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Evidence-Based Decision Making in Action: Part 1 - Finding the Best Clinical Evidence

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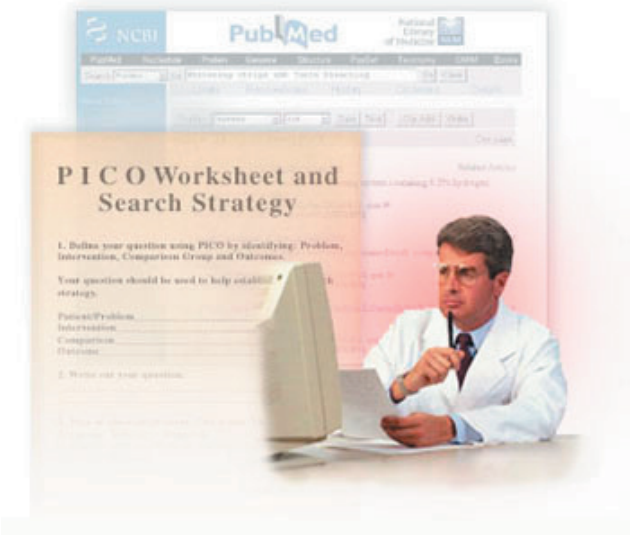

Abstract

The purpose of this article is to introduce evidence-based concepts and demonstrate how to find valid evidence to answer clinical questions. Evidence-based decision making (EBDM) requires understanding new concepts and developing new skills including how to: ask good clinical questions, conduct a computerized search, critically appraise the evidence, apply the results in clinical practice, and evaluate the process. This approach recognizes that clinicians can never be completely current with all conditions, medications, materials, or available products. Thus EBDM provides a mechanism for addressing these gaps in knowledge in order to provide the best care possible.

In Part 1, a case scenario demonstrates the application of the skills involved in structuring a clinical question and conducting an online search using PubMed. Practice tips are provided along with online resources related to the evidence-based process.

Keywords: Evidence-based decision making, evidence-based practice, MeSH, PubMed

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Introduction

It is important that clinical care decisions be supported by the best available scientific evidence in order to maximize the potential for successful patient care outcomes. Evidence has always contributed to clinical decision-making; however, with the proliferation of clinical studies and journal publications, keeping current with relevant research is nearly impossible. Because we rely on well-designed research studies to demonstrate the efficacy and effectiveness of diagnostic tests, treatment strategies, new materials, and products, the scientific literature is an essential component for "evidence-based decision-making" (EBDM) in clinical practice.

Based on the original definition of Evidence-Based Medicine (EBM),[1] the American Dental Association (ADA) defines "evidence-based dentistry" (EBD) as:

> an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to patient's oral and medical condition and history, with the dentists' clinical expertise and the patient's treatment needs and preferences.[2]

The current EBM definition is now stated as "the integration of best research evidence with clinical expertise and patient values,"[3] which explicitly recognizes the patient's role. Regardless of the definition used, the intent is that the use of current best evidence does not replace clinical skills, judgment, or experience but provides another dimension to the decision-making process that also considers the patient's preferences. (Figure 1)

Figure 1. Evidence - Based Descision Making Process

Translating this definition into action requires the following five steps:

1. Converting information needs/problems into clinical questions so they can be answered
2. Conducting a computerized search with maximum efficiency for finding the best external evidence with which to answer the question
3. Critically appraising the evidence for its validity and usefulness (clinical applicability)
4. Applying the results of the appraisal, or evidence, in clinical practice
5. Evaluating the process and your performance

The purpose of this article is to introduce evidence-based concepts and demonstrate how to find valid evidence to answer clinical questions. Steps involved in structuring a question and conducting the search will be outlined along with a discussion of the type of question and type of evidence for which you will be searching. A case scenario will demonstrate the application of the skills involved. Practice tips and learning activities are provided along with online resources related to searching the literature and levels of evidence.

Evidence Based Concepts

Understanding the basic concepts used in EBDM builds the foundation for developing the necessary skills needed to use the process. The following procedures provide an overview of the five steps and skills involved in establishing an evidence-based practice.

1. Converting information needs/problems into clinical questions so they can be answered

Patients have increasing access to medical and healthcare information on the Internet and are becoming more informed healthcare consumers. Therefore, the clinician's need to access new information and remain current with scientific findings is becoming more critical. The evidence-based approach guides clinicians in structuring well-built questions that result in patient-centered answers and can improve the quality of care and patient satisfaction.

Asking the right question is a difficult skill to learn, yet it is fundamental to evidence-based practice. The process almost always begins with a patient question or problem. A "well-built" question should include four parts, referred to as PICO that identify the patient problem or population (P), intervention (I), comparison (C), and outcome(s) (O).[4]

2. Conducting a computerized search with maximum efficiency for finding the best external evidence with which to answer the question

This type of search requires a shift in thinking. Often, especially now with fast web-based search engines, health professionals can look for "something" on a topic, a quick answer, or for "everything." Finding relevant evidence requires conducting a very focused search of the peer-reviewed professional literature based on the appropriate methodology.

Using an evidence-based approach recognizes that clinicians can never be completely current with all conditions a patient may have and provides a mechanism for addressing these gaps in knowledge in order to provide the best care possible. Online databases and software that enable quick access to the literature have made it easier to locate relevant clinical evidence.[5] Knowing what constitutes the highest levels of evidence and how to apply evidence-based filters and limits will let you search the literature with maximum efficiency.[6]

It is the combination of technology and good evidence that allows healthcare professionals to apply the benefits from clinical research to patient care.[5] When searching for evidence to answer a question or support decisions, it is important to not restrict the search to the literature within only one discipline. Looking at only "dental" literature would severely limit the resources available on a specific topic that may be well documented in the medical, educational, pharmacological, nursing, public health, or allied health literature.

To assist professionals in keeping up with the literature and in making it possible to quickly find needed information without leaving your location, online access to MEDLINE, provided by the National Library of Medicine (NLM), is now available. They also provide a free version of MEDLINE called PubMed that can be accessed at http://www.pubmed.gov.

What Constitutes the Evidence?

Scientific evidence is the product of well-designed and well-controlled research investigations. A single research study does not constitute "the evidence" but rather contributes to a body of knowledge that has been derived from multiple studies investigating the same area.[7] Thus, the body of evidence evolves over time as more research is conducted underscoring the importance of staying current with the scientific literature. Once synthesized, this evidence can help you make informed decisions about whether a method of diagnosis or a treatment/intervention is effective relative to other methods of diagnoses or to other treatment/interventions and under what circumstances.

The use of evidence in practice is not new. What is new is the nature of the clinical evidence itself in terms of the methods for gathering it [randomized controlled trials and other well-designed methods], the statistical tools for synthesizing and analyzing it [systematic reviews and meta-analysis], and the ways for accessing and applying it [electronic databases and EBDM].[8,9]

Levels of Evidence

Unfortunately, there is not one central repository for oral health information or quality evidence. Traditional sources of evidence include printed materials such as textbooks, personal journal collections, conference proceedings, and clinical guidelines, which may not be based on well-conducted research. Colleagues and personal experience are a predominant source of information for treatment decisions as well as those considered experts in the field.[10-12] As valuable as these sources are, scientific evidence supplements these components in the EBDM process. (Figure 1) Sources regarded as strong evidence include systematic reviews,

Figure 2. The Evidence Pyramid

individual randomized controlled trials (RCT), and well-designed non-randomized control studies. (Figure 2)[13]

The hierarchy of evidence is based on the notion of causation and the need to control bias.[14] The highest level of evidence or "gold standard" is the systematic review and meta-analysis [or more than one human RCT]. These are followed respectively by randomized controlled studies, cohort studies, case-control studies, to studies not involving human subjects.[13] Although each level may contribute to the total body of knowledge, "…not all levels are equally useful for making patient care decisions."[6] As you progress up the pyramid, the number of studies and correspondingly, the amount of available literature decreases, while at the same time their relevance to answering clinical questions increases. A graphical review of research methods and designs can be found at: http://servers.medlib.hscbklyn.edu/ebm/2100.htm.[13] Knowing which segment of the literature is appropriate for clinical decision-making and how to quickly retrieve this information is important to evidence-based practice.

3. Critically appraising the evidence for its validity and usefulness (clinical applicability)

Once you have found the most current evidence, the next step in the EBDM process is to understand what you have and its relevance to your patient and the PICO question. One resource available to critically appraise papers consists of a worksheet with a structured series of questions that can help you determine the strengths and weaknesses of how a study was conducted and how useful and applicable the evidence is to the specific patient problem or question being asked.[15] This will be discussed more fully in a subsequent article.

4. Applying the results of the appraisal, or evidence, in clinical practice; and 5. Evaluating the process and your performance

There are numerous ways EBDM can be incorporated into practical clinical situations. Using the EB process, you and/or your staff can be current with practice guidelines, statements and policies, support clinical decisions, answer patient questions, and explore alternative treatments, procedures, or materials. With an understanding of how to effectively use EBDM, practitioners can quickly and conveniently stay current with scientific findings on topics that are important to them and their patients.

Evidence-Based Decision-Making in Action

The PICO Process

The formality of using PICO to frame the question forces the questioner to focus on what the patient/client believes is the most important problem and the desired outcome. Doing this facilitates selecting language or key terms for conducting the computerized search,[6] the second step in the process. Next, it allows you to determine the type of evidence and information required to solve the problem and the outcome measures that will be used to determine the effectiveness of the intervention.

One of the greatest difficulties in developing each aspect of the PICO question is providing an adequate amount of information without being too detailed. Each component of the PICO question should be stated as a concise short phrase as illustrated in the following case example.

Case Example

Your new patient, Mr. Jim Logan, is a 48-year old marketing executive. His chief complaint is the/discoloration of his front teeth, which he feels is getting worse as he gets older. He would like them to be as white as they were when he was 25 and even brought in a picture to show you. He would like them whitened within three weeks before he attends his 30-year high school reunion. When reviewing his health history and behaviors, you learn that Mr. Logan is a coffee drinker and former smoker. Upon examination, you determine his only treatment needs are preventive care and suggest you re-evaluate the discoloration after that appointment since the stain could be due to both intrinsic and extrinsic factors. If additional treatment is needed, you can provide vital bleaching in the office or make him custom trays for use with an at-home whitening/bleaching system.

You present the bleaching procedure options and related fees to Jim. He questions you about the differences between them and the new whitening strips that do not require a tray and can be purchased at the local grocery store. Jim insists the whitening strips are just as effective and cost considerably less.

You are not familiar with the scientific literature on the whitening strips to answer Mr. Logan's questions thoroughly. You tell him you know the bleaching procedures you have suggested are safe, effective, and produce the desired outcomes in a relatively short period of time. However, you tell him you will be glad to investigate that option so each of you are fully informed about the pros and cons of each method before selecting a treatment. With the popularity of these treatment options and new products introduced quite frequently, this information will be a valuable addition to the evidence-based "library" you are creating in your office.

To find the answer, you must define Jim's question so it facilitates an efficient search of the literature. To guide this process, the PICO Worksheet and Search Strategyã form can assist you. (Table 1)

Applying the PICO Process

The first step in developing a well-built question is to identify the patient problem or population **[P]** by describing either the patient's chief complaint or by generalizing the patient's condition to a larger population. The problem is further shaped or refined by the most important characteristics that might influence the results such as:

* Disease or health status
* Age, race, gender, previous conditions, past and current medications1

In Mr. Logan's case, we know the chief complaint is **discoloration of his front teeth, which seems to be getting worse as he gets older**. We know that **coffee and tobacco** are contributing factors. So, in addition to the chief complaint, age, and current habits, previous behaviors may influence the decision as to which treatment might be most appropriate.

Identifying the Intervention **[I]** is the second step in the PICO process. It is important to identify what you plan to do for that patient. This may include the use of a specific diagnostic test, treatment, adjunctive therapy, medication, or the recommendation to the patient to use a product or procedure. The intervention is the main consideration for that patient.[4] In Mr. Logan's case, the intervention being considered is the whitening strips.

The third phase of the well-built question is the Comparison **[C]**, which is the main alternative you are considering.[4] It should be specific and limited to one alternative choice in order to facilitate an effective computerized search. The Comparison is the only optional component in the PICO question since oftentimes there may not be an alternative. In our case, we have selected the custom trays for at-home bleaching as the main alternative.

The final aspect of the PICO question is the outcome **[O]**. This specifies the result(s) of what you plan to accomplish, improve, or affect, and it should be measurable. Outcomes may consist of relieving or eliminating specific symptoms, improving or maintaining function, or enhancing esthetics. In Mr. Logan's case, you are finding evidence to demonstrate the effectiveness of each whitening/bleaching treatment under a given set of conditions, i.e., to best whiten his teeth within 3 weeks so they appear as white as they were when he was 25 years old.

Outcomes yield better search results when defining them in specific terms. "More effective" is not acceptable unless it describes how the intervention is more effective. For our example, more effective in whitening teeth within **three-weeks** is the desired outcome.

Structuring the PICO Question

After understanding the elements of PICO and identifying the patient's concerns, you are now ready to structure the PICO question

P = Patient Problem or Population

The first part of the PICO question begins with the following phrase: **For a patient with**… Inserting the patient's chief complaint or condition completes this phrase. Using the case for Mr. Logan, this phrase can be completed as follows: **For a patient with tooth discoloration due to coffee and tobacco**

I = Intervention

The main intervention being considered for Mr. Logan is whitening strips, so the question now reads: **For a patient with tooth discoloration due to coffee and tobacco, will whitening strips**

C = Comparison

The comparison phrase is stated "as compared to" the main alternative, which in this case is custom

Table 2. Completed PICO Worksheet and Search Strategy© for Mr. Logan's Case

P I C O Worksheet and Search Strategy

1. Define your question using PICO by identifying: Problem, Intervention, Comparison Group and Outcomes.

Your question should be used to help establish your search strategy.

Patient/Problem: _____
Intervention: _____
Comparison: _____
Outcome: _____

2. Write out your question: _____
_____
_____

3. Type of question/problem: *Circle one:*

Therapy/Prevention Diagnosis Etiology Prognosis

4. Type of study (Publication Type) to include in the search: *Check all that apply:*

❑ Meta-Analysis	❑ Systematic Review	❑ Randomized Controlled Trial
❑ Clinical Trial	❑ Practice Guideline	❑ Review
❑ Cohort Study	❑ Case Control Study	❑ Case series or Case Report
❑ Editorials, Letters, Opinions	❑ Animal Research	❑ In Vitro/Lab Research

Table 1. PICO Worksheet and Search Strategy© for Mr. Logan's Case (cont.)

5. List main topics and alternate terms from your PICO question that can be used for your search:

List your inclusion criteria -gender, age, year of publication, language:

List irrelevant terms that you may want to exclude in your search:

List where you plan to search, i.e. EBM Reviews, MEDLINE, AIDSLINE, CINAHL, PubMed:

trays for use with an at-home whitening/bleaching system. The question now reads: **For a patient with tooth discoloration due to coffee and tobacco, will whitening strips, as compared to custom trays for use with an at-home whitening/bleaching system,**

O = Outcome(s)
Mr. Logan's main concern is the discoloration of his teeth and having his teeth as white as they were when he was 25 years old within a 3 week period. The outcome(s) is then phrased as, **better whiten his teeth within 3 weeks.**

Based on these four parts, the final PICO question can be stated as: **For a patient with tooth discoloration due to coffee and tobacco, will whitening strips, as compared to custom trays for use with an at-home whitening/bleaching system, better whiten his teeth within 3 weeks?**

Following the PICO worksheet (Table 1), you would then identify the type of question and study and then list any additional terms or phrases related to the already identified P, I, C, and O. By generating these words, alternative key terms are identified that facilitate finding evidence to answer your question. For example, key terms that could be used in the search are 'tooth bleaching' or 'tooth whitening' or 'whitening strips' as well as 'hydrogen peroxide' or 'carbamide peroxide.' Also, your time will be used more efficiently by specifying terms prior to conducting a search. An example of a completed PICO worksheet for Mr. Logan's case is shown in Table 2.

Conducting an Evidence-based Search

Finding the Evidence - Where do I look?
There are two types of evidence-based sources: primary and secondary. Primary sources are original research publications. Secondary sources are synthesized publications of the primary literature, usually on specific topics or articles. Many of these secondary sources are being developed by evidence-based groups to quickly inform the busy practitioner on important issues. Table 3 lists sources of evidence and other online healthcare related resources.

Secondary Sources of Evidence

Systematic Reviews and Article Reviews
There are several groups, such as Cochrane and Bandolier that are developing systematic reviews. This source of evidence begins with a topic or question, and the authors systematically search, retrieve, appraise, and synthesize their findings based on primary literature. Systematic reviews follow strict guidelines that allow the process to be duplicated.

Evidence-Based Journals
Evidence-based journals are an emerging resource designed specifically to assist clinicians {e.g., Journal of Evidence-Based Dental Practice http://www.us.elsevierhealth.com/JEBDP/ and Evidence-Based Dentistry http://www.nature sj.com/ebd}. Depending on the journal, they provide concise and easy-to-read summaries of original and review articles or individual articles selected from the biomedical literature. A 1-2 page structured abstract along with an expert commentary highlighting the most relevant and practical information is generally provided. Unfortunately, the already appraised evidence does not cover many topics. In these cases, it is necessary to search for original studies most often found in scientific databases such as MEDLINE or PubMed
.

Clinical Practice Guidelines And Protocols
A helpful source of synthesized information on a specific topic is Practice Guidelines and Protocols. Prior to beginning a PubMed search it is often practical to identify a practice guideline or protocol. The ADA posts this information on their website, http://www.ada.org/. To find this source of evidence, click on Profession and select Professional Issues and Research. The ADA Guidelines, Positions, and Statements are posted here. The ADA Statement on The Safety of Home-Use Tooth Whitening Products, http://www.ada.org/prof/prac/issues/statements/whiten2.html -- is located under the category Tooth Whitening.

The ADA statement discusses two categories of whitening products:

1. Peroxide-containing whiteners or bleaching agents
2. Dentifrices only containing polishing or other chemical agents

Table 2. Completed PICO Worksheet and Search Strategy© for Mr. Logan's Case

P I C O Worksheet and Search Strategy

1. Define your question using PICO by identifying: Problem, Intervention, Comparison Group and Outcomes.

Your question should be used to help establish your search strategy.

Patient/Problem: Tooth Discoloration due to coffee and tobacco
Intervention: Whitening Strips
Comparison: Custom Trays for use with an at-home whitening/bleaching system
Outcome: Better whiten his teeth within 3 weeks

2. Write out your question: For a patient with tooth discoloration due to coffee and tobacco, will whitening strips as compared to custom trays for use with an at-home whitening/bleaching stystem, better whitten his teeth within three weeks?

3. Type of question/problem: *Circle one:*

Therapy/Prevention Diagnosis Etiology Prognosis

4. Type of study (Publication Type) to include in the search: *Check all that apply:*

☑ Meta-Analysis	☑ Systematic Review	☑ Randomized Controlled Trial
☑ Clinical Trial	☐ Practice Guideline	☐ Review
☐ Cohort Study	☐ Case Control Study	☐ Case series or Case Report
☐ Editorials, Letters, Opinions	☐ Animal Research	☐ In Vitro/Lab Research

Table 2. Completed PICO Worksheet and Search Strategy© for Mr. Logan's Case (cont.)

5. List main topics and alternate terms from your PICO question that can be used for your search:

Whitening Strips	
Tooth Whitening	
Tooth Bleaching	
Custom Tray Whitening/Bleaching	
Night Guard Bleaching	

List your inclusion criteria -gender, age, year of publication, language:	List irrelevant terms that you may want to exclude in your search:
English	Whitening/bleaching Dentifrice
1990 - Present	Whitening/bleaching toothpaste
Human Subjects	Whitening/bleaching mouthwash

List where you plan to search, i.e. EBM Reviews, MEDLINE, AIDSLINE, CINAHL, PubMed:

ADA Website	
PubMed	

However, their statement merely "advises patients to consult with their dentists to determine the most appropriate treatment," and does not provide a practice guideline or specific policy. Therefore, a more thorough search of the scientific literature is necessary.

Secondary Sources of Evidence

Searching with PubMed and Understanding its Key Features

The focus will be on presenting the steps involved in conducting a search using PubMed. As previously mentioned, it is provided free by the National Library of Medicine and can be accessed directly from your office or home at http://PubMed.gov.

Understanding how PubMed is structured and its features will help you search the literature with maximum efficiency. PubMed has an online Tutorial that walks through all the steps of a search and explains each PubMed feature and tool so users understand the language or how information on the database is indexed http://PubMed.gov. For example, PubMed and MEDLINE use MeSH (**M**edical **S**ubject **H**eadings) Vocabulary as the indexing language and have a MeSH browser that allows you to identify the appropriate terms for how articles are indexed on a specific topic. By opening this browser, you can enter a text word and it will show you the MEDLINE MeSH term and how the term is structured in the hierarchical "MeSH tree." This is a helpful tool when an original search does not yield enough results. It will often provide additional terms related to a search, which may lead to more relevant information.

Another valuable tool for conducting an evidence-based search is the LIMIT feature. The LIMIT feature allows you to limit the results of a search to specific fields, such as Age, Gender, Language, Publication Types (methodology), and Journal subsets. This feature is key to searching for levels of evidence because Publication Types allows the results to be limited to Clinical Trial, Meta-Analysis, Practice Guideline, Randomized Controlled Trial, and Review. However, there are some limitations of this feature. The PubMed Publication Types pull-down menu only contains a list of frequently searched publication types and does not utilize the more comprehensive list used when searching MEDLINE. For example, the PubMed Review LIMIT feature includes all reviews which does not allow you to separate specific types of reviews such as article, literature, academic, or systematic reviews. In addition, the Meta-Analysis LIMIT feature filters citations for quantitative summaries that combine results of independent studies that also may include systematic reviews. Thus, systematic reviews can be indexed and found using either or both of these two Publication Types.

In addition to the LIMIT feature, Boolean operators limit results of a search by letting you combine search terms or concepts. The three Boolean operators are **AND, OR**, and **NOT**; they must be capitalized when using them on PubMed.[16] The **AND** operator is used to retrieve results that contain all of the search terms in a citation. A search for "Hydrogen peroxide **AND** Carbamide peroxide" will retrieve only citations that reference **BOTH** Hydrogen peroxide **AND** Carbamide peroxide. The **OR** operator looks for citations that have at least one of the terms and combines them together in one result. The **OR** operator is used when you want to combine articles on similar topics or broaden your search. The **NOT** operator excludes the retrieval of terms from your search results. Typing "Hydrogen peroxide **NOT** Carbamide peroxide" excludes results about Carbamide peroxide, therefore, focusing the results on only Hydrogen peroxide. However, by using the **NOT** Boolean operator in this case you also may be eliminating results that contain information about both Hydrogen peroxide and Carbamide peroxide.[16]

The main topics and alternative terms identified on the PICO Worksheet and Search Strategy are used to identify MeSH terms. When typing the term 'Tooth Whitening' into the browser, you learn the MeSH term is 'Tooth Bleaching' and it is indexed under Esthetics, Dental. Using the MeSH term 'Tooth Bleaching' will yield more accurate results than just typing the word 'Bleaching' or 'Whitening.' However, if 'Tooth Bleaching' does not provide adequate results, using the term 'Esthetics, Dental' may help broaden your search. These terms are especially helpful if your search does not retrieve enough articles.

After identifying the MeSH terms, begin your search by typing key words for the Intervention in the search box at the top of the PubMed homepage. The main key word for the Intervention is 'Whitening Strips' and the patient's main concern is whitening his discolored teeth. The Comparison to the 'Whitening Strips' that was selected is 'custom trays for use with an at-home whitening/

bleaching system;' however to make sure key citations are not excluded, begin by using the MeSH term heading 'Tooth Bleaching' as the comparison term.

By entering the text word term 'Whitening Strips' and connecting it with the Boolean operator AND to the MeSH term 'Tooth Bleaching,' the search will retrieve results that include articles about both 'Whitening Strips' and 'Tooth Bleaching.' The search quickly finds 8 citations related to 'Whitening Strips' (Figure 3), several of which compare the effectiveness to custom trays for use with an at-home whitening/bleaching systems. Using the Limit feature, you next sort these by language, human subjects, and publication types to identify the citations you can read and that will provide the highest level of evidence. To limit search results, click on the word Limits below the text box and select the Limits that pertain to the search. You limit the original 8 citations for Human subjects and English language by selecting English from the Language pull-down menu and Human from the Human or Animal pull-down menu. (Figure 4) Clicking on the word GO limits the search and displays the new results, which is still the original eight. (Figure 5) To now separate the results by levels of evidence, again click on the Limits feature. Remembering there are two Publication Types that will identify systematic reviews [Meta-Analysis and Reviews], first select Meta-Analysis and click on GO to display the new results. (Figure 6)
Unfortunately, there are no Meta-Analysis or Reviews found on this topic. (Figure 7)
Next, going back to the 8 citations and changing the publication types selection to Randomized Controlled Trials (Figure 8), 5 citations are found. (Figure 9) By further Limiting to Clinical Trials, the results display 6 citations (Figure 10), 5 of which already were identified. Since Randomized Controlled Trials is a relatively new publication type, many RCTs also are categorized as Clinical Trials. Although it is an additional step and there may be overlapping results, using both publication types may identify more useful citations for answering a question.

In reviewing these citations and abstracts, we find there are several citations that appear to answer the PICO question. Yet, to truly make an evidence-based decision regarding Mr. Logan, it is important to complete the EBDM process by retrieving the full-text of the literature, critically appraising it, and determining if it applies to his specific question and situation before making the final decision.

For a quick look at what is available on PubMed, Clinical Queries provides a quick check of the literature based on the Type of Question. This feature supports evidence-based searching by allowing you to conduct a specialized search for the highest levels of evidence in the literature on questions of therapy, diagnosis, etiology, and prognosis, http://www.ncbi.nlm.nih.gov:80/entrez/query/static/clinical.html. This method of searching may not always be as accurate as a PICO search. Nevertheless, using Clinical Queries allows a quick search of what is available on a topic and oftentimes provides at least one very relevant citation.

Clinical queries use filters to conduct a formulated search using key terms. There are two filters to choose from: Research Methodology Filters based on the type of question and Systematic Reviews. These are selected by highlighting the bullet next to the title. When selecting the Research Filter, it is important to indicate the Category and emphasis as well (a description of these is found in the Tutorial). We selected Therapy and Sensitivity, typed the key word(s), 'Whitening Strips,' and clicked GO. (Figure 11) The results were the same 5 RCTs found using the PICO search strategy. (Figure 12) However, if Therapy and Specificity is selected (Figure 13), the results yield only one RCT on Tooth Whitening Efficacy and Safety. (Figure 14) Returning to the Clinical Queries page, we then selected the Systematic Reviews option, typed 'Whitening Strips' in the text box, and clicked on GO. Again, there were no citations found that coincided with the results when we limited the search strategy to Meta-Analysis and Reviews.

Figure 3: Intervention and Comparison

Figure 4: Search Limited to English Language, Human Subjects

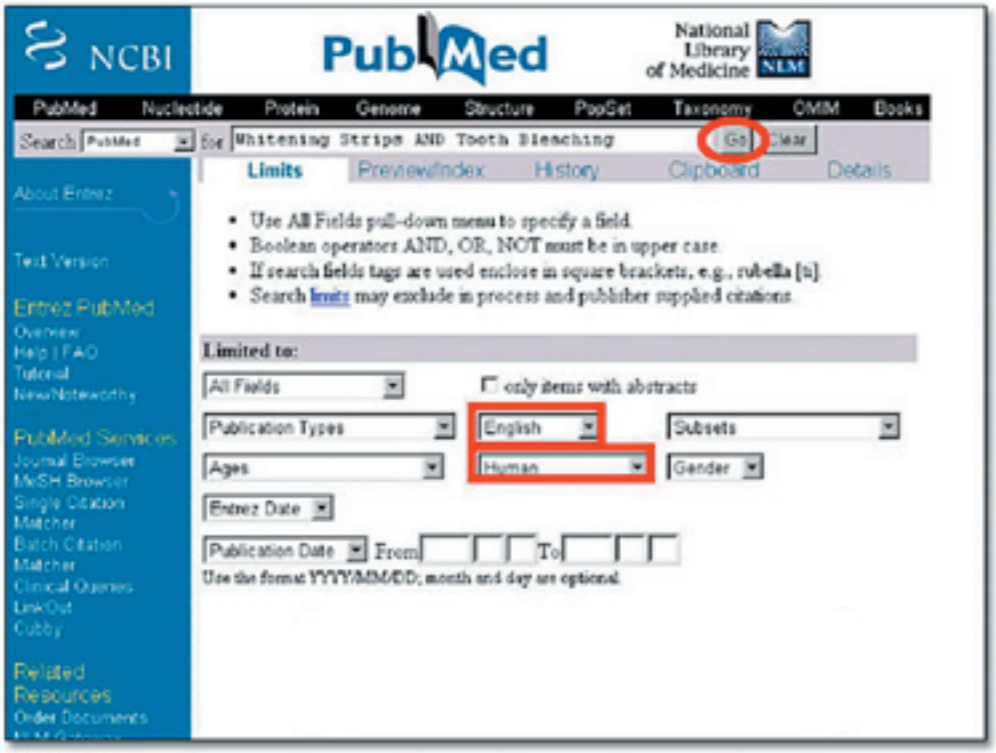


Figure 5: Result of English, Human Limits

Figure 6: Limit to Meta-Analysis, English, Human

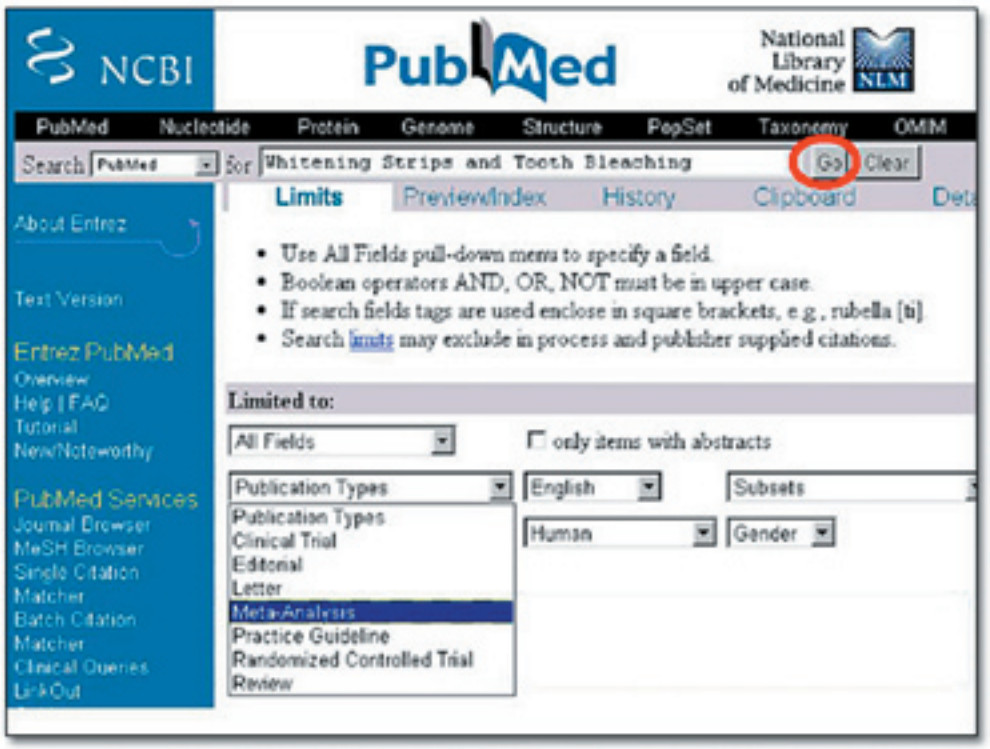


Figure 7: No Meta-Analysis or Reviews

Figure 8: Limit search to RCT, English, Human

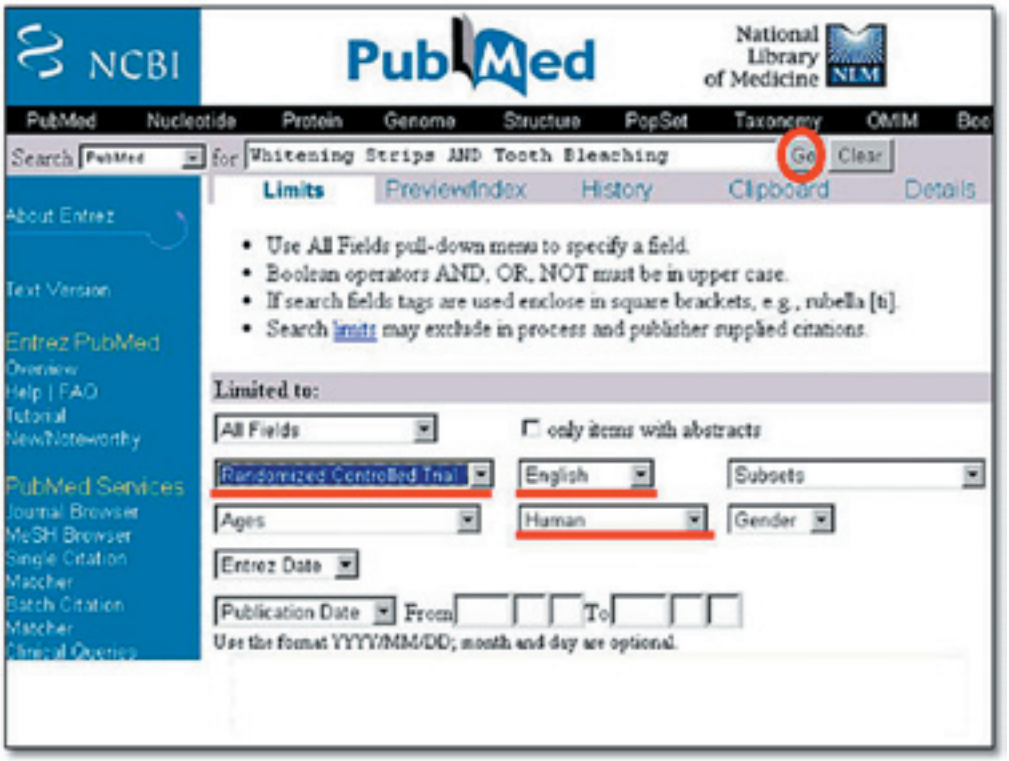


Figure 9: Results of Limit to RCT, English, Human

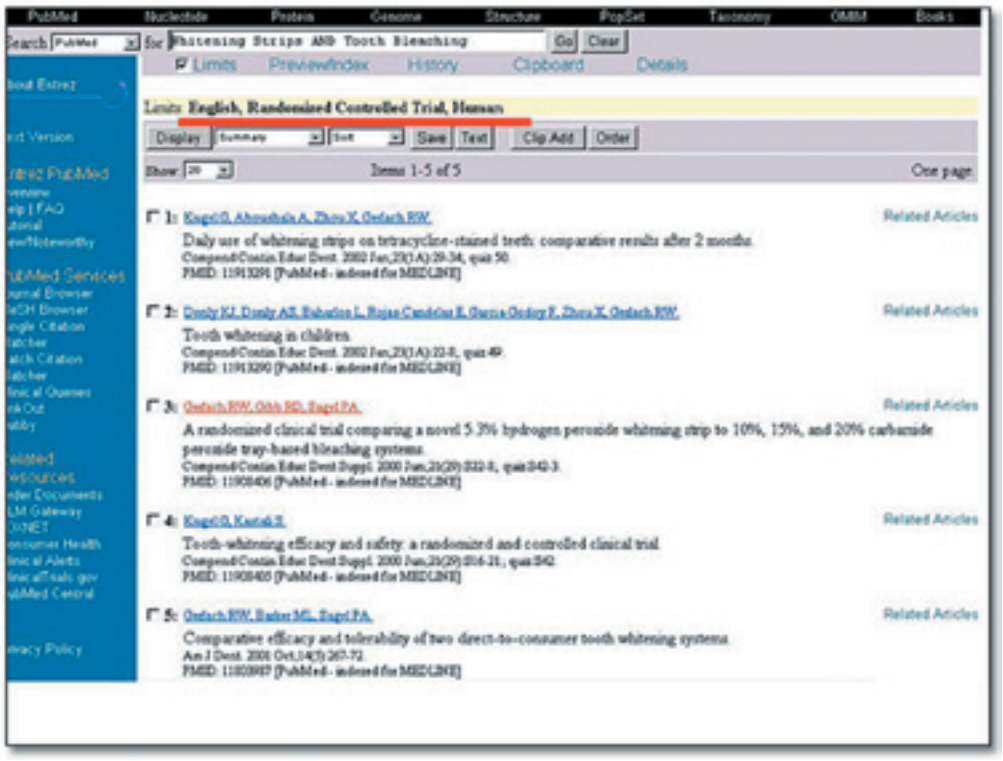


Figure 10: Results of Limit to RCT, English, Human

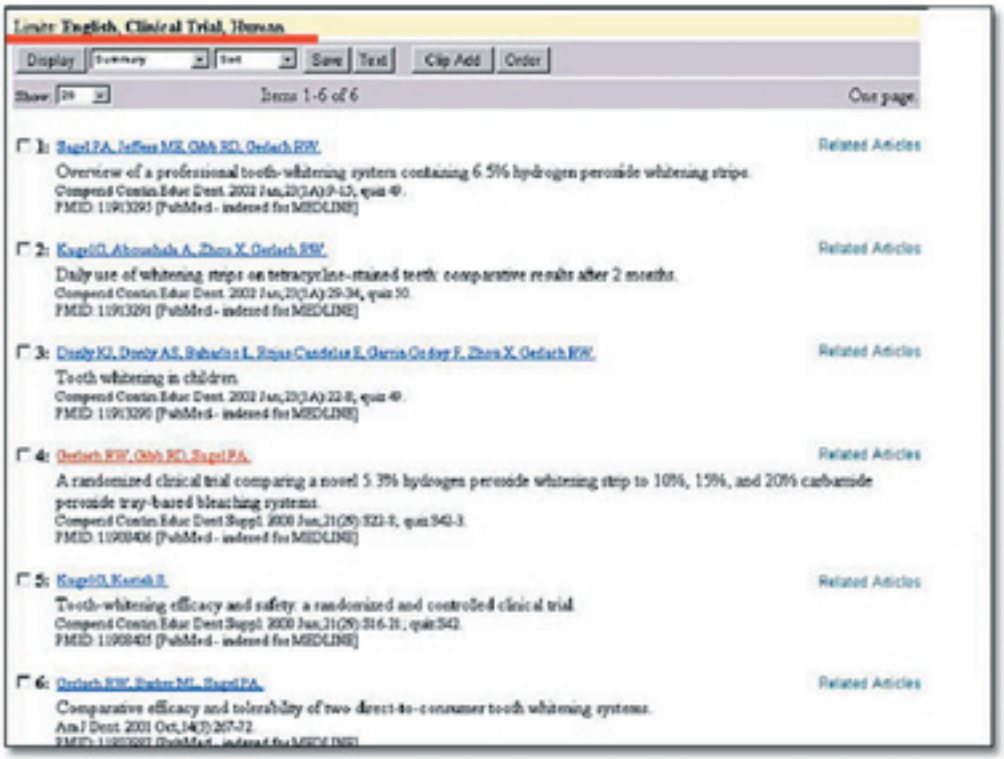


Figure 11: Research Filter, Sensitivity Search

Figure 12: Research Filter, Sensitivity Search Results

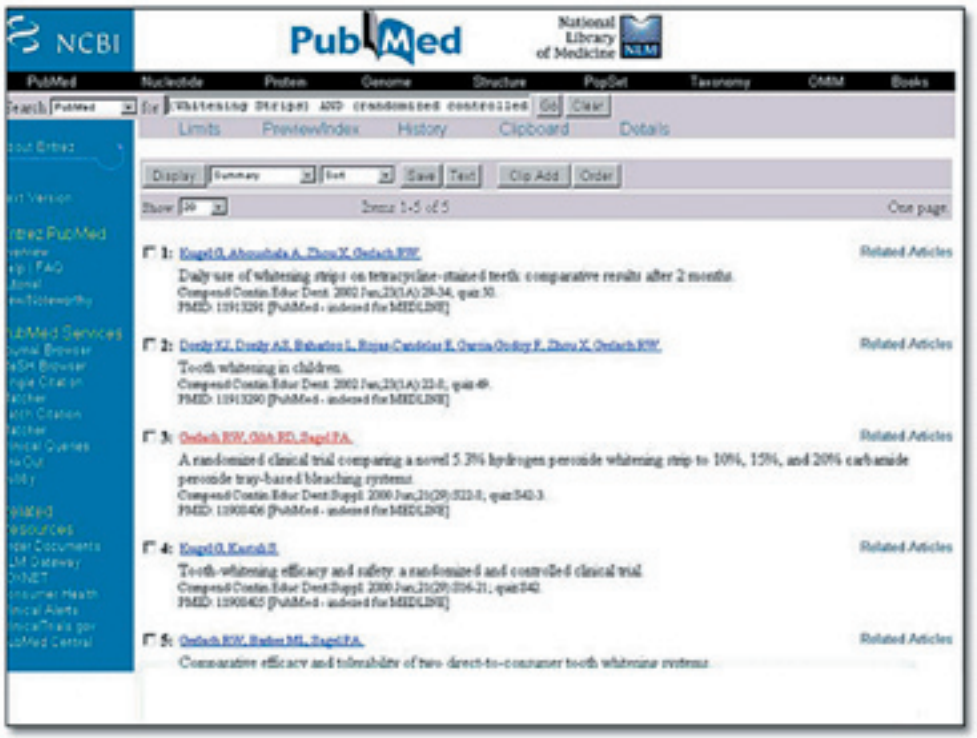


Figure 13: Research Filter, Specificity Search

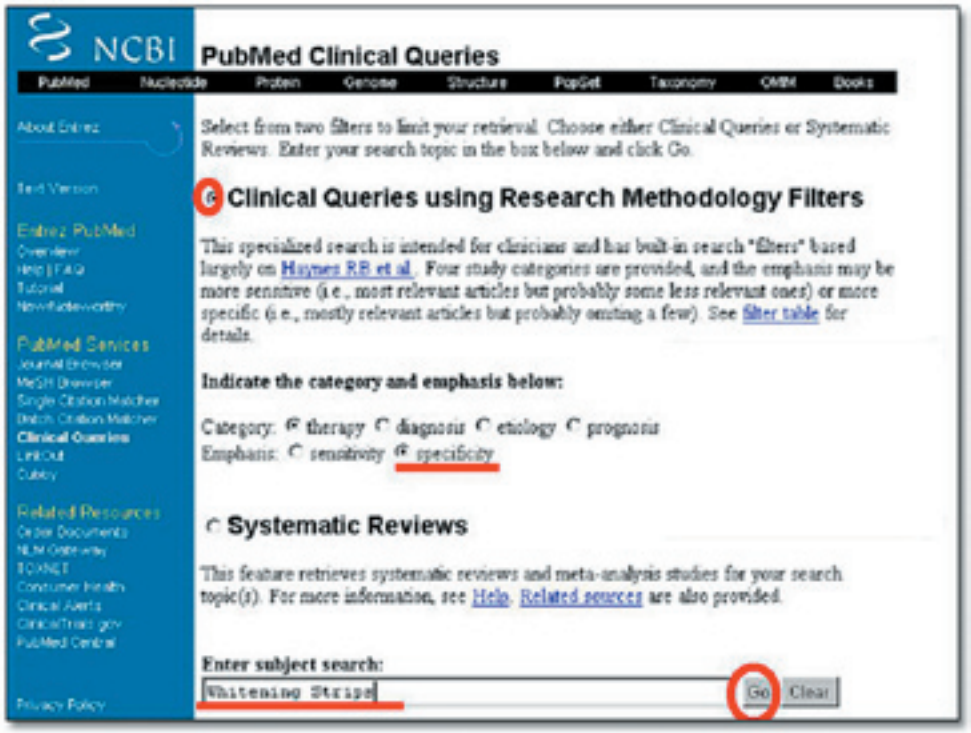
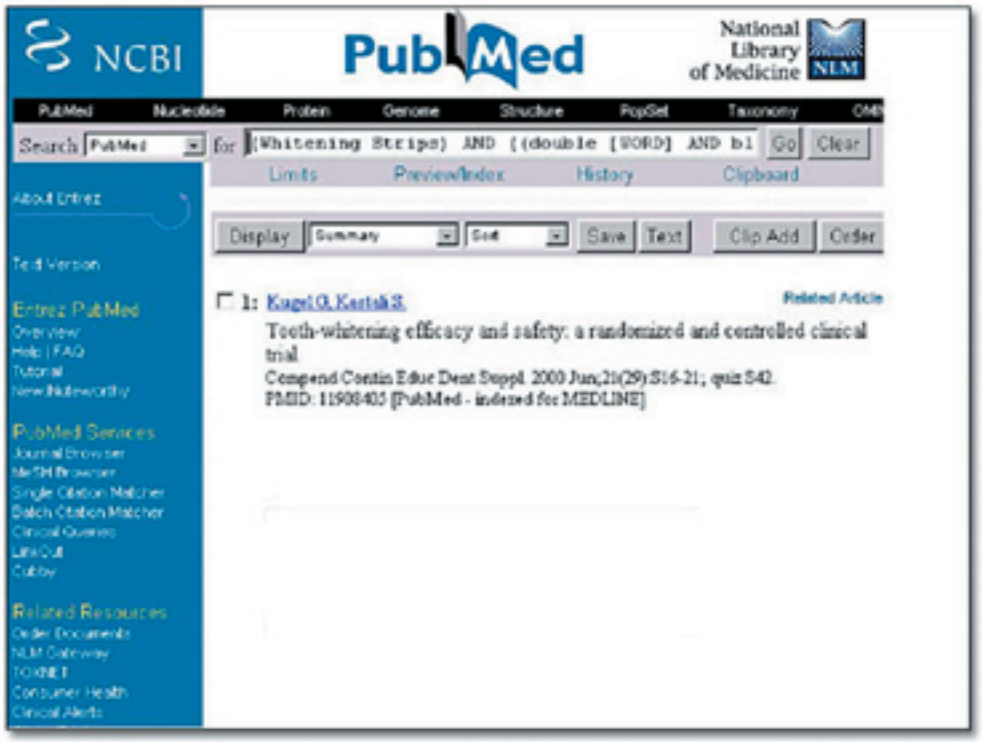


Figure 14: Research Filter, Specificity Search Results



In summary, after having defined the PICO question, the strategy involved in conducting a PubMed search includes the following steps:

Identify the type of question [therapy/prevention, diagnosis, etiology/causation, or prognosis]
Identify the type of study/research methodology to search for [RCT, cohort study]
Identify alternate terms related to the PICO Question [synonyms for the Problem, Intervention, Comparison, Outcomes]
Identify MeSH terms for the PICO Question [use the MeSH Browser]
List your inclusion criteria-limits
Type your Intervention term(s) in the search box
Combine it with your Comparison term using the appropriate Boolean operator [AND, OR and/or NOT]
Limit the search by language and human subject (if applicable) [or Age, Gender, Journal subsets]
Limit the search by publication type, beginning with the highest level of evidence [see Figure 2. Evidence Pyramid]
Review the citations and abstracts [often the methodology is included in the abstract]
Select citations that appear to address the question
Access the related full-text articles or order them [The full-text of articles for some journals are available via a link to the publisher's Website from the PubMed Abstract or Citation display. If not, directions for ordering full-text copies of articles from a medical library (local fees and delivery methods may vary) from Loansome Doc are provided.[17]]

Practice Tips

There are several ways to incorporate an EBDM approach into a practice environment, beginning with learning evidence-based principles and the skills related to formulating good clinical questions. These can be learned through online tutorials such as: "Evidence Based Clinical Practice," by the University of Rochester Medical Center, http://www.urmc.rochester.edu/Miner/guides/ebhctut1.html and "An Introduction to Evidence-Based Medicine," by Duke/UNC at http://www.hsl.unc.edu/lm/ebm/index.htm. In addition, the PubMed tutorial provides step-by-step searching procedures along with a visual demonstration of all the features. These tutorials can be completed prior to staff meetings or first attempts to search for relevant evidence to answer a specific clinical question. Building on this foundation, procedures presented in this article can be used to find evidence when clinical problems or patient questions arise.

Establishing an "evidence-based library" can prove to be a good resource to have on hand. As patient problems or questions arise, these would be documented along with the completed PICO Worksheet and Search Strategy form©, a printed search history from PubMed, selected citations and abstracts, and a completed critical appraisal form for each full-text article found that assisted in addressing the problem.

Through the EBDM process you can provide valuable information to your patients and staff and stay informed about procedures, policies, and materials in your field. Your credibility may increase when current best evidence is effectively communicated in such a way that patients are able to make better-informed decisions.

Conclusions

Recognizing that clinicians have time constraints and yet want to provide the best possible care to their patients, an evidence-based approach offers clinicians a convenient method of finding current research on specific topics or questions. Using an EBDM approach requires understanding new concepts and developing new skills. These include knowledge of what constitutes the evidence and its hierarchy along with the abilities to formulate clinical questions, access available resources, and efficiently retrieve relevant evidence. This process concludes with critically appraising the evidence, incorporating it into clinical decision-making, when appropriate, and evaluating the process.

The PICO Worksheet and Search Strategy form© provides a framework for learning the needed skills related to building your PICO question, structuring your online search, and finding relevant evidence to answer your question. Keep in mind there is more than one way to conduct an effective search depending on the number and specificity of terms used and the sequence in limiting results and combining terms using Boolean operators. The procedures outlined here provide an introduction to the first two steps in the evidence-based process and a basic example of how to apply the key features of PubMed to obtain evidence to answer Mr. Logan's question. The remaining three steps, including critical appraisal, application, and evaluation will be the focus of the next article.

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Note: Links to citations open in a new browser window. To return to this page, just close the newly opened browser window by clicking on the X in the upper right hand corner of the window.

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