PubMed Practical: Guided literature search example in PubMed

Clinical question

„In children with type 1 diabetes, does insulin pump therapy produce normoglycemia and improve the quality of life (in comparison with daily insulin injections)?“

Clear, logical approach with PICO

! PICO helps identify the **key components** of a well-focused question.

Problem	**Diabetes type I**
Population	**Children / adolescents**
Intervention	**Insulin pump**
Comparison, if any	(compared to daily insulin injection)
Outcome(s)	**produces normoglycemia, improves quality of life**

! Note, that you **might not use** all the components of the well-built clinical question in your PubMed search strategy. Always start with the most important and specific components. Here: **Problem, Population + Intervention**

Always search with MeSH (Medical Subject Headings) and textwords (freetext terms in title/abstract) - why?

To be comprehensive you need to combine the MeSH with a textword search (with OR):

MeSH terms (controlled vocabulary)

Indicate what an article is about (conversely a textword may appear in an abstract even if irrelevant to the article's focus);
Are applied retrospectively to PubMed records – therefore you will miss the most recent articles if applying a MeSH search without a textword search;
Author terminology differs – MeSH capture many synonyms;
There are aspects/therapies/illnesses, that are not covered by a specific MeSH term (e.g. new technologies)

Combine

Use textwords

to find articles that may have been inconsistently indexed by MeSH terms;
to find brand new articles that have not yet been indexed by the National Library of Medicine;
to find minor mentions of your term;
to search for aspects not included in MeSH terminology (e.g. avoidable hospitalization)

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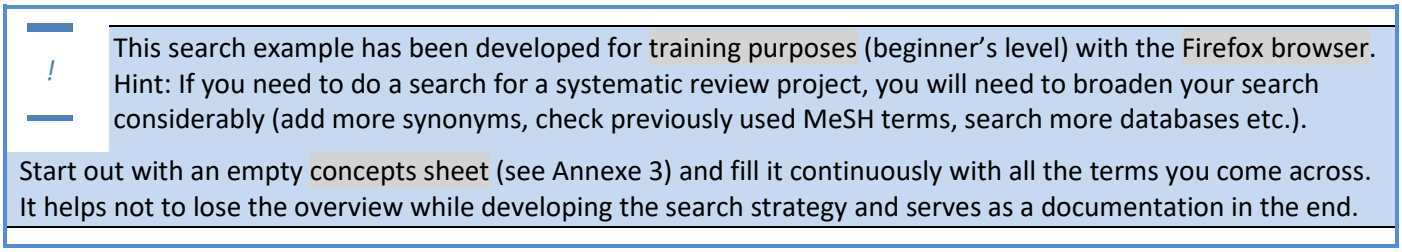
Contents

General remarks

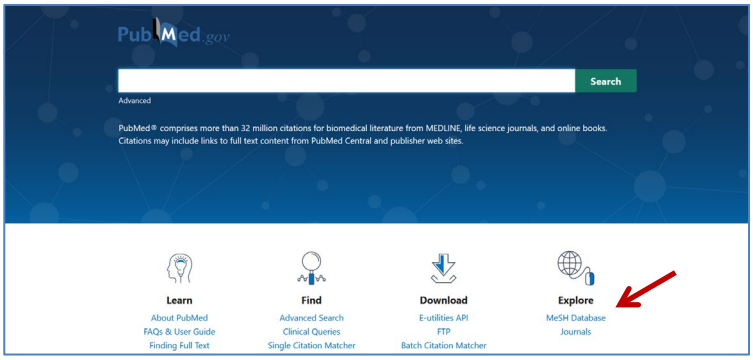


Building up the search strategy

1. Problem (P1) Diabetes Type 1: Start with the MeSH Search

1.1

GO TO PUBMED: You can access the **MeSH database** through the PubMed Homepage.

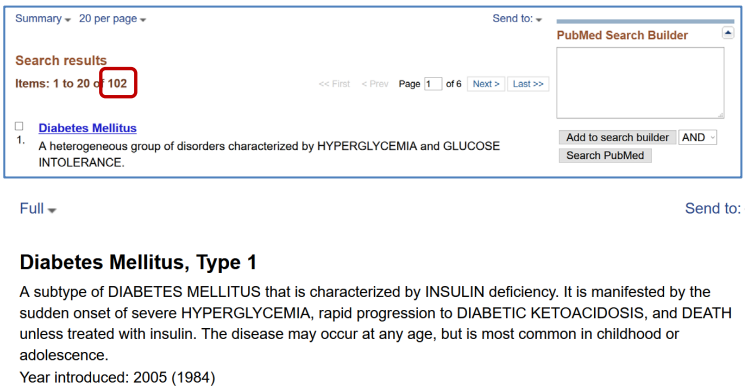


1.2

Type ***diabetes*** in the search box. It will be mapped to the corresponding MeSH indexing term(s).

1.3

This example will return a list of 102 **MeSH terms** about diabetes. The first mentioned term is often the most general one. Scroll down the list and click on the appropriate MeSH term: **Diabetes Mellitus**, Type 1. This will take you to a new page where more information is displayed (subheadings/qualifiers, entry terms, previous indexing and where the term is located in the hierarchical „MeSH tree“structure).



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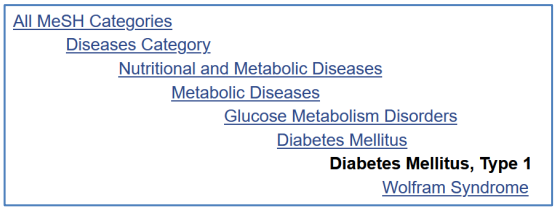
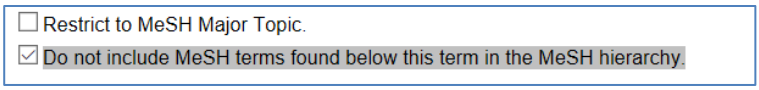
MeSH terms are organized in a “tree structure”, from most general to most specific terms:



Hint: When PubMed searches a MeSH term, it will **automatically include narrower terms** in the search. This is also called "automatic explosion." In most searches, this is desired, therefore it’s the default in the database.

Option: Select **Do not include MeSH terms found below** this term in the MeSH hierarchy if you do NOT want PubMed to search for all narrower terms found beneath your MeSH terms in the MeSH tree. Note: If a MeSH term is not exploded, it’s indicated in the search strategy as follows: **[Mesh:NoExp].**

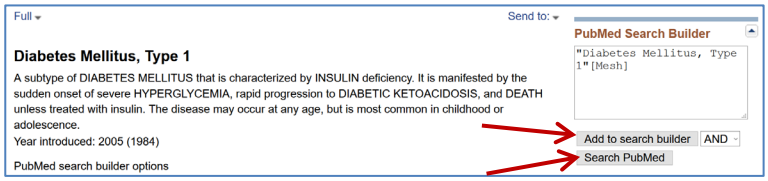


1.4 ***Tip***: Go quickly through the **entry terms** listed in the MeSH database record for Diabetes Mellitus, Type 1. **Copy/paste or write down in the concepts sheet all variants you would like to use in the textword search later on** (ignore the ones with a comma, they are a relic from the pre-internet era, when the terms were still published as a printed encyclopedia).

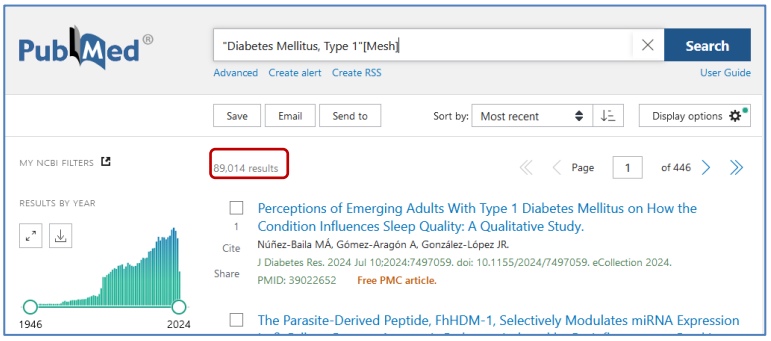
Entry Terms:

- Type 1 Diabetes
- Diabetes, Type 1
- Diabetes Mellitus, Insulin-Dependent
- Diabetes Mellitus, Insulin Dependent
- Insulin-Dependent Diabetes Mellitus
- Diabetes Mellitus, Juvenile-Onset
- Diabetes Mellitus, Juvenile Onset
- Juvenile-Onset Diabetes Mellitus
- IDDM
- Diabetes Mellitus, Type I
- Diabetes Mellitus, Sudden-Onset
- Diabetes Mellitus, Sudden Onset
- Sudden-Onset Diabetes Mellitus
- Type 1 Diabetes Mellitus
- Diabetes Mellitus, Insulin-Dependent, 1
- Insulin-Dependent Diabetes Mellitus 1
- Insulin Dependent Diabetes Mellitus 1
- Juvenile-Onset Diabetes
- Diabetes, Juvenile-Onset
- Juvenile Onset Diabetes
- Diabetes, Autoimmune
- Autoimmune Diabetes
- Diabetes Mellitus, Brittle
- Brittle Diabetes Mellitus
- Diabetes Mellitus, Ketosis-Prone
- Diabetes Mellitus, Ketosis Prone
- Ketosis-Prone Diabetes Mellitus

1.5 Click **Add to search builder** to transfer the MeSH term to the PubMed search builder.
Then click on **Search PubMed** to transfer the MeSH search to PubMed.



1.6 With the MeSH search, we have found 89'014 records (search date 18.07.2024) in PubMed indexed with Diabetes Mellitus, Type 1.



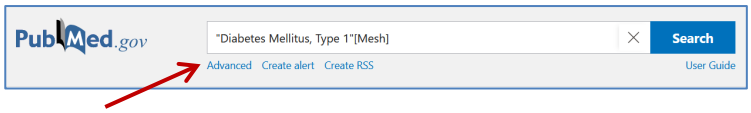
2. Problem (P1) Diabetes type 1: Formulate the Textword Search

! Synonyms, antonyms, acronyms: Think of all possible textwords an author might have used in the article. Include the entry terms you have seen in the MeSH record for Diabetes Mellitus, Type 1 (see tip in section 1.4). Are there other ways to spell them?
Use **OR** to **combine synonyms**, alternative spelling or related terms.

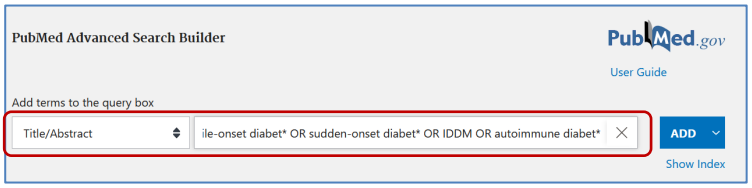
Use truncation (also called stemming) to broaden your search and to include various endings (singular, plurals, multiple variants of a word), i.e. **diabet* to cover diabetes, diabetic**, etc. Be aware that PubMed does **not** allow a truncated term consisting of **less than 4 characters**. When this occurs, you will get a warning message.

Proximity searching allows you to search for any number of terms appearing in any order within a specified distance (~N) to one another. Search terms **(no truncation!)** need to be enclosed in **double quotes**. Only available for **[ti]** and **[tiab]**. Example: **"animal therapy"[tiab:~2]** picks up animal therapy, animal based therapy, animal-assisted play therapy, therapy in animal models (~2 means: up to 2 words may appear in between the two terms.)

2.1 Start the textword search on the **Advanced** Search Page.



2.2 Choose **Title/Abstract** from the drop-down menu and type all search terms (connected with OR) into the search field:



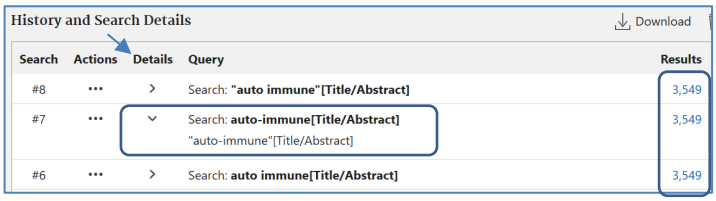
type 1 diabet* OR type I diabet* OR diabetes mellitus type 1 OR diabetes mellitus type I OR T1DM OR insulin-dependent diabet* OR juvenile-onset diabet* OR sudden-onset diabet* OR IDDM OR autoimmune diabet* OR brittle diabet* OR ketosis-prone diabet*

! Option: You may choose to **broaden the search** by connecting the single terms with the Boolean operators AND/OR (**nesting** required!):

(diabet* AND ("type 1" OR type1 OR "type i" OR insulin-dependent OR juvenile-onset OR sudden-onset OR autoimmune OR auto-immune OR brittle OR ketosis-prone)) OR T1DM OR IDDM

! Quotation marks & hyphens in PubMed

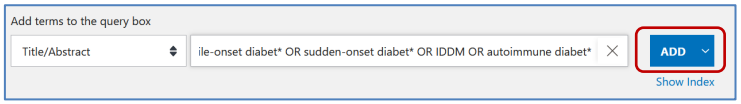
If you search with **field codes** (i.e. title/abstract) you normally don't need to **put quotation marks around an expression** (#8) since PubMed interprets it correctly. However always check this by opening the **details** section in the search history (#7).

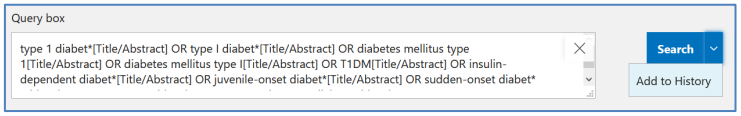


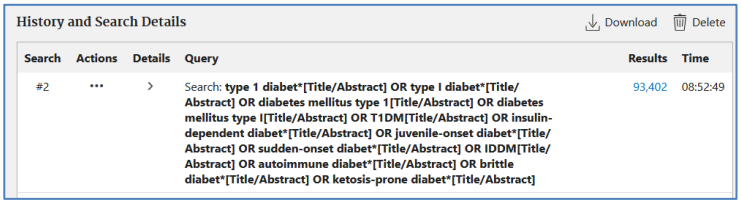
However, if you search in **all fields** (without entering field codes), PubMed will put an AND in-between, which results in many irrelevant hits. If you want to keep an expression together in an all-fields search, you can either put quotation marks around it or a hyphen in-between the words.

2.3 Clicking on **ADD** pushes the search string into the query box below.

Change Search to **Add to History** to see the number of the results of the textword search immediately in the History section below: 93'402 records on PubMed (search date 18.07.2024). In this phase of building the search strategy, we are not yet interested in the records themselves, therefore there is no need to switch to the results list at this stage.

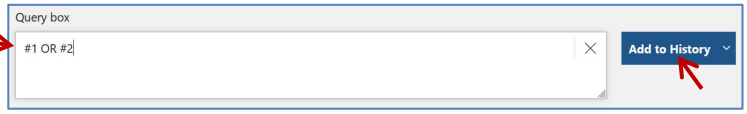






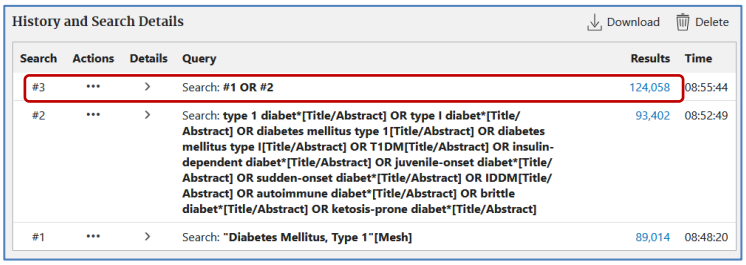
3. Problem (P1): Combine the results of the Textword and the MeSH Search

3.1 To combine search steps with OR, use #search directly in the query box. Then click on **Add to History.**



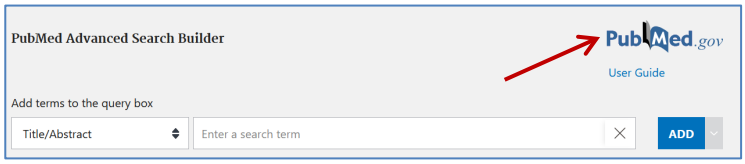
124'058 items have been found.

Hint: OR adds the results of the textword search (#2) to those of the MeSH search (#1): the set union (#3).



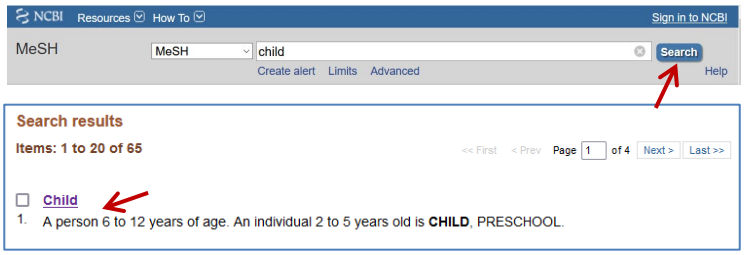
4. Population (P2) Children / adolescents: Start with the MeSH Search

4.1 Click on the **PubMed logo** to quit the Advanced search modus and to go back to the PubMed Homepage:



4.2 Open the **MeSH Database** again and search for **Child**.

You can see the definition (child = a person 6-12 years of age). To harvest the other MeSH terms for the age range 0-18, we need to open the tree by clicking on the MeSH **Child**.



4.3 Scroll down to the tree structure. Child is below **Age Groups**.

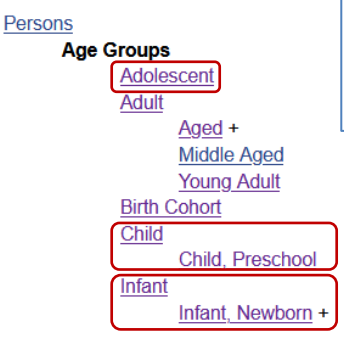
A **click on Age Groups** reveals other important terms:

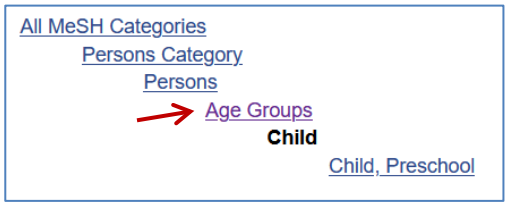
Adolescent
A person 13 to 18 years of age.

Child, Preschool
A child between the ages of 2 and 5.

Infant
A child between 1 and 23 months of age.

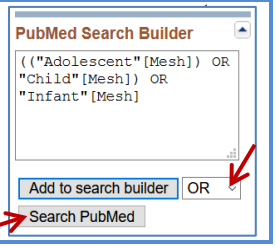
Infant, Newborn
An infant during the first 28 days after birth.





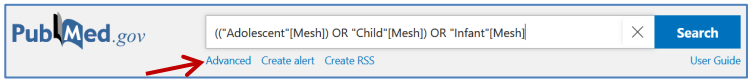
4.4 **Add one by one to the Search Builder (you need to open them all individually)**. Be careful that the correct operator is chosen: **OR**! Then click on **Search PubMed**. Over 4 million records have been found with the MeSH search.

Hint: *Child, Preschool* and *Infant, Newborn* don't need to be added (narrower terms are automatically included).

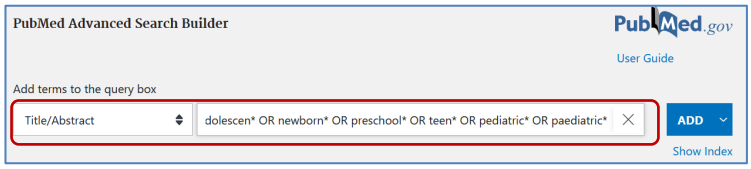


5. Population (P2) Children / adolescents: Formulate the Textword Search

5.1 Start the textword search on the **Advanced** Search Page.



5.2 Choose **Title/Abstract** from the drop-down menu and **type all search terms** (connected with OR) into the search field. Click on **Add** and on **Add to History**.



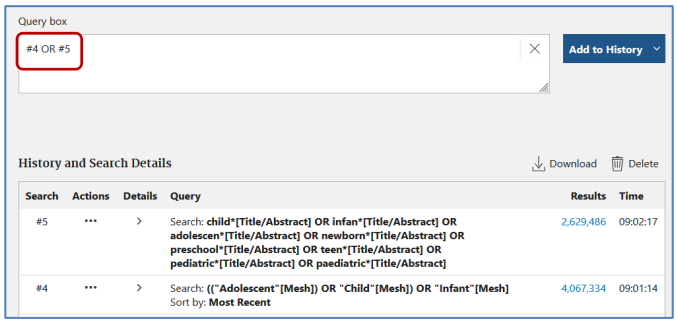
child* OR infan* OR adolescen* OR newborn* OR preschool* OR teen* OR pediatric* OR paediatric*

6. Population (P2): Combine the results of the Textword and the MeSH Search

6.1 Combine the MeSH and textword search for the concept children/adolescents according to 3.1.

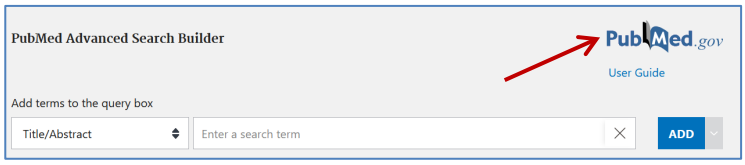
	Query	Results
#6	Search: **#4 OR #5**	4,776,137

More than 4 ½ million hits have been found.

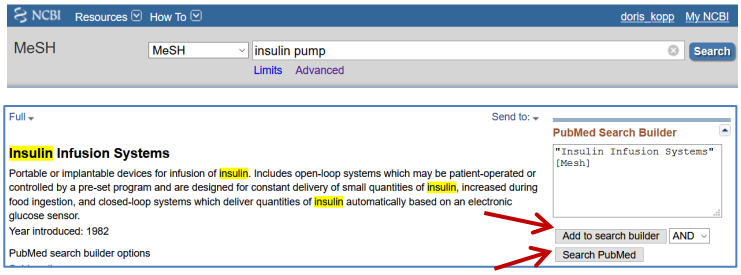


7. Intervention (I) Insulin pump: Start with the MeSH Search

7.1 Click on the **PubMed logo** to quit the Advanced search modus and to go back to the PubMed Homepage:



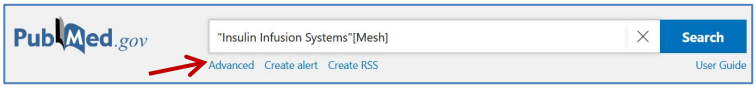
7.2 Open the **MeSH Database** again and search for **insulin pump**.



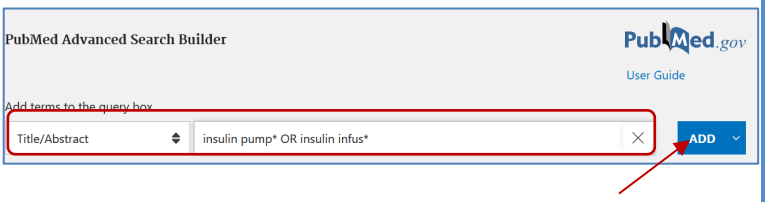
You are directly taken to the MeSH term Insulin Infusion Systems (since there is just one term). Click on **Add to search builder** and then **Search PubMed**. You get 6668 results.

8. Intervention (I) Insulin pump: Formulate the Textword Search

8.1 Start the textword search on the **Advanced** Search Page.



8.2 Choose **Title/Abstract** from the drop-down menu and **type all search terms** (connected with OR) into the search field. Click on **Add** and on **Add to History**.

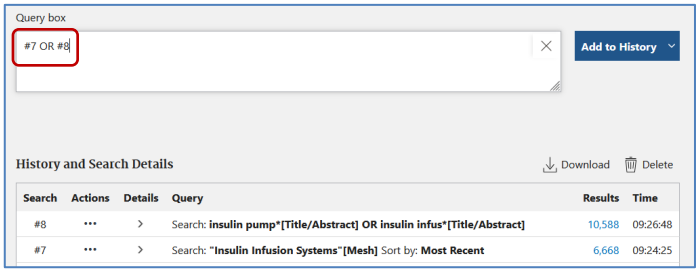


insulin pump* OR insulin infus*

9. Intervention (I): Combine the results of the Textword and the MeSH Search

9.1 Combine the MeSH and textword search for the concept insulin pump (#7 OR #8).

	Query	Results
#9	Search: **#7 OR #8**	13,393

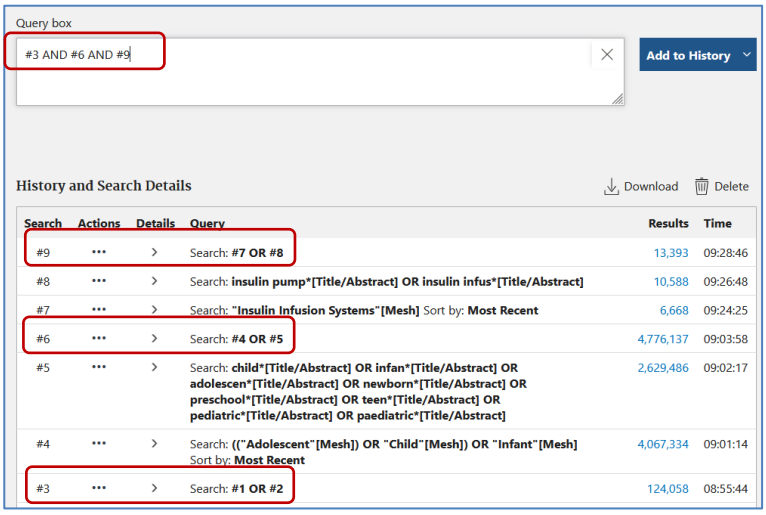


13'393 hits have been found.

10. Final step: Combine P1, P2 AND I to find all articles containing all 3 concepts

10.1 Combine the final steps for all the concepts with AND (#3 AND #6 AND #9).

By clicking on the 2831 results found (see full history below) **you will be led back the PubMed search results list**, where you can see the list of results and display them as you like.



History and Search Details

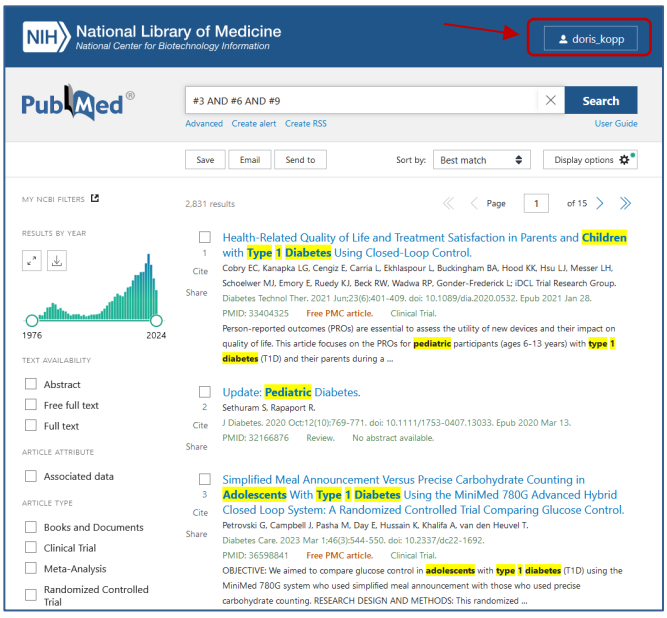
Download Delete

Search	Actions	Details	Query	Results	Time
#10	•••	›	Search: **#3 AND #6 AND #9**	2,831	09:31:56
#9	•••	›	Search: **#7 OR #8**	13,393	09:28:46
#8	•••	›	Search: **insulin pump*[Title/Abstract] OR insulin infus*[Title/Abstract]**	10,588	09:26:48
#7	•••	›	Search: **"Insulin Infusion Systems"[Mesh]** Sort by: **Most Recent**	6,668	09:24:25
#6	•••	›	Search: **#4 OR #5**	4,776,137	09:03:58
#5	•••	›	Search: **child*[Title/Abstract] OR infan*[Title/Abstract] OR adolescen*[Title/Abstract] OR newborn*[Title/Abstract] OR preschool*[Title/Abstract] OR teen*[Title/Abstract] OR pediatric*[Title/Abstract] OR paediatric*[Title/Abstract]**	2,629,486	09:02:17
#4	•••	›	Search: **(("Adolescent"[Mesh]) OR "Child"[Mesh]) OR "Infant"[Mesh]** Sort by: **Most Recent**	4,067,334	09:01:14
#3	•••	›	Search: **#1 OR #2**	124,058	08:55:44
#2	•••	›	Search: **type 1 diabet*[Title/Abstract] OR type I diabet*[Title/Abstract] OR diabetes mellitus type 1[Title/Abstract] OR diabetes mellitus type I[Title/Abstract] OR T1DM[Title/Abstract] OR insulin-dependent diabet*[Title/Abstract] OR juvenile-onset diabet*[Title/Abstract] OR sudden-onset diabet*[Title/Abstract] OR IDDM[Title/Abstract] OR autoimmune diabet*[Title/Abstract] OR brittle diabet*[Title/Abstract] OR ketosis-prone diabet*[Title/Abstract]**	93,402	08:52:49
#1	•••	›	Search: **"Diabetes Mellitus, Type 1"[Mesh]**	89,014	08:48:20

11. Results list: Display options

11.1 In the drop-down menu **Display options** you may change the format or the order of the results listed.

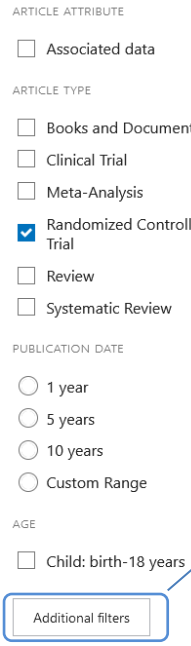
All the terms we used in the search strategy are highlighted in yellow, if you're **logged into** your **NCBI account**. This is helpful to see immediately, where in the record your search terms appear. To log in or create an account, see **Annexe 2**.



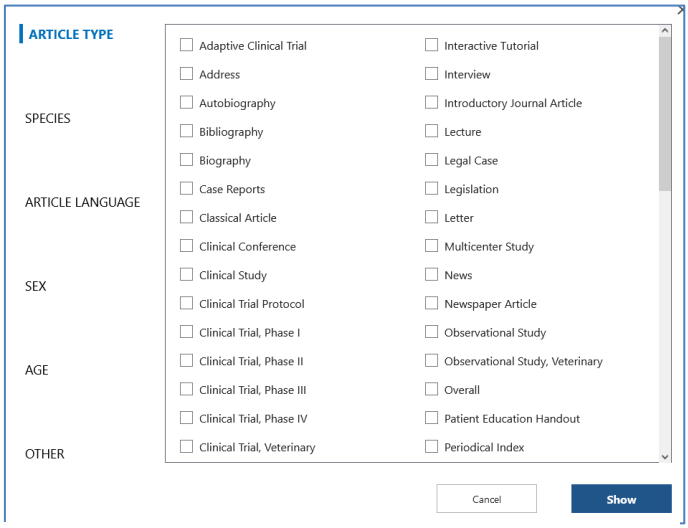
12. Refine Results – Applying filters

12.1

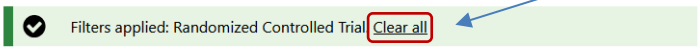
You may refine your search from the Search Results page by applying various filters.



A few filters are displayed on the left of the results list. A click on **Additional filters** reveals more to choose from.



Please note: Once you have set up filters, they will also be used in your next searches unless you **untick** them. Therefore, click on **Clear all**.



!

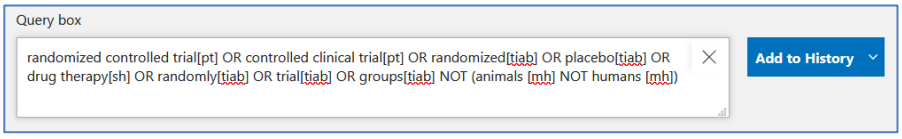
Hint: Be careful in the use of these database filters
They often lead to a too strong limitation of your search results. Besides, in many cases you will lose the recent, not yet indexed articles. This is because **most filters are based on MeSH terms** (except for the filters for Systematic Reviews, Languages and Publication dates).

!

Tip: Use a validated RCT filter:
We recommend "The Cochrane highly sensitive search strategies for identifying randomized trials in PubMed": http://work.cochrane.org/pubmed (sensitivity maximizing version).

12.2

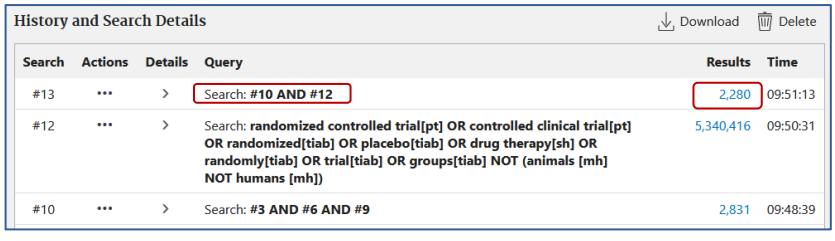
To filter for RCTs, use the following Cochrane search string in the **Query box of the advanced search**:



randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] NOT (animals [mh] NOT humans [mh])

Now **combine the Cochrane search filter (#12) with the last step of the concepts search (#10).**

Hint: If you need a validated **Humans filter**, extract it from this RCT filter:
NOT (animals [mh] NOT humans [mh])



13. How to save the search results and the search strategy (including the alert function)

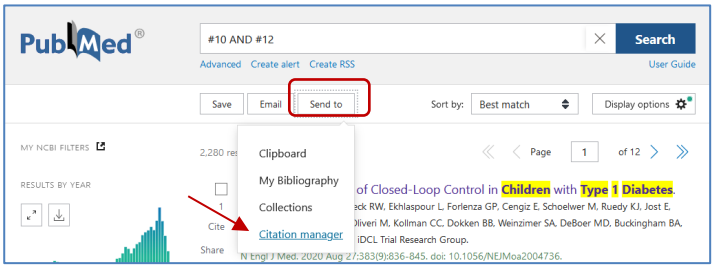
!

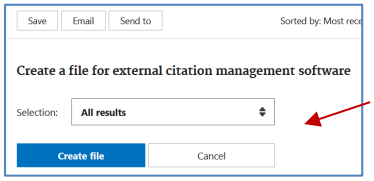
Every search must be transparent and reproducible! Therefore, you need to save your search strategy (and if desired set an alert function).
In most cases, you will need to work with the search results repeatedly to review abstracts, get full texts, etc. Save your results in PubMed or in a reference management programme (Endnote, Mendeley, etc.).

13.1

Saving the search results

To export your results, click on the **Send to** menu. Select **Citation manager**.





Then, after choosing **All results** from the drop-down menu, click the **Create file** button. An .nbib file will be created (which can be imported into many reference management programmes).

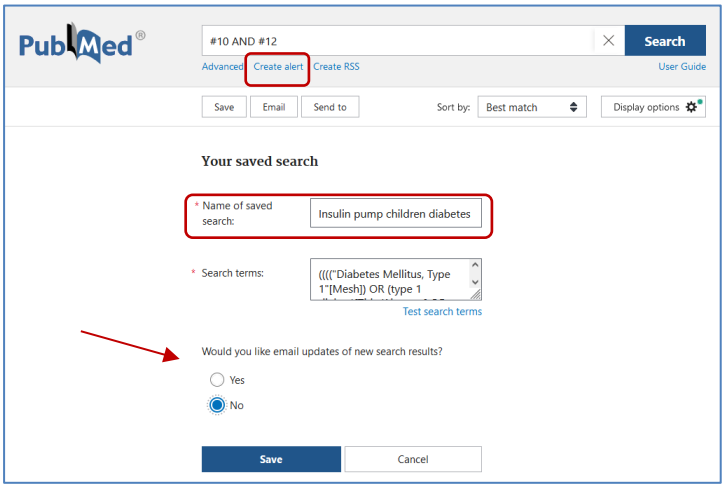
13.2

Saving the search strategy

Log into your account or register for an account (see Annexe 2).

Click on **Create alert** (directly below the search bar on the results page). **Name your search** and decide whether you want to receive email updates of new search results. Click on **Save**.

Alternatively, you might also just copy/paste the whole search history into a Word document or download it (.csv Excel file). This way you also see the number of results for each search step.



14. Obtaining the fulltext of the articles (at the University of Bern campus)

14.1

On the **Search Results** page, choose one of the references by clicking on the title.

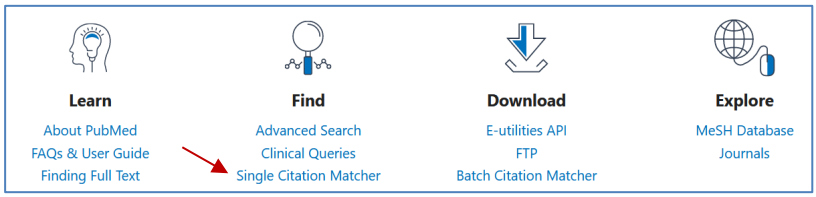
You can see the full reference. On the right, there are icons linking to the **publisher's website and selected repositories** like PMC or **University of Bern resources**.

Annexe 1: Check your results list for core articles

A1

A good and comprehensive search strategy should return core articles on the topic. Let's see if our search strategy has returned the following core article:

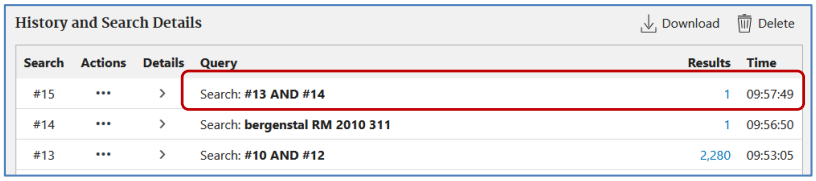
Bergenstal RM, Tamborlane WV, Ahmann A, et al. Effectiveness of sensor-augmented insulin-pump therapy in type 1 diabetes. N Engl J Med. 2010;363(4):311-320.



Use the **Single Citation Matcher** on the PubMed homepage (listed in the **Find** section) to search for the article, or **type relevant terms in the search box (author's surname and initial, publishing year, first page number**, etc.)

Go to the **history** (on the Advanced page).

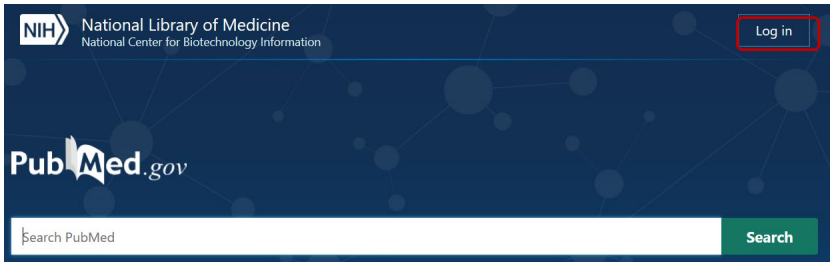
Now combine your 2280 results from the final search strategy (#13) with the search step of the core article (#14) with **AND.** If it returns **1**, the core article is included in the search results.

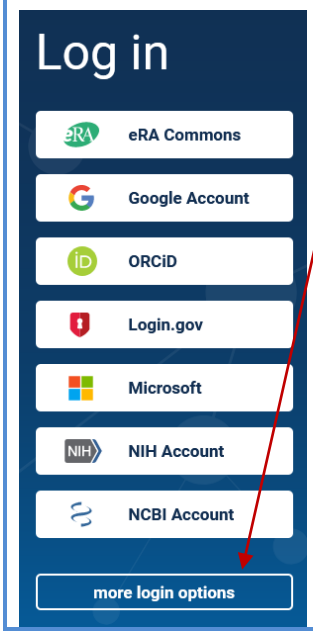


Annexe 2: Log in or register for an NCBI account

A2

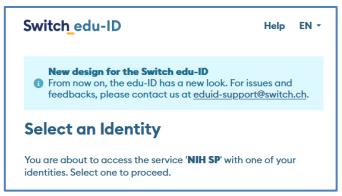
You can sign up for a personal account in PubMed (NCBI account). This is especially useful to be able to set up alerts.



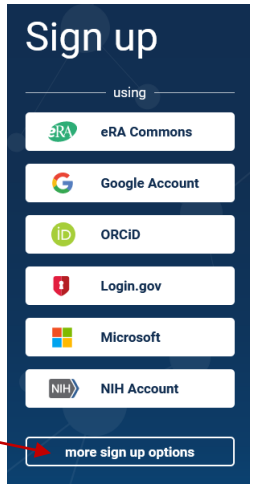


Log in with one of the proposed accounts. Under "more login options" you can also log in with your **SWITCH edu-ID**:

1. Find your login provider: choose "Universität Bern"
2. Login with your SWITCH edu-ID



If you don't have an account, you need to **sign up** using one of the accounts (also SWITCH edu-ID under "more sign up options".



Annexe 3: Document your search, fill in the concept sheet

Search strategy (concepts) Date last searched 18.07.2024 (PubMed)

Topic / Research Question **In children with type 1 diabetes, does insulin pump therapy produce normoglycemia and improve the quality of life (in comparison with daily insulin injections)?** Study selection: **Randomized controlled trials (RCTs)**

Concept 1: P1 (Problem) **Diabetes Type 1**	*Subject Heading (MeSH)* "Diabetes Mellitus, Type 1"[Mesh] **OR** *Textwords [Title/Abstract]* type 1 diabet* OR type I diabet* OR diabetes mellitus type 1 OR diabetes mellitus type I OR T1DM OR insulin-dependent diabet* OR juvenile-onset diabet* OR sudden-onset diabet* OR IDDM OR autoimmune diabet* OR brittle diabet* OR ketosis-prone diabet*
AND	
Concept 2: P2 (Population) **Children/Adolescents*** *Please note: If you do a search for creating a systematic review, make sure to include even more terms, like: youth*, schoolchild*, girl*, etc.*	*Subject Heading (MeSH)* "Adolescent"[Mesh] OR "Child"[Mesh] OR "Infant"[Mesh] **OR** *Textwords [Title/Abstract]* child* OR infan* OR adolescen* OR newborn* OR preschool* OR teen* OR pediatric* OR paediatric*
AND	
Concept 3: I (Intervention) **Insulin pump**	*Subject Heading (MeSH)* "Insulin Infusion Systems"[Mesh] **OR** *Textwords [Title/Abstract]* Insulin pump* OR insulin infus*
AND	
Limits/Filters for study type **RCT** The Cochrane highly sensitive search strategies for identifying randomized trials in PubMed https://work.cochrane.org/pubmed	randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] NOT (animals [mh] NOT humans [mh])

PubMed History (18.07.2024, date last searched)

History and Search Details

Download creates a CSV File (can be opened with Excel)

Download Delete

Search	Actions	Details	Query	Results	Time
#10	•••	>	Search: **#3 AND #6 AND #9**	2,831	10:02:08
#15	•••	>	Search: **#13 AND #14**	1	09:57:49
#14	•••	>	Search: **bergenstal RM 2010 311**	1	09:56:50
#13	•••	>	Search: **#10 AND #12**	2,280	09:53:05
#12	•••	>	Search: **randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] NOT (animals [mh] NOT humans [mh])**	5,340,416	09:50:31
#11	•••	>	Search: **#3 AND #6 AND #9** Filters: **Randomized Controlled Trial**	381	09:40:21
#9	•••	>	Search: **#7 OR #8**	13,393	09:28:46
#8	•••	>	Search: **insulin pump*[Title/Abstract] OR insulin infus*[Title/Abstract]**	10,588	09:26:48
#7	•••	>	Search: **"Insulin Infusion Systems"[Mesh]** Sort by: **Most Recent**	6,668	09:24:25
#6	•••	>	Search: **#4 OR #5**	4,776,137	09:03:58
#5	•••	>	Search: **child*[Title/Abstract] OR infan*[Title/Abstract] OR adolescen*[Title/Abstract] OR newborn*[Title/Abstract] OR preschool*[Title/Abstract] OR teen*[Title/Abstract] OR pediatric*[Title/Abstract] OR paediatric*[Title/Abstract]**	2,629,486	09:02:17
#4	•••	>	Search: **(("Adolescent"[Mesh]) OR "Child"[Mesh]) OR "Infant"[Mesh]** Sort by: **Most Recent**	4,067,334	09:01:14
#3	•••	>	Search: **#1 OR #2**	124,058	08:55:44
#2	•••	>	Search: **type 1 diabet*[Title/Abstract] OR type I diabet*[Title/Abstract] OR diabetes mellitus type 1[Title/Abstract] OR diabetes mellitus type I[Title/Abstract] OR T1DM[Title/Abstract] OR insulin-dependent diabet*[Title/Abstract] OR juvenile-onset diabet*[Title/Abstract] OR sudden-onset diabet*[Title/Abstract] OR IDDM[Title/Abstract] OR autoimmune diabet*[Title/Abstract] OR brittle diabet*[Title/Abstract] OR ketosis-prone diabet*[Title/Abstract]**	93,402	08:52:49
#1	•••	>	Search: **"Diabetes Mellitus, Type 1"[Mesh]**	89,014	08:48:20

PubMed 1-line-search string

(format when saved in the database, easy to replicate, just copy/paste in search box)

((((("Diabetes Mellitus, Type 1"[Mesh]) OR (type 1 diabet*[Title/Abstract] OR type I diabet*[Title/Abstract] OR diabetes mellitus type 1[Title/Abstract] OR diabetes mellitus type I[Title/Abstract] OR T1DM[Title/Abstract] OR insulin-dependent diabet*[Title/Abstract] OR juvenile-onset diabet*[Title/Abstract] OR sudden-onset diabet*[Title/Abstract] OR IDDM[Title/Abstract] OR autoimmune diabet*[Title/Abstract] OR brittle diabet*[Title/Abstract] OR ketosis-prone diabet*[Title/Abstract])) AND ((("Adolescent"[Mesh]) OR "Child"[Mesh]) OR "Infant"[Mesh]) OR (child*[Title/Abstract] OR infan*[Title/Abstract] OR adolescen*[Title/Abstract] OR newborn*[Title/Abstract] OR preschool*[Title/Abstract] OR teen*[Title/Abstract] OR pediatric*[Title/Abstract] OR paediatric*[Title/Abstract])) AND (("Insulin Infusion Systems"[Mesh]) OR (insulin pump*[Title/Abstract] OR insulin infus*[Title/Abstract])))) AND (randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] NOT (animals [mh] NOT humans [mh])))