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## Let's Climb an Evidence Pyramid

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*Hospital librarians seek information in an evidence-based way. After formulating a searchable, answerable foreground question, they seek literature as high as possible on an evidence pyramid of study types or publication types. The 6S pyramid of study types is the one most climbed today: studies (randomized, cohort, case-control) to synopses of studies to syntheses to synopses of syntheses to summaries to systems at the peak. For publication types, the pyramid with systematic reviews at its summit is preferred.*

*KEYWORDS* cohort studies, evidence-based practice, evidence pyramids, literature searching, randomized controlled trials, systematic reviews

### INTRODUCTION

Hospital librarians seek information in an evidence-based way. They assess the situation by reading and listening carefully. They ask background questions to fill in knowledge gaps. They construct a searchable question that features a particular problem, population or patient, an intervention perhaps compared with a placebo, gold standard, or benchmark, and an outcome. They acquire evidence to answer a question. They appraise or quality filter this literature looking at validity, statistical significance of the data, and application to the patients and then recommend or supply the literature to our users for clinical care. They also apply this method to our practice of evidence-based librarianship (EBLIP). An important paper by Jonathan Eldredge will guide librarians in their practice (1).

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The information librarians find from seeking information in an evidence-based way can be organized on evidence pyramids constructed by publication type or study type or a combination of publication and study types. The higher one climbs up a pyramid the better the chance for higher-quality evidence that has been summarized, synthesized, and analyzed. Librarians strive to move up an evidence pyramid as high as possible. The higher one climbs, the larger the opportunity to reliably predict outcomes. The higher the climb, the less chance of bias. This paper scales several evidence pyramids. Put on your hiking boots; let's go climbing!

### USEFULNESS OF MEDICAL INFORMATION EQUATION

As librarians climb each of these pyramids, they should keep the usefulness of medical information equation in mind (2).

$$\text{Usefulness} = \frac{(\text{relevance}) (\text{validity})}{(\text{work})}$$

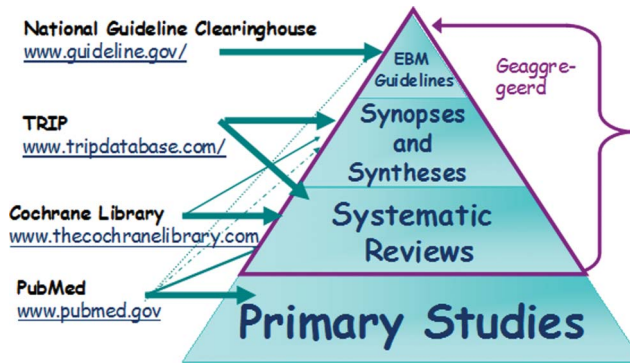
Librarians seek to look for literature that has high relevance to everyday practice, multiplied by highly valid correct methodology over the amount of work taken to find the literature. Ideally one wants a high usefulness equation—high validity multiplied by high relevancy divided by little work. The higher one climbs up a study-type, publication-type, or combination-type pyramid, the higher the usefulness equation because each tool uses more summary, more analysis; therefore, less work for the searcher.

### 4S TO 5S TO 6S PYRAMID

The 4S pyramid has levels of studies, syntheses, synopses, and systems (3). The addition of the summaries level in between synopses and systems transformed the 4S pyramid into the 5S pyramid (4). The 5S pyramid transformed into the 6S pyramid (5). Another level was added and the pyramid was a bit rearranged. The searcher climbs up from studies to synopses of studies to syntheses to synopses of syntheses to summaries and finally to systems.

Before climbing the most currently used 6S pyramid, let's explore another 4-level pyramid. It appeared on Laika's MedLibLog ([laikaspoetnik.wordpress.com](http://laikaspoetnik.wordpress.com)) on March 20, 2010 (Figure 1).

Primary studies that can be found in databases such as PubMed, EMBASE, CINAHL, PsycINFO, and others anchor this pyramid. The second level is systematic reviews. They are further explained below as a level of the widely used 6S pyramid. The third level of this 4-level pyramid is synopses and syntheses. The Trip Database (<http://tripdatabase.com>) pulls from

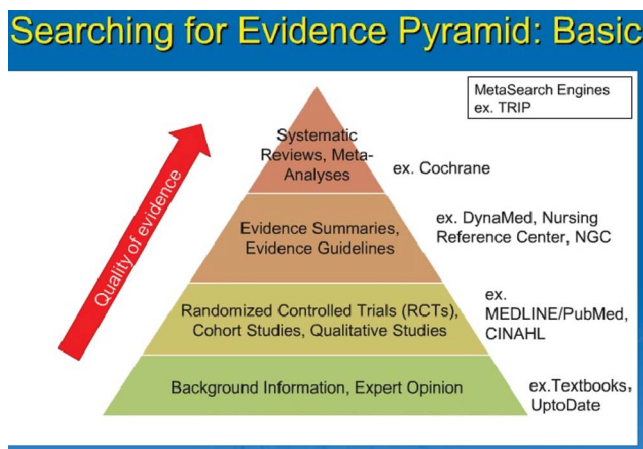


**FIGURE 1** Example of 4S pyramid. *Note.* Geaggregeerd is the Dutch word for aggregated (color figure available online).

resources that summarize, analyze, and integrate evidence-based medical information. Librarians will retrieve journal articles of single studies, trials, or systematic reviews. On Trip, one can also retrieve book chapters and clinical trials. Use this high-scoring medical information usefulness equation tool to fill in background or to move forward to answering searchable questions.

Another 4-level pyramid is mentioned within a slide presentation given to nurses and nursing students by Janet Schnall of the University of Washington Health Sciences Libraries (<http://www.slideshare.net/nlmpnr/rml-rendezvous-evidence-based-nursing>). It is constructed of different levels combining study type and publication type (Figure 2).

Background information or expert opinion found in a textbook or topic review is at the base of the pyramid. Find information in hardcopy or an electronic version of a textbook. Searchers can find collections of



**FIGURE 2** 4-level pyramid within Janet Schnall presentation. *Source:* University of Washington Health Sciences Library, Seattle, WA (color figure available online).

books from McGraw Hill in the many “Access” families, MDConsult from Elsevier, STAT!Ref, a Teton Data Systems product, the National Center for Biotechnology Information (NCBI) Bookshelf, Books@Ovid, and eBook collections from EBSCOhost. The online textbook eMedicine (<http://emedicine.medscape.com>) is available from Medscape or the Trip Database (<http://tripdatabase.com>). Expert opinions and recommendations, also on the base of this pyramid, can be found in topic reviews in a tool like UpToDate.

Moving from background information and expert opinion at the base, the searcher climbs to randomized controlled trials, cohort studies, and qualitative studies. These can be found searching online databases such as PubMed, other MEDLINE sources, EMBASE, CINAHL, PsycINFO, and others. Possible search strategies are explained below. Evidence summaries and guidelines are on the next highest level. Tools such as DynaMed, the Nursing Reference Center, or the Rehabilitation Reference Center from EBSCOhost are suggested for this level. DynaMED has over 3200 topic summaries. Many have recommendations and guidelines. Guidelines can also be found at the National Guideline Clearinghouse (NGC; <http://guideline.gov>).

At the peak of this 4-level pyramid that combines publication and study types are systematic reviews and meta-analyses. These can be found in online databases or the Cochrane Library of Systematic Reviews. More on the Cochrane Library below.

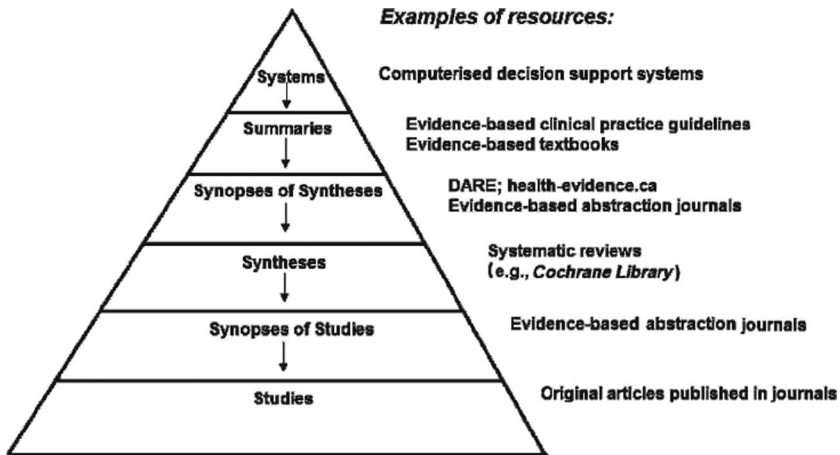
## 6S PYRAMID

The 6S pyramid (Figure 3) is now most widely used. At its base, studies are randomized controlled trials (RCTs) or nonrandomized controlled trials, such as cohort or case-control studies. RCTs can be found by searching through Clinical Queries in PubMed or selecting Randomized Controlled Trial from the list of article types filters, or adding the word random with truncation symbols to retrieve randomly, random, randomization, or randomisation. In EMBASE, randomized controlled trial is a limit under clinical trials. In CINAHL, use the term randomized controlled trials. In PsycINFO, use clinical trials with the word randomized.

As for the nonrandomized trials, cohort, and case-control studies, use cohort studies and case-control studies in PubMed. In EMBASE, search with cohort analysis and case-control study. Use prospective studies for cohort study in CINAHL. Like PubMed, in CINAHL, use case-control studies.

Using the 6S pyramid, the searcher climbs from studies to synopses of studies. Journals such as *ACP Journal Club*, *Evidence-Based Nursing*, *Evidence-Based Child Health*, or *Evidence-Based Ophthalmology* offer a snapshot of a quality paper. There is a structured abstract, significant summary charts or tables, and an invited expert commentary.

The next level is syntheses. Systematic reviews are at this level. Most librarians think immediately of the Cochrane Library of Systematic Reviews,



The 6S hierarchy of pre-appraised evidence

**FIGURE 3** 6S pyramid. *Source:* (5). Reproduced with permission from the BMJ Publishing Group.

but systematic reviews also appear in other information resources. DARE (Database of Abstracts of Reviews of Effects) has systematic reviews in a separate database within the Cochrane Library from the Cochrane Collaboration. They are not Cochrane Library systematic reviews. DARE records summarize a paper in a structured abstract with commentary and cover literature that centers on the effects of health care interventions and the delivery and organization of health services. DARE also includes reviews of the wider determinants of health such as housing, transport, and social care where these impact directly on health, or have the potential to impact health.

Systematic reviews of quantitative topics will probably have meta-analysis. The data from each original study are “recrunched” with special statistical software to synthesize the data to show relationships in a display such as scatter or forest plots (Figure 4).

The Campbell Collaboration ([Campbellcollaboration.org/library.php](http://Campbellcollaboration.org/library.php)) focuses on systematic reviews on more qualitative subjects such as education, crime and justice, and social welfare. Systematic reviews of qualitative research may contain meta-synthesis where findings are integrated or compared to create new interpretations and form generalizations.

Systematic reviews are reviews of randomized controlled trials plus other types of literature. Other types are found by extensive literature searching or handsearching to locate conference or symposia proceedings, position papers, or specialty abstracts.

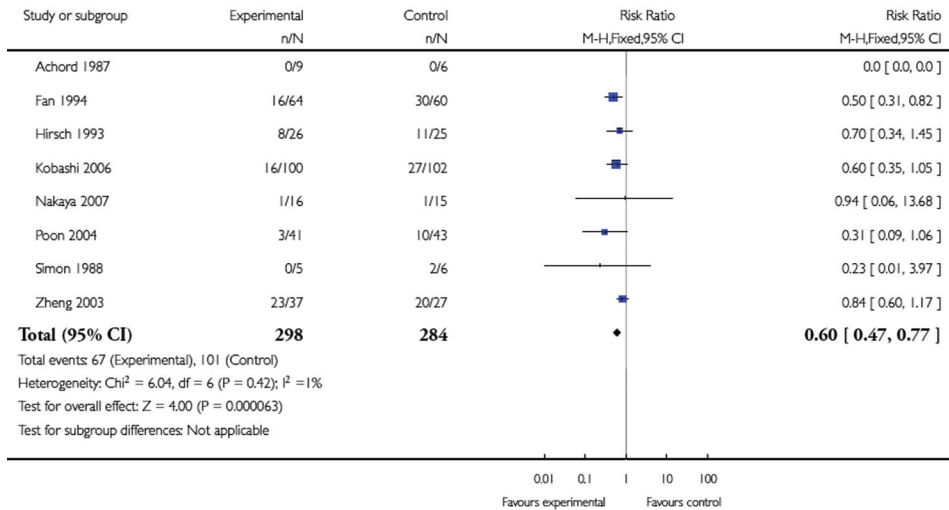
Typically, a systematic review is composed of an abstract with a plain language summary. The Methods section reveals an exhaustive search strategy, inclusion and exclusion criteria in selecting literature for the synthesis, and a chart showing the information flow to narrow the studies included

**Analysis 2.1. Comparison 2 Appearance of ascites, Outcome 1 All studies.**

Review: Nutritional support for liver disease

Comparison: 2 Appearance of ascites

Outcome: 1 All studies



**FIGURE 4** Forest plot from the Cochrane Library of Systematic Reviews. *Source:* (6) (color figure available online).

for synthesis. The Background section overviews the topic. Within this section, each paper is briefly summarized, referenced, and if online, linked to full text. In the Results section, a conclusion is reached with implication for research or clinical practice. The addition of summary tables and the meta-analysis creating forest plots offers a pictorial display of the results.

## COCHRANE LIBRARY OF SYSTEMATIC REVIEWS

At present, there are more than 7300 Cochrane Library systematic reviews. They are updated on a regular schedule. Protocols are also included. They are systematic reviews in progress. The records are incomplete but still may have some references.

Some systematic reviews can come to a definitive recommendation, whereas some cannot and further literature review is needed. Searchers need to “drill down” to randomized controlled trials or nonrandomized controlled studies, such as a cohort or case-control studies, individual studies, and single-case reports.

Hospital librarians can subscribe to the Cochrane software offered by Wiley or the EMBR database from Ovid. In EMBASE, you can limit to Cochrane Library or systematic review. In PubMed, search in Clinical

Queries, select systematic review from the list of article types filters now displayed on the left-hand side of the PubMed screen, or you can search directly by adding 'AND systematic[sb]' to your search strategy.

The next level in the 6S pyramid is synopses of syntheses. The evidence-based abstraction journals found at the synopses of studies level are also located at this level. The difference between synopses of studies and synopses of syntheses is that a record in *ACP Journal Club*, *Evidence-Based Medicine*, *Evidence-Based Nursing*, or the other evidence-based subject journals may include a record of a meta-analysis or systematic review with meta-analysis. These kinds of abstraction journal articles will discuss the synthesis of the data within these kinds of papers.

From synopses of syntheses, we climb up to the summaries level. This level includes e-textbooks. eMedicine (<http://emedicine.medscape.com/>) is an online textbook accessed directly on the Web and also accessible from eTextbooks in TripDatabase.com. Also on the summaries level are point-of-care tools. UpToDate, Clinical Evidence, PIER, Essential Evidence Plus, DynaMed, or Natural Standard offer an evidence-based topic overview noting levels of evidence or grades of evidence and references. References linked to PubMed may be included for further reading.

These tools fit nicely on a handheld device to take to the bedside, clinic, or other points of care. UpToDate is a Wolters Kluwer Health product. Clinical Evidence is a BMJ Publishing Group Limited product. PIER (Physician's Information and Education Resource) is a product from the American College of Physicians. Essential Evidence Plus (formerly InfoRetriever and InfoPOEMs) is a product from Wiley-Blackwell, and DynaMed is a product of EBSCOhost.

Natural Standard is also a point-of-care tool specializing in integrative medicine. The Bottom Line and Flashcard feature a brief display of information with levels of evidence. There are databases of foods, herbs and supplements, health and wellness, comparative effectiveness, medical conditions, sports medicine, genomics and proteomics, and environmental and global health. Natural Standard also has calculators and nutrition labels.

In 2008, CAPHIS, the Consumer and Patient Health Information Section of the Medical Library Association, endorsed Natural Standard. They said that the database was easy to use. Also they said that it was an excellent resource for academic, hospital, consumer health, and public libraries.

These point-of-care tools summarize background or foreground information and lead to the literature that was used to build the document. There are summary tables and figures. Some of these summary tables and figures can be downloaded directly into PowerPoint.

Guidelines are also at the summaries level of the evidence pyramid. Based on much research, guidelines outline protocols of diagnosis or treatment. The National Guideline Clearinghouse (<http://guideline.gov>) is a free database from the Agency for Healthcare Research and Quality (AHRQ)



that is updated regularly. Librarians can subscribe to e-mail updates. It also offers syntheses of guidelines. The syntheses show areas of agreement and difference, compare recommendations, and reveal strength of the evidence.

At the pinnacle of the 6S pyramid is systems. These are clinical decision support tools. Many of these systems are linked to the electronic health record. InfoButtons is a popular example. At the level of data on the EHR, an InfoButton can be moused over to reveal supporting information to help make a clinical decision. Hospital librarians can play a vital role in implementing InfoButtons by going to [infobuttons.org](http://infobuttons.org) and then linking to LITE—Librarian InfoButton Tailoring Environment. LITE is a tool that works with InfoButtons to provide information resource links to clinical systems users at your institution. The InfoButton could link to information tools and also institution-wide protocols, practice guidelines, and recommendations.

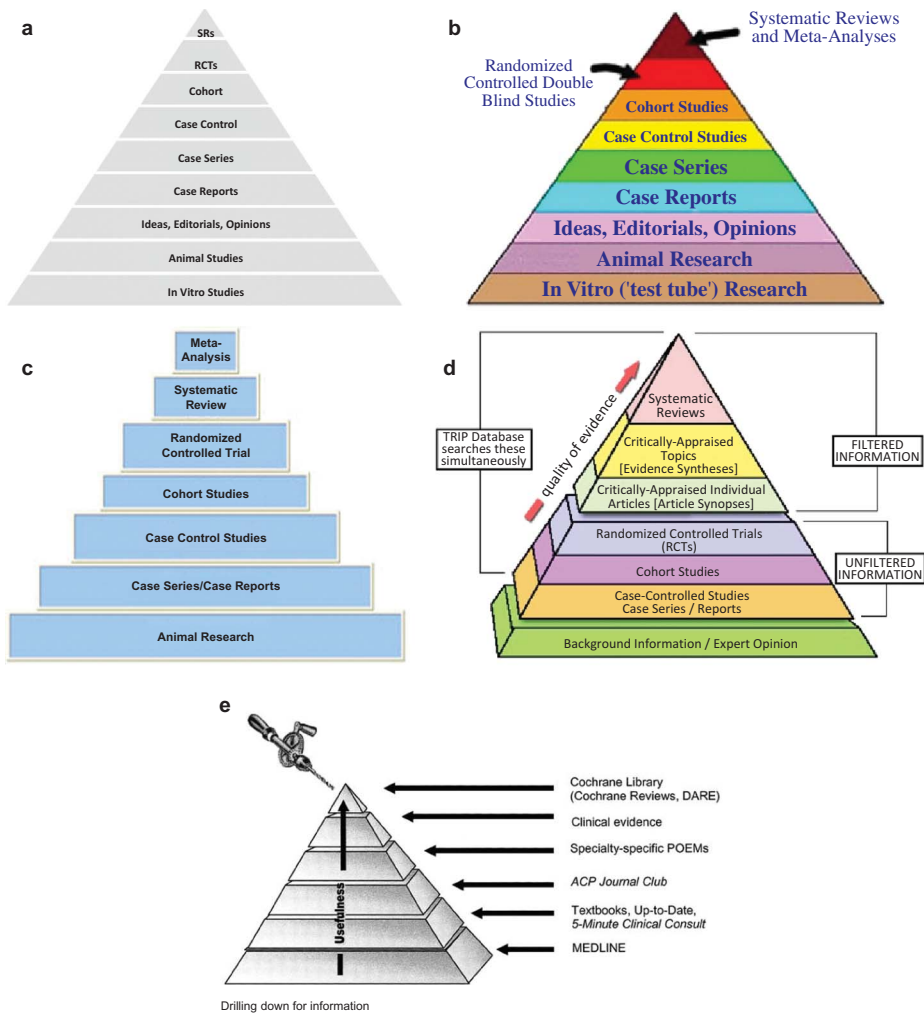
### PYRAMID OF PUBLICATION TYPES

The 6S pyramid focuses on study types, but there are pyramids that focus on publication types with systematic reviews and meta-analyses at the pinnacle. Pandis (7) and Rosner (8) construct a pyramid with *in vitro* or test tube research or laboratory research at the base. Animal studies are next, followed by ideas, editorials, and opinions. Case reports, case series, and case-control studies are on the next higher levels. Next to the top are randomized controlled trials.

On the Pandis pyramid (Figure 5a), systematic reviews are at the top. On the Rosner pyramid (Figure 5b), systematic reviews and meta-analyses are at the summit. Remember that PubMed and EMBASE have meta-analysis as a separate article type filter, but meta-analysis is also a quantitative method that may be included within a systematic review. A meta-analysis combines results of single studies and synthesizes the summaries and conclusions.

The 7-level pyramid in Figure 5c is one designed by Connie Schardt at Duke University and Jill Mayer from the University of North Carolina and included in an online study program. If you Google for evidence pyramids, you will find many within quality EBM introductory sites that may include online tutorials and slide presentations. The pyramid in Figure 2 was included in a PowerPoint presentation by Janet Schnall at the Health Sciences Library, University of Washington. Laika's MedLibLog has several posts about evidence pyramids. Using the EBM generator (<http://embpyramid.org>) from Dartmouth, you can customize your own pyramid. The pyramid in Figure 5d was created from the EBM generator.

Another pyramid of publication types has different layering. Journal articles are at the base, climbing to textbooks, critically-appraised individual



**FIGURE 5** Evidence pyramids: (a) Pyramid of publication types (*Source: (7)*); (b) Pyramid of publication types that puts systematic reviews and meta-analyses at its peak; (c) Pyramid used by Connie Schardt at Duke University and Jill Mayer at the University of North Carolina (*Source: Introduction to evidence-based practice, 5th ed. Duke University Medical Center Library. Health Sciences Library UNC Chapel Hill, © 2010*); (d) Customized EBM pyramid, created from the EBM generator from Dartmouth; (e) Pyramid of publication types, including critically-appraised individual articles and critically-appraised topics (reprinted with permission of the Medical Library Association) (color figure available online).

articles to specialty-specific POEMs (Patient-Oriented Evidence that Matters) to critically-appraised topics to ultimately systematic reviews (Figure 5e).

Librarians retrieve journal articles from a variety of online databases, such as PubMed, PsycINFO, EMBASE, CINAHL, and Google Scholar. On this pyramid, UpToDate with its topic reviews is included on the textbook level,

along with e-books. eMedicine, available through Medscape.com or the TRIP database (tripdatabase.com), is also on the textbook level.

At the critically-appraised individual articles level are journals such as *ACP Journal Club*, *Evidence-Based Medicine*, *Evidence-Based Mental Health*, and *Evidence-Based Nursing*. A structured abstract summarizes a quality article and an expert appraises the paper in commentary found at the bottom of the record.

This particular pyramid (Figure 5e) has specialty-specific POEMs at this level. Delivered directly by e-mail every Monday through Friday, Daily POEMs identify the most valid, relevant research. Daily POEMs are part of Essential Evidence Plus. At this level, librarians should also include any daily update services that keep you abreast of new quality papers. Search strategies stored in a MyNCBI account can be run daily. Librarians may subscribe to the e-mail alert service, Evidence Updates from the *British Medical Journal* (BMJ) and McMaster University. Evidence Alerts are also available from STAT!Ref. Setup a profile in Medicine, Nursing, or Rehabilitation categories to receive a daily e-mail alert.

On the next level are critically-appraised topics. These are short summaries of evidence on a topic of interest. Many hospital departments or institutions build their own database of CATS. CATmaker software can be downloaded for Windows (<http://www.cebm.net/index.aspx?o=1216>).

Systematic reviews sit at the top. The Cochrane Library of Systematic Reviews has full-length documents and also within the Cochrane Library are DARE reviews that bring an abstract with a commentary.

## CONCLUSION

We have climbed a variety of evidence pyramids from 4 to 5 to 6 levels. Some are organized by study type, by publication type, or by a combination. How does one put them to use? A searchable question, who is asking it and how is the information going to be used, is most important. With that in mind, calculate a high usefulness of medical information equation. Think of information tools that are highly relevant and highly valid with little work to find it. With the usefulness equation calculation, consider also the “presearch probability” and decide at what level you will start to find evidence on the evidence pyramid for the question and the person asking it.

A physician asks you to find literature comparing colonoscopy versus virtual colonoscopy for colorectal cancer screening. You know this is a “hot” topic with much written about it. Looking at the pyramid of publication types, you plan to climb straight to the top with a systematic review that includes a meta-analysis. Search PubMed Clinical Queries to answer a narrowly focused diagnosis question to retrieve systematic reviews,

meta-analysis, and randomized controlled trials. Search PubMed and select the Practice Guideline article types filter.

On the study-type pyramid, considering the usefulness equation calculation and a high suspicion of presearch probability, plan to climb straight to the top, inquiring if the institution has a protocol built into the electronic medical record when a patient comes in with the possibility of colorectal cancer. Moving down just one level, you seek to find guidelines. Search the National Guideline Clearinghouse (<http://guideline.gov>) for colorectal cancer screening and colonoscopy and colonography. There are also guideline syntheses where more than one guideline on colorectal screening is compared. If you were going to choose one source to find an answer to this question, the Trip Database (<http://www.tripdatabase.com>) will search for guidelines, systematic reviews, and meta-analyses.

As you seek information in an evidence-based way, keep those climbing boots handy to reach the highest level on a pyramid of publication type, study type, or combination of types to retrieve summarized, analyzed, and synthesized, hopefully unbiased, literature to support excellent health care.

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