been given subject headings and indexed with the current terms.
- Citations to some additional life sciences journals that submit full text to PMC® (PubMed Central®) and receive a qualitative review by NLM.

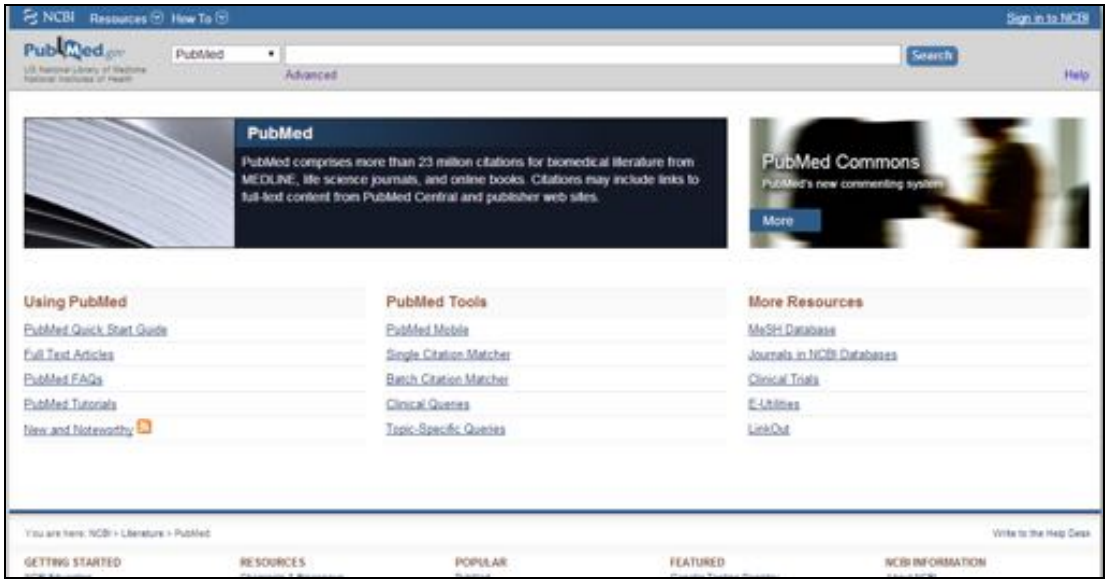
PubMed Central® is an online repository of approximately 3 million journal articles, created in 2000. PubMed Central® articles are free on the web. If an article is submitted to PubMed Central and is within the scope of PubMed®, it is included. As an example the article "Library Outreach to Support Groups: A Case Study" was published by the Journal of Hospital Librarianship in 2009. The Journal of Hospital Librarianship is not indexed in PubMed® / Medline©, but because this article was submitted to PubMed Central® (it was funded by an NIH Grant and is subject to the Open Access policy), you can find it in PubMed®.

- Citations to author manuscripts of articles published by NIH-funded researchers.

  This is another way that NIH funded researchers make their works freely available.
- Citations for the majority of books available on the NCBI Bookshelf (a citation for the book and in some cases each chapter of the book). Medline© does not include records for books, only journal articles.

In executing the search, we first tell the database to look for articles that contain each of the concepts that are present in our question, and by selecting Pubmed® as the searchable resource as per figure 11 (Ncbi.nlm.nih.gov, 2014). This will include finding the subject headings that the database uses to describe the term, as well as adding additional keywords to make the search as inclusive as possible and account for possible delays in indexing.

Figure 11: Pubmed® basic search home page.



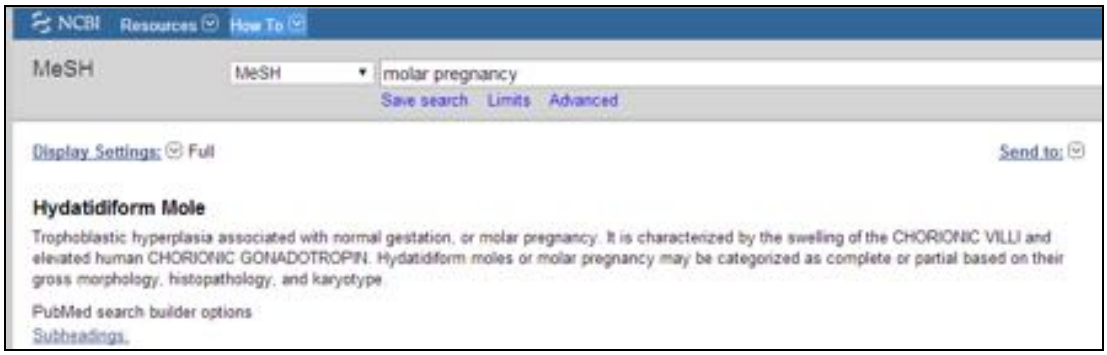
To identify potential subject headings:

Select MeSH in the search box, by clicking the drop down field as illustrated in figure 12 (Ncbi.nlm.nih.gov, 2014). Enter the first concept into the search box, in this case molar pregnancy.

Figure 12: Selecting MeSH to run a search of key concepts.

You will be presented with one or more subject headings to choose from that are potential matches.

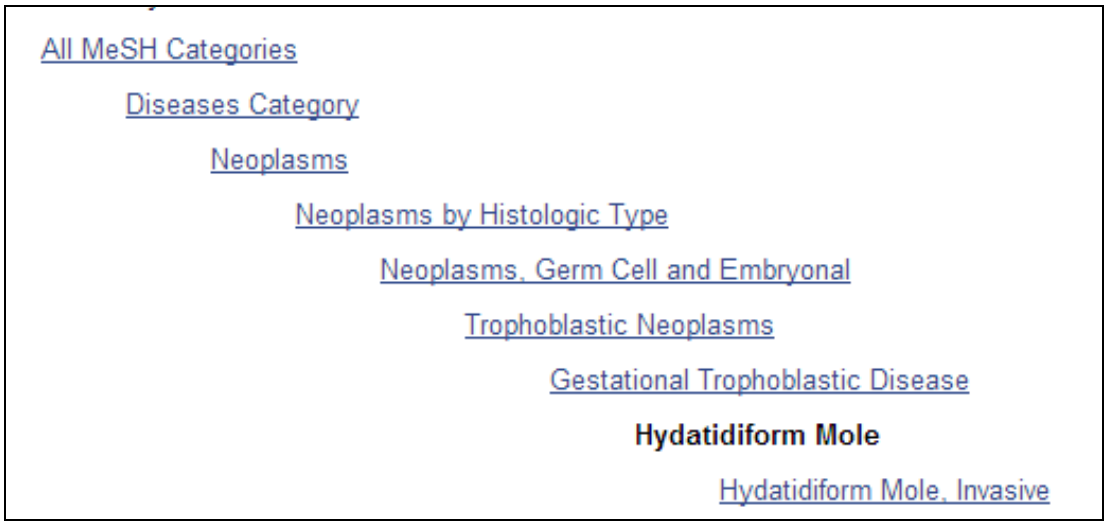
Figure 13: MeSH subject heading and term description



In this instance, as per figure 13 (Ncbi.nlm.nih.gov, 2014), we are presented with only one match, and it appears to be a clear synonym with our topic of molar pregnancy. If we scroll down a little further then the definition, we can see more information about the topic, including entry terms. These are the terms that the subject heading is used for when indexing the article. For example, we'll see molar pregnancy is the fifth term listed here, and this means that any articles about molar pregnancy are given the term Hydatidiform Mole instead.

One of the important but often overlooked pieces of information that is provided on the subject heading page is the MeSH Hierarchy, also called the tree structure or subject tree, as per figure 14 (Ncbi.nlm.nih.gov, 2014), the view of the MeSH Hierarchy can be considered 'tree-like' with branches of terms and concepts.

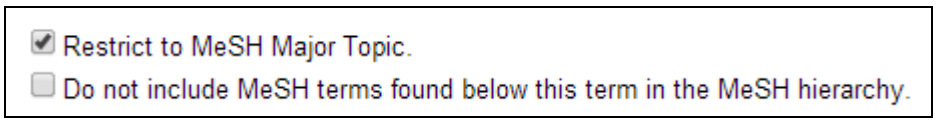
Figure 14: The MeSH Hierachy



The MeSH Hierarchy arranges subject headings from broader to more specific terms. In this example, the hierarchy indicates that **Hydatidiform Mole** is a more specific term than **Gestational Trophoblastic Disease**. Also, **Hydatidiform Mole**, Invasive is a more specific term than **Hydatidiform Mole**. You can go up or down the hierarchical structure to get to a more specific term or less specific term and either expand or reduce the number of articles retrieved. The default is to include any terms that are narrower than the one you've selected in your search, although you can turn this feature off with a checkbox. In this example, any articles about **Hydatidiform Mole** or **Hydatidiform Mole, Invasive** would be returned unless that feature is turned off. In our question, we are interested in invasive hydatidiform moles as well, so we will leave this box unchecked.

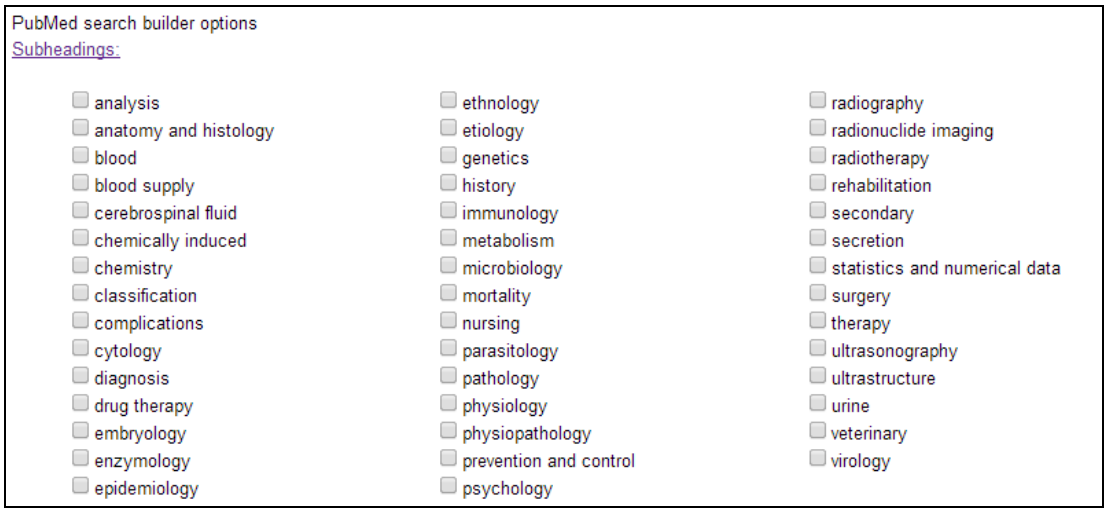
The subject heading page also provides us with an option to "Restrict to MeSH Major Topic" (see figure 15 for detail (Ncbi.nlm.nih.gov, 2014)). This means that only articles where this is the major topic would be included. While each article is given many subject headings that relate to what the article is about, only the most pertinent ones are given the designation of a major topic.

Figure 15: Applying limits by MeSH hierarchy



Subheadings are another option for refining your search (Figure 16(Ncbi.nlm.nih.gov, 2014)). Subheadings, also called qualifiers, are some of the most commonly searched concepts related to the particular topic you might be looking for. Not every subheading fits with every topic, but subheadings cross several different topics and are concepts that often come up over and over. For example, the subheading 'adverse effects' is common across many different medications and chemical compounds, and is given to any subject heading related to drugs or chemicals used in the intended way. This is different from the subheadings for 'poisoning' or 'toxicity' which would refer to medications or chemicals not used in the intended way!

Figure 16: Subheadings within Pubmed® that enable filtering of search results.



In this instance, subheadings work perfectly with our Key Concept 2 as several of them relate to treatment options. Because we did not specify what types of treatment we would be pursuing, in this example we would check any subheading that relates to treatment options, such as 'drug therapy', 'prevention and control', 'radiotherapy', 'rehabilitation', 'surgery' and 'therapy'. You would then choose to add to the search builder. The search builder shows the whole of the search strategy as you progressively add to it (see Figure 17 [Ncbi.nlm.nih.gov, 2014]).

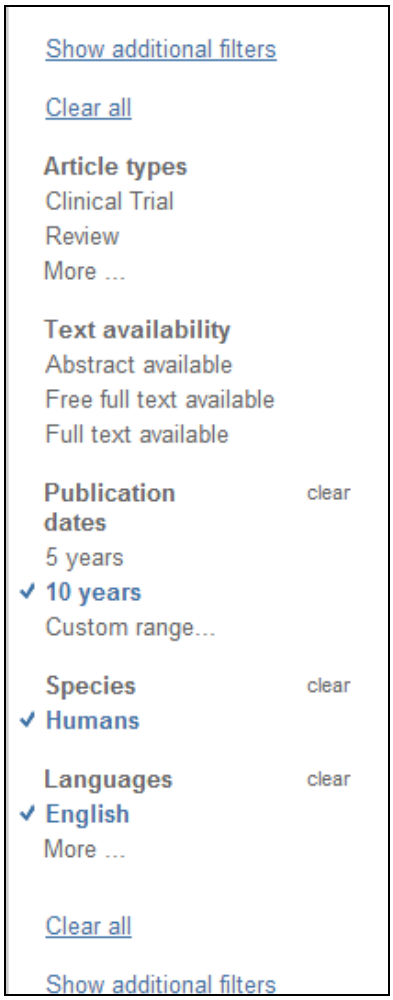
Figure 17: The results of a search in the Pubmed® Search Builder

There is also a YouTube Tutorial on searching which you can find linked from the search box.

Limits

Limits are also available to help reduce your numbers further to ensure that you are only retrieving the most relevant results. You can choose to add the limits before your search, or afterwards, where they are referred to as filters. Commonly searched limits / filters include age, language of publication, gender, and species. You can find the full list by selecting Show Additional Filters, on the left side of the search screen. As illustrated in Figure 18 (Ncbi.nlm.nih.gov, 2014), these basic limits are readily available inside the Pubmed® Interface.

Figure 18: Limits applicable to search strategies in the Pubmed® Interface.



We can then look at our table of key search concepts again and compare them to how the search was conducted. You can see the search details in the box (figure 19 [Ncbi.nlm.nih.gov, 2014]) on the right hand side. The search details box show which terms have been added, the level within MeSH they represent as terms, and how they have been combined with a Boolean operator.

Figure 19: The Search Details Field in Pubmed®, including example of terms and limits using MeSH headings.

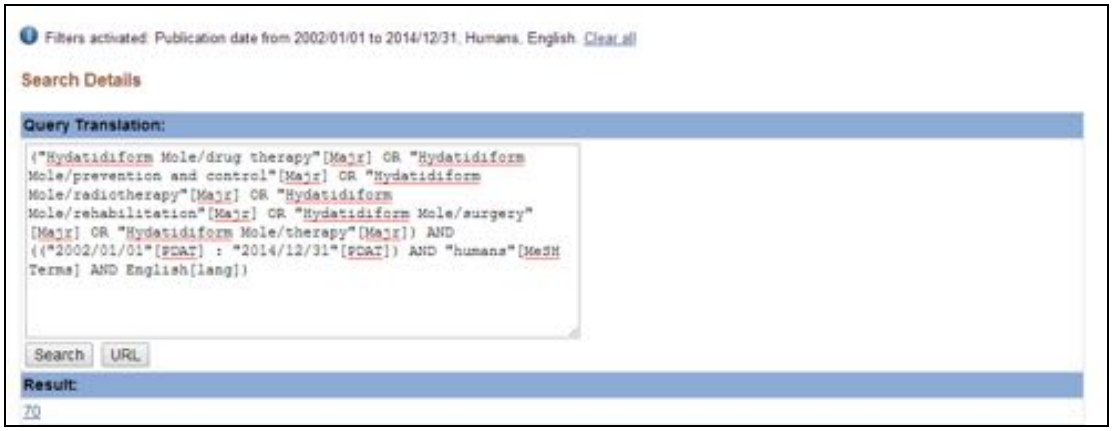
Let's break it down line by line and compare to our original key concepts table (Table 13):

Table 13: Worked Example of Boolean logic across search concepts and terms.

	AND →			
OR ↕	Key Concept 1	Key Concept 2	Key Concept 3	Key Concept 4
	Molar Pregnancy	Therapy	Female Humans of reproductive age	In English since 2002
	Definition	Definition	Definition	Definition
	"A rare form of gestational trophoblastic disease in which there is overproduction of chorionic villi normally destined to develop into the placenta." Includes both partial and complete moles. (Definition from Taber's Cyclopedic Medical Dictionary)	Any type of treatment, including but not exclusive to surgery, drug therapy, medical management, post-surgical rehabilitation, counselling, etc.	Adult Female Approximate age 15-50	Published in English since 2002. Research may have been conducted earlier.
	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms	Alternate Spellings / Synonyms
	Molar pregnancy(cies) Hydatiform mole(s) Complete mole(s) Complete hydatidiform(s) Partial hydatidiform mole(s)	Drug therapy Drug Treatment Surgery Surgical treatment Counselling Post-abortive Counselling Genetic Counselling Etc.	Woman	X
	Truncation	Truncation	Truncation	Truncation
	(Molar or Mole*) pregnan* Hydatiform mol*	Therap* Treatment* Therap* Surgical Surger* Counsel* Psychotherap*	Adult* Wom*n Female* Adolescent* Young Adult*	X

Remember the AND command is used to join to disparate concepts together, where both are required in the article. The OR command is used to join similar concepts, such as synonyms, or concepts where the presence of that specific term is not required. In this example, we are not interested in what type of therapy is being considered, only that it be one of them (e.g. "Either drug therapy *or* surgery must be discussed in the article, but it does not matter which of the two it is."). Our search strategy in Pubmed®, therefore presents as is illustrated in Figure 20 (Ncbi.nlm.nih.gov, 2014).

Figure 20: Illustration of completed search inclusive of Boolean operators, MeSH headings, and limits.



In Table 14 the search is exploded out using a line-by-line format, with color-coding to compare to our four color-coded concepts on the previous page, so it is easier to read:

Table 14: Expanded Illustration of Search terms and limits.

Search Query in Pubmed®	**Plain Language Translation:** **"I want all the articles…**
("Hydatidiform Mole/drug therapy"[Majr] OR	…about drug therapy for molar pregnancy
"Hydatidiform Mole/prevention and control"[Majr] OR	…or about the prevention and control of molar pregnancy
"Hydatidiform Mole/radiotherapy"[Majr] OR	….or about radiotherapy for molar pregnancy
"Hydatidiform Mole/rehabilitation"[Majr] OR	…or about rehabilitation for molar pregnancy
"Hydatidiform Mole/surgery"[Majr] OR	…or about surgery for molar pregnancy
"Hydatidiform Mole/therapy"[Majr])	…or about any other therapies I may not have specified above
AND (("2002/01/01"[PDAT] : "2014/12/31"[PDAT])	BUT, I only want them published between January 1, 2002 and December 31, 2014

AND "humans"[MeSH Terms]	..and I only want articles about humans
AND English[lang])	…and I only want them in English.

Jessica completes her search in PubMed®. She also decides that she will supplement her search with other databases and the grey literature. He helps her retrieve some of the articles that are not available. Jessica meets with the team throughout the search process to identify resources that are applicable to their question. Tom has agreed to review Jessica's search strategies and agrees her search has been exhaustive. Jessica saves the search strategy and documents the decisions of the group to ensure that the search had been transparent and reproducible. Table 15 summarizes the key considerations when searching bibliographic databases.

Table 15: Checklist of indicators for a complete search strategy.

Checklist Searching Bibliographic Database
✓ What bibliographic databases and guideline sources should we search?
✓ Do we have access to these databases?
✓ Have we checked with our local health sciences library?
✓ Do we know how to search the databases? Do we need training? What training is provided?
✓ Have we budgeted to search databases that are not freely available?
✓ Have we budgeted for retrieval of articles and guidelines that may not be freely available?
✓ Is there a medical librarian available to review our search strategies?
✓ Have we searched enough databases to make the search exhaustive?
✓ Have we used the database's controlled vocabulary if one exists?
✓ Have we used the explode feature if available correctly?
✓ Have we used keywords to describe our concepts?
✓ Are the keywords spelled correctly?
✓ Have we considered alternative spellings for our keywords (eg Canadian, USA and UKA English)
✓ Have we truncated keywords correctly?
✓ Have we combined term with Boolean operators correctly – using brackets where required?
✓ Have we used appropriate limits?
✓ Have we recorded the search strategies using a search strategy template?
✓ Have we recorded the number of citations retrieved?
✓ Have we saved the search strategy to the database itself?
✓ Have we recorded the decisions of the group regarding inclusion and exclusion of articles?
✓ Have we had an expert searcher, such as a medial librarian, review our search strategies?

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