Introduction to Boolean Logic


In the context of database searching, **Boolean** logic refers to the logical relationships among search terms.

- The Boolean operators **AND**, **OR**, **NOT** can be used to combine search terms in PubMed.
- In PubMed, Boolean operators **must be entered in uppercase letters**.

**OR:**

- Used to retrieve a set in which each citation contains *at least one* of the search terms.
- Use OR when you want to pull together articles on similar topics.

**Example:**  *football OR hockey OR soccer*

Each circle in the diagram to the right represents the retrieval for each term. The grey areas represent the retrieval for this example – all records that include any one of these terms.

The table below represents sample results for each term, then for the terms combined with OR.

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>football</td>
<td>4819</td>
</tr>
<tr>
<td>hockey</td>
<td>1058</td>
</tr>
<tr>
<td>soccer</td>
<td>2517</td>
</tr>
<tr>
<td>football OR hockey OR soccer</td>
<td>6090</td>
</tr>
</tbody>
</table>

**NOT:**

- Retrieves a set from which citations to articles containing specified search terms following the **NOT** operator are eliminated.

**Example:**  *arthritis NOT letter*

Note in the diagram to the right and in the sample search results below that the retrieval is a portion of the total retrieval for arthritis – that portion not including the term letter.
• Use the NOT operator with caution; you might eliminate relevant articles.

**AND:**

• Used to retrieve a set in which each citation contains all search terms.

**Example:** *salmonella AND hamburger*

Note in the diagram to the right and in the sample search results below that the retrieval is only the overlap of the results for each term – those records in which both terms appear.

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>salmonella</td>
<td>64810</td>
</tr>
<tr>
<td>hamburger</td>
<td>2494</td>
</tr>
<tr>
<td>salmonella AND hamburger</td>
<td>12</td>
</tr>
</tbody>
</table>

• AND is the default operator used in PubMed. If you do not include Boolean operators in your search, PubMed will automatically use AND between terms.

**Example:** *diabetes mellitus phototherapy*

PubMed searches as: *diabetes mellitus AND phototherapy*

**Nesting:**

• When using multiple Boolean operators in PubMed, they are processed left to right.

**Example:** *salmonella AND hamburger OR eggs*

This will retrieve records that include both terms *salmonella AND hamburger* as well as all records with the term *eggs*, whether or not they contain the other two terms.
• To change the order in which terms are processed, enclose the terms(s) in parentheses. The terms inside the set of parentheses will be processed as a unit and then incorporated into the overall strategy. This is called nesting.

**Example:** *salmonella AND (hamburger OR eggs)*

This will retrieve records that contain the term *salmonella*, as well as one or both of the terms *hamburger* OR *eggs*.

---

**Review**

PubMed processes **Boolean logic** using the following search rules and syntax:

• Boolean operators: AND, OR, and NOT
  • AND, OR and NOT must be entered in UPPERCASE.
  • AND is the default operator used in PubMed. If you do not include Boolean operators in your search, PubMed will automatically use AND between terms.
• PubMed processes Boolean connectors in a left-to-right sequence.
• You can change the order in which PubMed processes a search statement by enclosing, that is nesting, an individual concept in parentheses. The terms inside the parentheses will be processed as a unit and then incorporated into the overall strategy.