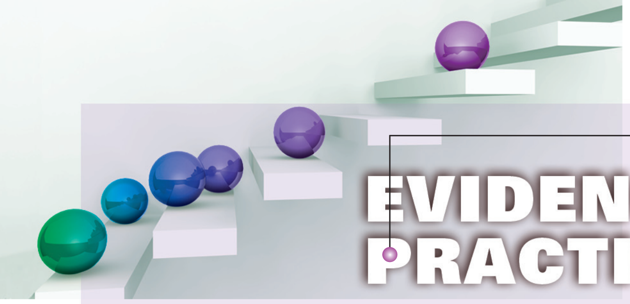


EVIDENCE-BASED PRACTICE Step by Step

By Susan B. Stillwell, DNP, RN, CNE, Ellen Fineout-Overholt, PhD, RN, FNAP, FAAN, Bernadette Mazurek Melnyk, PhD, RN, CPNP/PMHNP, FNAP, FAAN, and Kathleen M. Williamson, PhD, RN

Searching for the Evidence

Strategies to help you conduct a successful search.

This is the fourth article in a series from the Arizona State University College of Nursing and Health Innovation's Center for the Advancement of Evidence-Based Practice. Evidence-based practice (EBP) is a problem-solving approach to the delivery of health care that integrates the best evidence from studies and patient care data with clinician expertise and patient preferences and values. When delivered in a context of caring and in a supportive organizational culture, the highest quality of care and best patient outcomes can be achieved.

The purpose of this series is to give nurses the knowledge and skills they need to implement EBP consistently, one step at a time. Articles will appear every two months to allow you time to incorporate information as you work toward implementing EBP at your institution. Also, we've scheduled "Chat with the Authors" calls every few months to provide a direct line to the experts to help you resolve questions. See details below.

In the previous article in this series, our hypothetical nurse, Rebecca R., with the help of one of her hospital's expert evidence-based practice (EBP) mentors, Carlos A., learned Step 1 of the EBP process—how to formulate a clinical question. The impetus behind her desire to develop her question, as you may recall in our case scenario, was that Rebecca's nurse manager asked her to search for more evidence to support her idea of using a rapid response team to decrease rates of in-hospital cardiac arrests and unplanned ICU admissions—both of which were on the rise on Rebecca's medical–surgical unit. She learned of the idea of a rapid response team from a study she read on the subject in *Critical Care Medicine*.[1]

Here is the clinical question Rebecca formulated: "In hospitalized adults (P), how does a rapid response team (I) compared with no rapid response team (C) affect the number of cardiac arrests (O) and unplanned admissions to the ICU (O) during a three-month period (T)? Her question, called a PICOT question, contains the following elements: patient population (P), intervention of interest (I), comparison intervention of interest (C), outcome(s) of interest (O), and time it takes for the intervention to achieve the outcome(s) (T). (To review PICOT questions and how to formulate them, see "Asking the Clinical Question: A Key Step in Evidence-Based Practice," March.)

This month Rebecca begins Step 2 of the EBP process, *searching for the evidence*. For an overview of this step, see *How to Search for Evidence to Answer the Clinical Question*.

THE BEST EVIDENCE TO ANSWER THE CLINICAL QUESTION

In their next meeting, Carlos and Rebecca discuss what type of evidence will best answer her clinical question. Carlos explains that knowing the type of PICOT question you're asking (for example, is it an intervention, etiology, diagnosis, prognosis, or meaning question?) will help you determine the best type of study design to search for. Rebecca's PICOT question is an intervention question because it compares two possible interventions—a rapid response team versus no rapid response team.

Need Help with Evidence-Based Practice? Chat with the Authors on May 5!

On May 5 at 1 PM EDT, join the "Chat with the Authors" call. It's your chance to get personal consultation from the experts! Dial-in early! U.S. and Canada, dial 1-800-947-5134 (International, dial 001-574-941-6964). When prompted, enter code 121028#.

Go to www.ajnonline.com and click on "Podcasts" and then on "Conversations" to listen to our interview with Susan B. Stillwell and Ellen Fineout-Overholt.

Determine the level of evidence. Research evidence, also called external evidence, can be viewed from a hierarchical perspective. The best external evidence (that which provides the most reliable information) is at the top of the list and the least reliable is at the bottom (see *Hierarchy of Evidence for Intervention Studies*[2]). The level and quality of the evidence are important to clinicians because they give them the confidence they need to make clinical decisions. The research methodology that provides the best evidence will differ depending on the type of clinical question asked. To answer a question that includes an intervention, such as Rebecca's question, a systematic review of randomized, controlled trials or a metaanalysis in which studies are compared using statistical analysis is the best study design.[2-5] When well designed and executed, these studies provide the strongest evidence, and therefore the most confidence for clinical decision making.

"What happens when there isn't a metaanalysis or systematic review available?" Rebecca asks. Carlos replies that the next-best evidence would be Level II evidence, the findings of a randomized, controlled trial. Carlos reminds Rebecca that when deciding whether to use evidence to support a practice change, it's important to consider both the level and quality of the evidence as well as the feasibility of implementing the intervention.

WHERE TO FIND THE EVIDENCE

Rebecca and Carlos set up an appointment with Lynne Z., the hospital librarian, to learn how to begin searching for the evidence. Lynne tells Rebecca and Carlos that no matter what type of question is being asked, it's wise to search more than one database. Because databases index different journals, searching several databases will reduce the possibility of missing relevant literature.

Select relevant databases to search. To find evidence to answer Rebecca's PICOT question, Lynne recommends searching the following databases:

- the Cochrane Database of Systematic Reviews (CDSR) and the Database of Abstracts of Reviews of Effects (DARE), which are found in the Cochrane Library and can be accessed through the Cochrane Collaboration Web site (www.cochrane.org)
- PubMed, which includes MEDLINE (www.ncbi.nlm.nih.gov/pubmed)
- CINAHL (www.ebscohost.com/cinahl), an acronym for Cumulative Index to Nursing and Allied Health Literature

The CDSR and DARE databases contain systematic reviews and metaanalyses of randomized, controlled trials. The reviews conducted by the Cochrane Collaboration are contained in the CDSR, and abstracts of systematic reviews not conducted by Cochrane are indexed in the DARE. Cochrane reviews are considered to have the strongest level of evidence for intervention questions because they have the best study designs and are generally the most rigorous.

To find other types of evidence, databases other than CDSR and DARE must be searched. Because the intervention—rapid response team—is a multidisciplinary, interprofessional initiative, evidence to answer Rebecca's question may be found in medical as well as in nursing and allied health journals. Therefore, the PubMed database, which contains medical and life sciences literature, and the CINAHL database, which contains nursing and allied health literature, should be searched. Abstracts can be reviewed and accessed free of charge in the Cochrane Library and PubMed databases (although a fee may be required to obtain electronic copies of reviews or articles), but a subscription is required to access CINAHL.

SEARCHING STRATEGIES

Now that Rebecca and Carlos have decided what databases to search, they need to select the keywords they'll use to begin their search.

Choose keywords from the PICOT question. Rebecca and Carlos identify the following keywords from her PICOT question: *hospitalized adults*, *rapid response team*, *cardiac arrests*, and *ICU admissions*. Lynne

How to Search for Evidence to Answer the Clinical Question

1. Identify the type of PICOT question.
2. Determine the level of evidence that best answers the question.
3. Select relevant databases to search (such as the CDSR, DARE, PubMed, CINAHL).
4. Use keywords from your PICOT question to search the databases.
5. Streamline your search with the following strategies:
   - Use database controlled vocabulary (such as "MeSH terms").
   - Combine searches by using the Boolean connector "AND."
   - Limit the final search by selecting defining parameters (such as "humans" or "English").

recommends that in cases when a database has its own indexing language, or controlled vocabulary, the search be conducted with these index terms. In this way, the search will be the most inclusive.

Use database controlled vocabulary. For example, when the keyword *rapid response team* is entered into PubMed, the PubMed database matches it to the controlled vocabulary term "Hospital Rapid Response Team." All articles that contain the topic of hospital rapid response teams can be found by searching with this one index term. Using controlled vocabulary in a search saves time and helps prevent the chance of missing evidence that could answer the clinical question.

If the index terms matched by the database aren't relevant to the searcher's keyword, then the keyword and its synonyms should be used to search the database. It's helpful, though rare, when a keyword and an index term match perfectly. More often, the searcher will need to determine which of several database index terms is closest in meaning to the keyword.

Combine searches. Each keyword in the PICOT question is searched individually. However, keyword searches can result in a large number of articles. For example, a CINAHL search of *cardiac arrest* resulted in more than 2,700 articles and a search of *rapid response team* resulted in 100 articles. But combining the searches using the Boolean connector "AND" (for example, *cardiac arrest* AND *rapid response team*) yielded a more manageable 12 articles that contained both concepts and were more likely to answer the clinical question. (Note that databases index articles on a regular basis; therefore, the same search conducted at different times will likely produce different numbers of articles.)

Rebecca and Carlos want to combine their searches because they're interested in finding articles that contain all of the keywords (*hospitalized adults* AND *rapid response team* AND *cardiac arrests* AND *ICU admissions*). After they enter each keyword into the selected database and search it individually, they'll combine all the searches using the Boolean connector "AND." There's a chance, however, that combining the searches may result in few or even no articles. For example, the first time Rebecca searched PubMed using its controlled vocabulary for her PICOT keywords, and then combined the searches, the database came up with only one article. She decided to refocus her search, hoping that including only the intervention and outcomes keywords, and not the patient population, would produce articles relevant to her clinical issue.

Place limits on the final combined search to further narrow the results. This strategy can eliminate articles written in languages other than English or those in which animals, and not humans, are the subjects. Other limits—such as age or sex of subjects or type of article (such as clinical trial, editorial, or review)—are available; however, placing too many limits on a search may produce too few or even no articles.

Hierarchy of Evidence for Intervention Studies[2]

Type of evidence	Level of evidence	Description
Systematic review or metaanalysis	I	A synthesis of evidence from all relevant randomized, controlled trials.
Randomized, controlled trial	II	An experiment in which subjects are randomized to a treatment group or control group.
Controlled trial without randomization	III	An experiment in which subjects are nonrandomly assigned to a treatment group or control group.
Case-control or cohort study	IV	Case-control study: a comparison of subjects with a condition (case) with those who don't have the condition (control) to determine characteristics that might predict the condition. Cohort study: an observation of a group(s) (cohort[s]) to determine the development of an outcome(s) such as a disease.
Systematic review of qualitative or descriptive studies	V	A synthesis of evidence from qualitative or descriptive studies to answer a clinical question.
Qualitative or descriptive study	VI	Qualitative study: gathers data on human behavior to understand *why* and *how* decisions are made. Descriptive study: provides background information on the *what*, *where*, and *when* of a topic of interest.
Opinion or consensus	VII	Authoritative opinion of expert committee.

CONDUCTING THE SEARCH

Rebecca begins to search the PubMed database for the evidence to answer her PICOT question. She and Carlos will be searching the keywords *rapid response team*, the intervention of interest, and *cardiac arrests* and *ICU admissions*, the outcomes of interest. To follow along, access the PubMed home page at www.ncbi.nlm.nih.gov/pubmed. (Note that because new articles are added to the database regularly, your search results may not match those described here.)

Rebecca starts by using PubMed's Medical Subject Heading (MeSH) database to search for the intervention keyword, *rapid response team*. From the PubMed home page, she clicks on "MeSH Database" (see Figure 1). On the MeSH database screen, she types *rapid response team* in the search field and clicks "Go" (see Figure 2). *Rapid response team* is a direct match to the one MeSH term provided—"Hospital Rapid Response Team" (see Figure 3). Rebecca selects this term by clicking the box next to it and then selects "Search Box with AND" from the pull-down menu. "'Hospital Rapid Response Team' [Mesh]" appears in the search box on the next screen (see Figure 4); Rebecca clicks on "Search PubMed." Her search is performed and results in 19 articles (see Figure 5). She notes that most but not all articles appear to be relevant to the clinical question, and that they date back only to 2009 because the MeSH term "Hospital Rapid Response Team" was recently introduced.

Before Rebecca continues with her MeSH database searches, Lynne suggests that she use *rapid response team* in a separate search because the search will be broader than a MeSH term search and may yield additional useful articles.

From the results page, Rebecca enters *rapid response team* in the search field and clicks "Search." This search produces over 300 articles (see Figure 6); however, many of them still don't appear to be relevant to the clinical question. Lynne reassures Rebecca that eventually combining her searches will help weed out the irrelevant articles. (Because this search produced so many more articles than her MeSH term search, which captured only the most recent articles, Lynne suggests that when Rebecca combines her searches, she use the results of her keyword *rapid response team* search, not her "Hospital Rapid Response Team" search.

Rebecca continues to use the MeSH database to search her two remaining keywords. For each one, she starts back on the PubMed home page (click on the PubMed.gov logo on any results page to get to the home page).

Again, she enters *cardiac arrest* on the MeSH database screen. Of the three MeSH terms provided she selects "heart arrest," which yields over 25,000 articles. Since the keyword *ICU admissions* produces no MeSH terms, Lynne advises Rebecca to search with the keyword *intensive care units*, which matches perfectly with the MeSH term "Intensive Care Units" and yields more than 40,000 articles. After searching her keyword and appropriate MeSH terms, Rebecca has a total of more than 60,000 articles.

Lynne reassures Rebecca that she won't need to read all 60,000 articles. She explains that the next step, combining the searches, will eliminate extraneous articles and focus on the search results specific to the clinical question. Combining the searches by using the Boolean connector "AND" will produce a list of articles that contain all three keywords Rebecca searched.

To combine her searches, Rebecca selects the "Advanced Search" tab at the top of any results page. Each of her searches now appears on the Advanced Search page in the "Search History" box. Lynne reminds Rebecca to clear the search field at the top of the page of any keywords from past searches before combining the final group of searches.

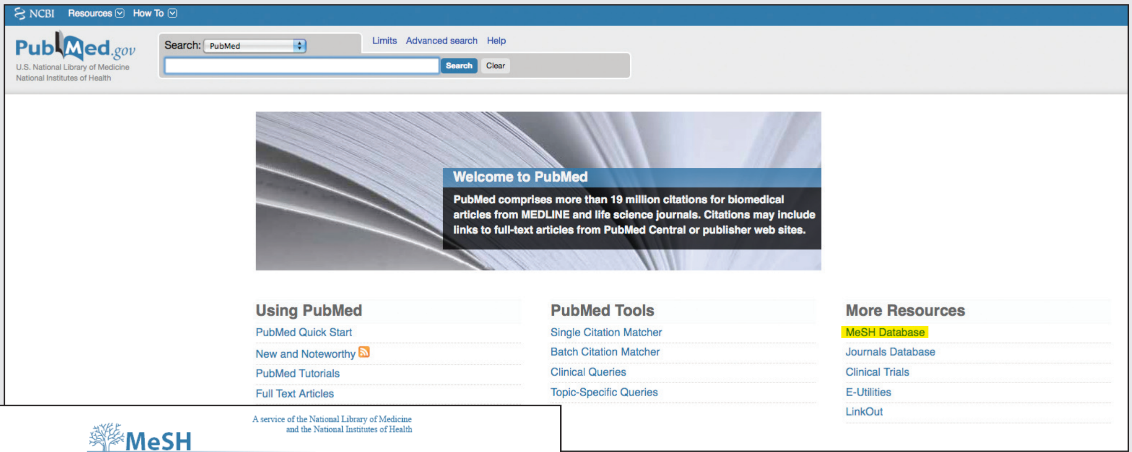
Rebecca clicks on the number assigned to her *rapid response team* keyword search and selects AND from the pull-down "Options" menu. Lynne shows her that the number assigned to her keyword search now appears in the search field at the top of the page. Rebecca continues to select her individual searches and, one by one, their corresponding numbers appear in the field above (see Figure 7). To run the combined searches and view the results, Rebecca selects the "Search" tab.

Her combined search produces 11 articles (see Figure 8), a much more manageable number to review for relevancy to the clinical question than the more than 60,000 articles produced by the individual keyword and controlled vocabulary searches.

Rebecca asks Lynne if she can request the three free full-text articles (see "Free Full Text (3)" under "Filter your results" on the upper right of the results page; Figure 8). Lynne informs her that she can apply any number of limits to her search, including "Links to free full text." However, the more limits applied, the narrower the search, and evidence to answer the clinical question may be missed.

Lynne shows Rebecca where "Limits" can be found on the

Figure 1. Select "MeSH Database" on the PubMed home page.



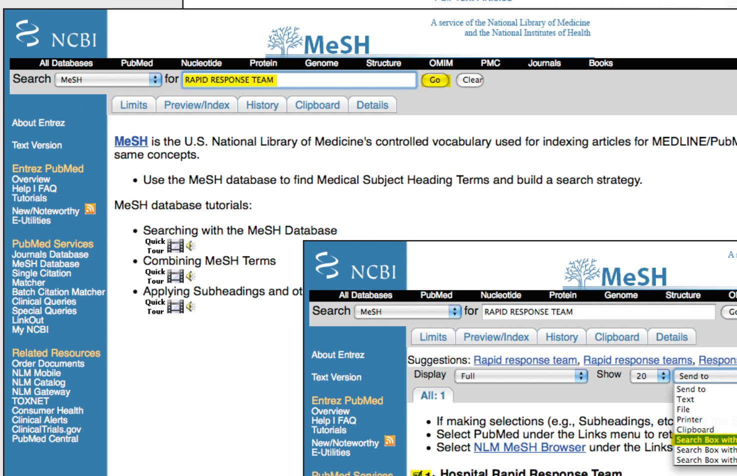


Figure 2. Type *rapid response team* in the search field and click "Go."

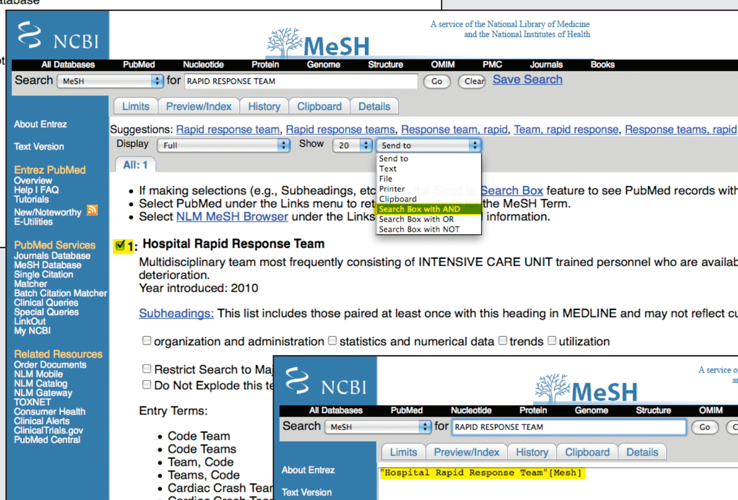


Figure 3. Select the MeSH term "Hospital Rapid Response Team," then select "Search Box with AND" from the pull-down menu.

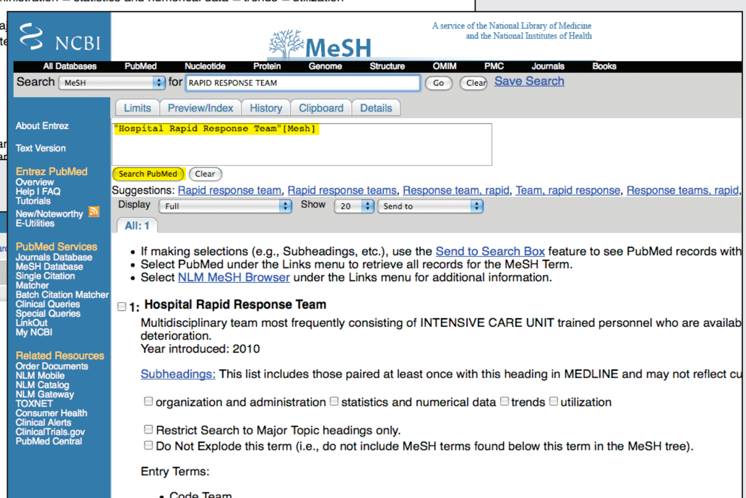


Figure 4. Click on "Search PubMed."

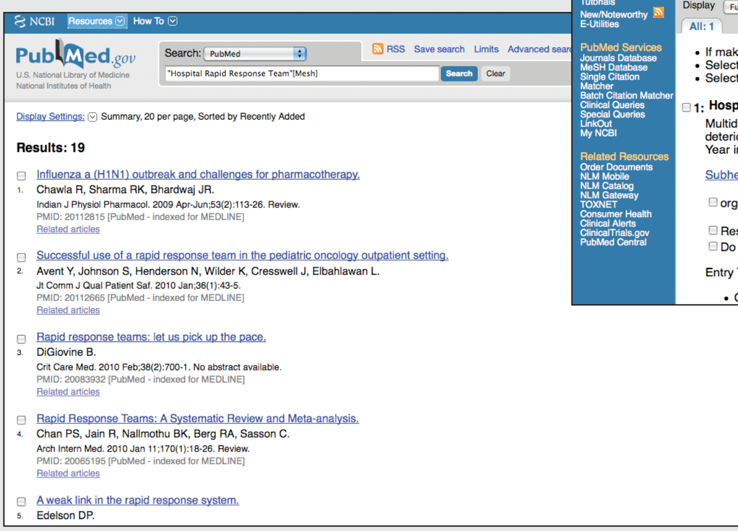


Figure 5. The "Hospital Rapid Response Team" search yields 19 articles.

top of the Advanced Search page (Figure 7). She suggests that Rebecca consider limiting the ages of her population to further reduce her results. If she eliminates the pediatric population, for example, the number of articles produced by her search should decrease. But Rebecca thinks that any articles that include children may be of interest to the nurses on the pediatric unit, so she decides to limit her search to only "Humans" and "English" (Figure 9). Applying these limits to Rebecca's final combined search reduces the results from 11 articles to 10.

Rebecca asks Lynne if any of the articles retrieved in the search are metaanalyses, which she remembers is the best study design to answer her clinical question. Lynne responds that a quick way to find out is by going back to the Limits page and selecting "Meta-Analysis" (see Figure 9). Although this didn't produce any results, limiting the search to "Randomized Controlled Trial" resulted in one article.

As Rebecca's session in searching PubMed concludes, Lynne explains to Carlos and Rebecca that searching is a skill that improves with practice. Moreover, each database may have its own controlled vocabulary and limits. In any search, Lynne emphasizes the importance of

- searching at least two databases
- searching one keyword at a time
- using the database's controlled vocabulary when available
- combining the searches to yield articles that are manageable in number and relate specifically to the PICOT question
- applying "Humans" and "English" limits to the final search

Rebecca is excited to practice her searching skills to find the answer to her clinical question. She and Carlos set up a time to search the Cochrane and CINAHL databases. Carlos reminds Rebecca that although considering the level of evidence when making a clinical decision is important, it's not the only factor. The decision should also be based on the quality of the evidence, the feasibility of implementing a change in the hospital, and a consideration of the patients' values and preferences.

In the next article in this series, to be published in the July issue of *AJN*, Rebecca gathers all the articles relevant to her PICOT question and meets with Carlos to learn how to critically appraise the evidence. You're invited to

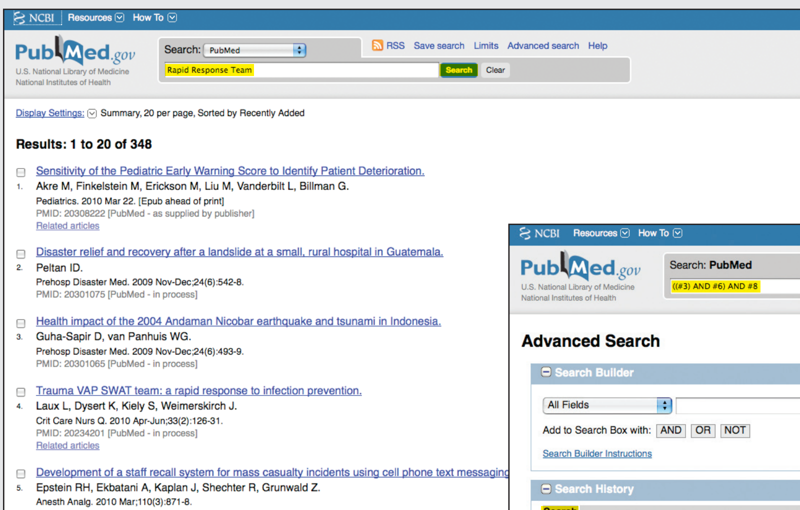


Figure 6. Type *rapid response team* in the search field and click "Search"; this search results in more than 300 articles.

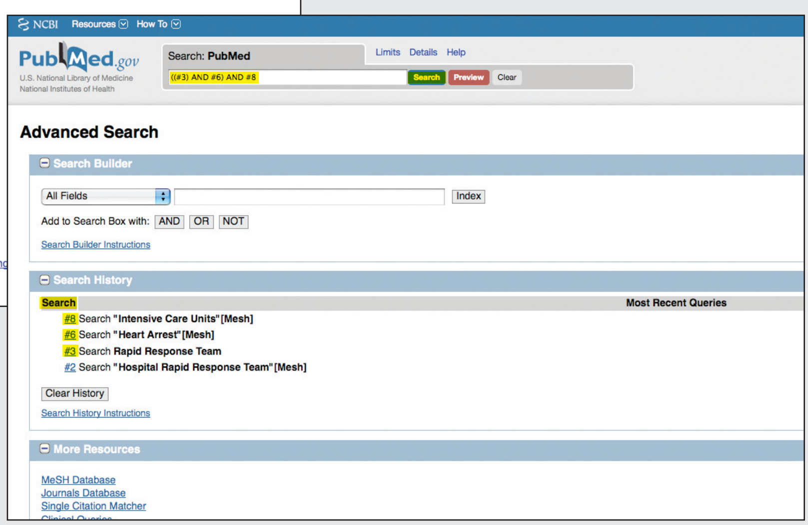


Figure 7. Combine the individual searches.

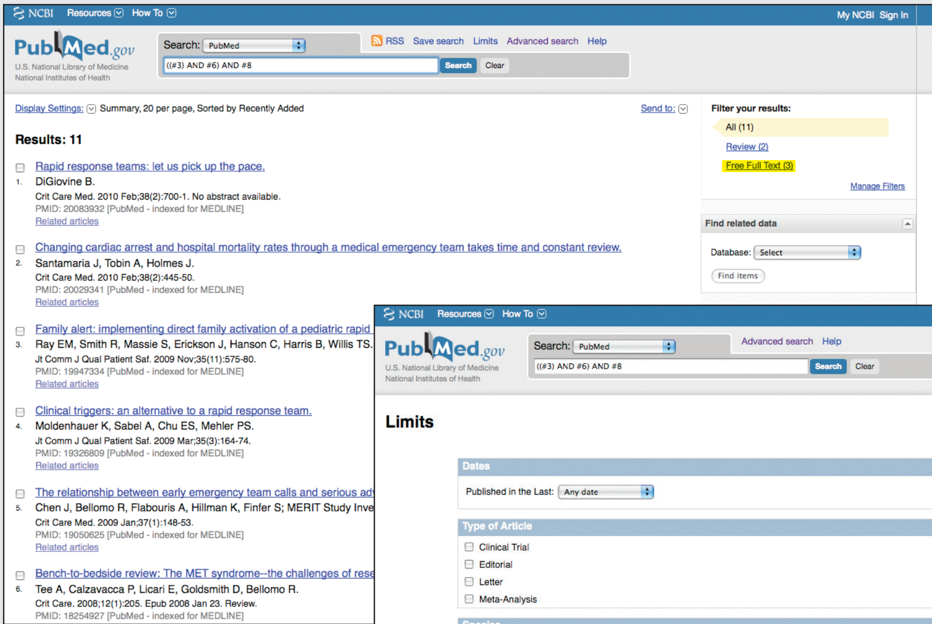


Figure 8. The final results.

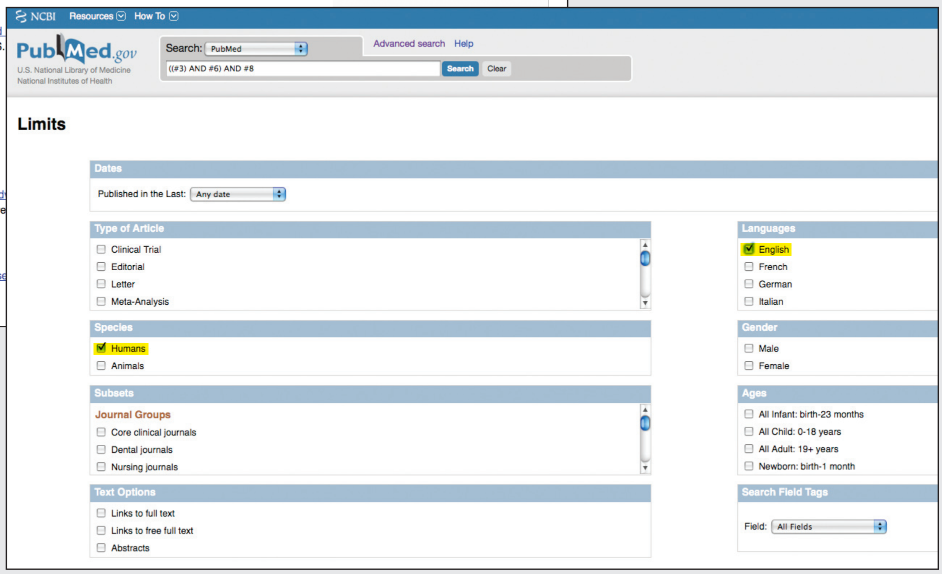


Figure 9. Using limits to narrow the search.

this meeting to learn, along with Rebecca, how to select "keeper" studies that, when synthesized, will help determine if a practice change should be implemented at her hospital. ▼

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Solutions to Our "Practice Creating a PICOT Question" Exercise

Did your questions come close to these?

Scenario 1: A meaning question.

How do family caregivers (P) with relatives receiving hospice care (I) perceive the loss of their relative (O) during end of life (T)?

Scenario 2: An intervention or therapy question.

In patients with dementia who are agitated (P), how does baby doll therapy (I) compared with risperidone (or antipsychotic drug therapy) (C) affect behavior outbursts (O) within one month (T)?

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