KNOWLEDGE MANAGEMENT:

PROGRESSING FROM A QUESTION TO

DOING A SYSTEMATIC LITERATURE SEARCH

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In the first number of Radiography Open, the article - Knowledge management: How to find the best knowledge sources was published (Nordsteien, 2014). Several free access research databases and resources were presented relating to evidence-based practice (Nortvedt et al., 2012) and the knowledge pyramid of Dicenso, Bayley and Haynes (2009). It is often possible to find a specific article by searching for the title in Google. To find any article on a topic, you will probably succeed by entering the subject in the search field of research databases. However, if the aim is to find all or the best information about a topic, you have to use advanced search techniques. Illustrating how to do a systematic literature search is the aim of this second brief article on knowledge management.

The first step of a literature search is to define the information needs; whether the knowledge required concerns a clinical question or a broader research study. To formulate a precise question and to transform it into search terms is often challenging. A framework that is designed to assist this process is PICO (see figure 1).

P:	**Population**	**Who are the users, patients or community o finterest?**
I:	Intervention	What is being done for the population?
C:	Comparison	Do you have a control group, comparison element, different treatment or diagnostic options?
O:	Outcome	What do you want to achieve, improve, measure etc.?

Figure 1: The PICO framework

The PICO framework is best suited for questions concerning the impact of interventions, but is also suitable for other types of questions. It is important to note that not all fields in the framework need to be filled out. In some cases, it is only necessary to fill out, for example, Population (P) and Outcome (O), because the question does not contain any interventions. In the previous article the example question was what sensitivity PET-CT has for imaging lung cancer. Using the PICO framework, we would put the words *lung cancer* under P, *PET-CT* under Intervention (I) and *sensitivity* under O. In this case, there is nothing to fill out under Comparison (C), but if you want to compare PET-CT with MRI, it is natural to put the word *MRI* under the C in the PICO framework. In this way, the framework helps to choose which aspects we want to include in our search strategy.

The second step of the literature search is to find appropriate search terms. Many medical databases contain a thesaurus in which you can find medical subject headings (MeSH). The articles in these databases are allocated a few appropriate MeSH to improve the ability to find the relevant articles. In our example, one MeSH is *Lung neoplasms*, however, PET-CT is assigned two MeSH, which later must be combined: *Positron-Emission Tomography* and *Tomography, X-ray computed*. A way to find the relevant MeSH is by searching [PubMed Medical Subject Headings](#).

A systematic search strategy requires searching for both MeSH and text words. Text words include words in the title and abstract of the articles; in some databases it also includes all text. It is important to search for text words to cover all possible synonyms. The MeSH-system should be used to be sure to find all the relevant articles, but there is not a MeSH for every single word and all relevant MeSH are not necessarily indexed to an article. The more we use synonyms in our search, the more articles we find. By text word searching, we should also think about different endings of words (e.g. Plural). In such cases, one can put an asterisk after the root word (truncation), for example, 'imag*' to cover 'imaging', 'image' and 'images'. There are a number of different characters to cover different spelling of words and to specify how closely two words should occur. This varies slightly between different databases and one can consult the user manual and help functions for each database. To keep track of all the search terms, it is helpful to put these into the PICO framework.

The third and final step of a literature search is to carry out the search in relevant databases. All the search terms in the PICO framework should now be combined with help of the operators AND or OR. Synonyms should be combined with OR and the various aspects of the question should be combined with AND (see figure 2 and 3). Using OR expands the search; we get hits on all articles that have used one of the terms in the circles below to the right. Use of AND has the opposite effect, as we get only those articles that contain both terms (see the dark blue area to the left in figure 2).
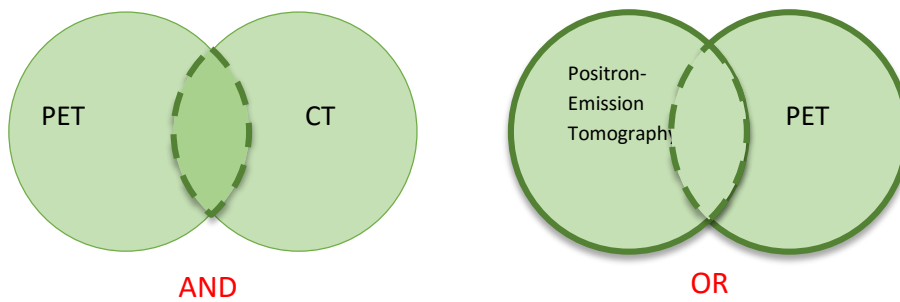
Figure 2: Limiting the number of hits by the use of AND, expanding the number by OR.

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P:	Pasient/problem	*Lung Neoplasms* **OR lung cancer OR pulmonary neoplasms OR pulmonary cancer**	AND
I:	Intervention	*Tomography, X-Ray Computed* OR CT <u>AND</u> *Positron-Emission Tomography* OR PET etc.	
C:	Comparison	-	AND
O:	Outcome	*Sensitivity and Specificity* OR sensitivity etc.	
			AND

Figure 3: The PICO-framework with examples, the MeSH in italics and some examples on text words after these

In the example, in figure 3, the subject headings are written in italics. As a general rule, the search terms within each field of the PICO framework should be combined with OR. The results from the OR-queries should then be combined with AND. However, in cases with complex concepts, you sometimes have to use AND also inside a field; in our case example, because we want to include two different terms (CT AND PET). If you get too many hits, there are opportunities to refine the search by for example narrowing down the year of publication, language, peer reviews, age and study design. The user interface is slightly different from database to database and it is recommended to use the help function in each database.

Here are some links to more information about using PICO and conducting a systematic literature search:

https://www.youtube.com/watch?v=iOSWnQpVMjc

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2233974/

https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html

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