

KNOWING WHEN TO STOP

Final results vs. work involved in
systematic review database searching

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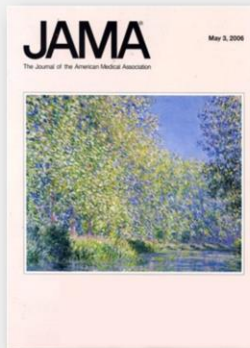
Does searching more databases add value to the systematic review?



Here we aim to answer the question: Does searching more databases add value to the systematic review. Especially when considering the time it takes for the ENTIRE process, the resources available like the number of people and access to databases.

The reason we ask this question is because we were seeing a number of published SRs that were searching 10, 11, 12 databases, plus we were getting requests at our university to search 8, 9, 10 databases, which takes a lot of time, and resources, and we wondered if it was really necessary.

Searched PubMed for all articles in...



To scope this project, we selected three top-tier biomedical journals that publish systematic reviews, hoping that they had a higher standard of reporting of their published systematic reviews.




As part of the scope, we collected data from four years' worth of publications beginning January 2012 to December 2015

We collected records from a PubMed search which yielded 14,006 records ; the next step was to identify just the systematic reviews

Review | **Meta-analysis** | **Guidelines**
Consensus | **No publication type**

screened
4,426



This process left us with 4426 records left for title/abstract screening.

REVIEWED

1,284

for full text

1284 were reviewed for full-text to determine whether they were indeed a systematic review or reported on a systematic review where reporting of their methodology could be found (for instance, the US Preventative Task Force would publish findings in the journal, but refer to the full report on their website)

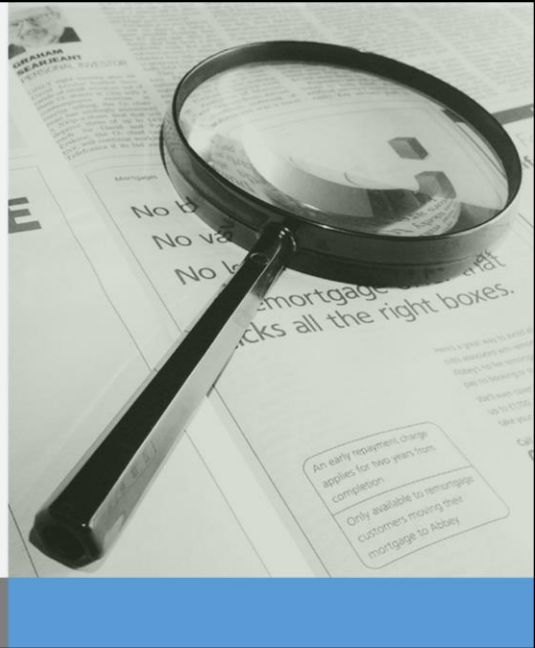
INCLUSION CRITERIA

databases searched (>1)

final includes

number of results retrieved from
each database

search strategy



To be included in final analysis, articles had to meet the following criteria:

They had to report the databases searched – and it had to be more than one.

Several times the papers reported only searching PubMed.

They had to report somewhere their list of final included studies (we did not search through text; so either in a table in the manuscript or an appendix)

They had to report the number of results from each database (not just an aggregate total, which happened often)

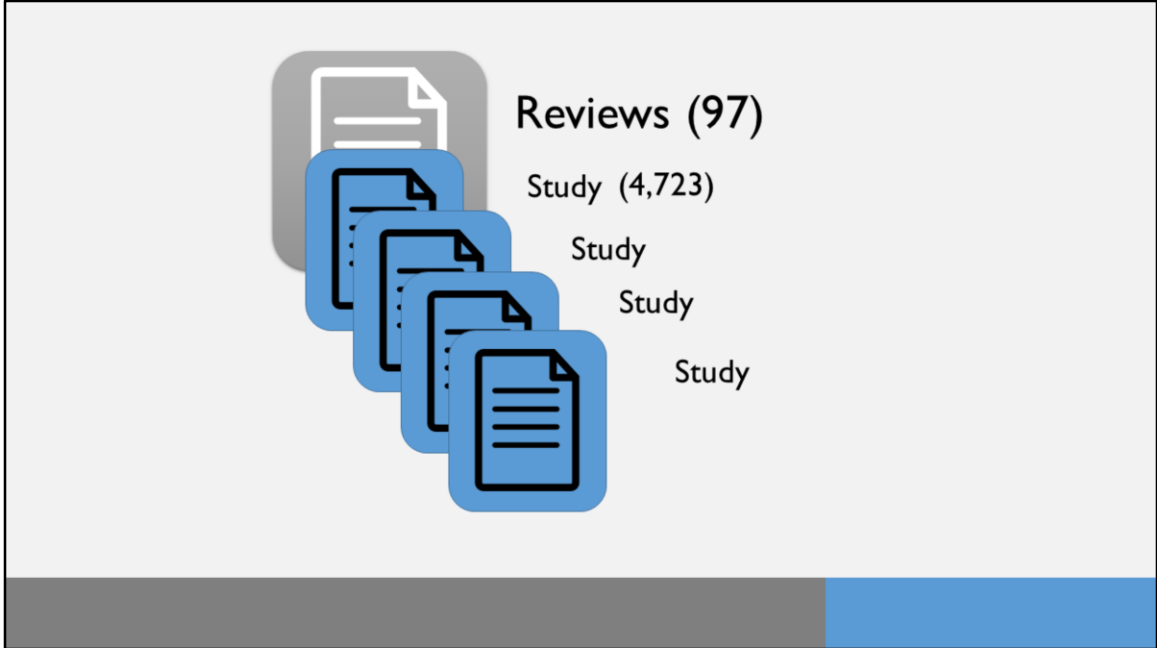
They had to report the search strategy of at least one database

97

reviews
included in
final analysis

~2%
of what we
started with

This left us with 97 reviews to include in our final analysis (approx. 2% of what we started with)



Take a moment to explain terminology going forward to hopefully lessen confusion:

When using the word Reviews we're talking about the 97 systematic reviews we used as our sample.

We did analyses on these reviews and looked at the individual Studies that were included in those systematic reviews

(Averages to about 49 included studies per SR)

DATA EXTRACTION

- databases searched
- # retrieved from each database
- final includes

DATA EXTRACTION:

Similar to our inclusion criteria, we extracted the following data for each of the 97 included SRs:

Names of the databases the authors reported searching

total number of results found in each database,

And the citation information of their final included studies

34 databases with defined scope were searched by 97 included systematic reviews and were included in our analysis

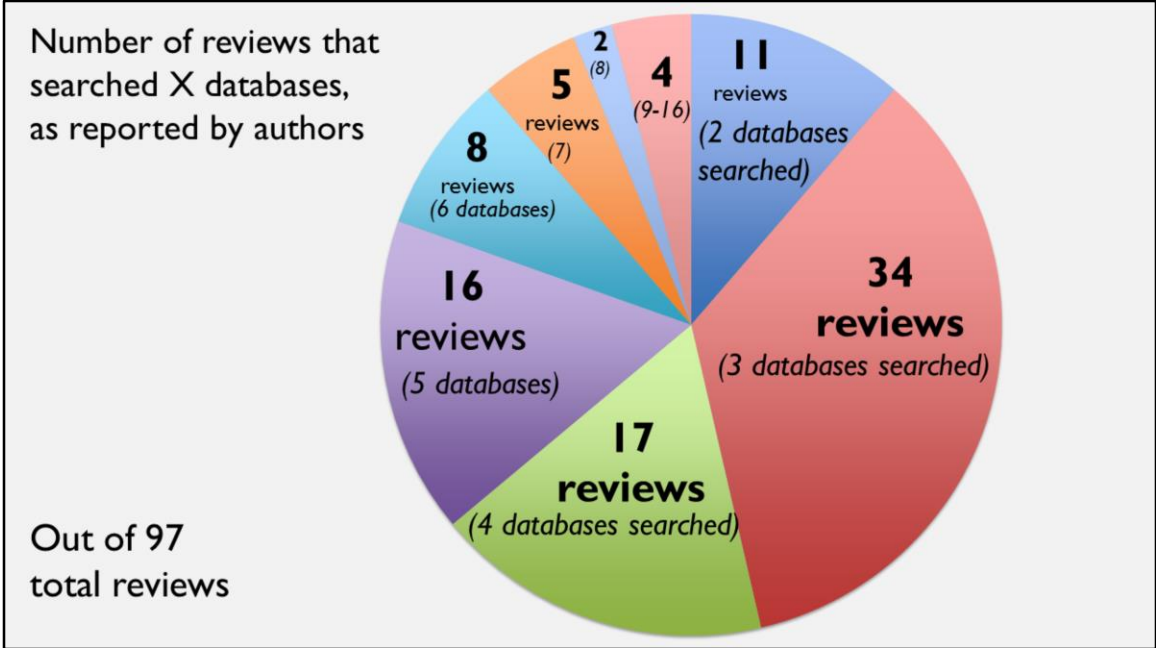


Some details about that data...

The SR authors reported searching 57 sources among the 97 reviews.

34 of which were primary literature databases with a defined scope which we could use in our analysis

The 23 other sources included grey lit and other sources with curated collections that did not have a defined scope.

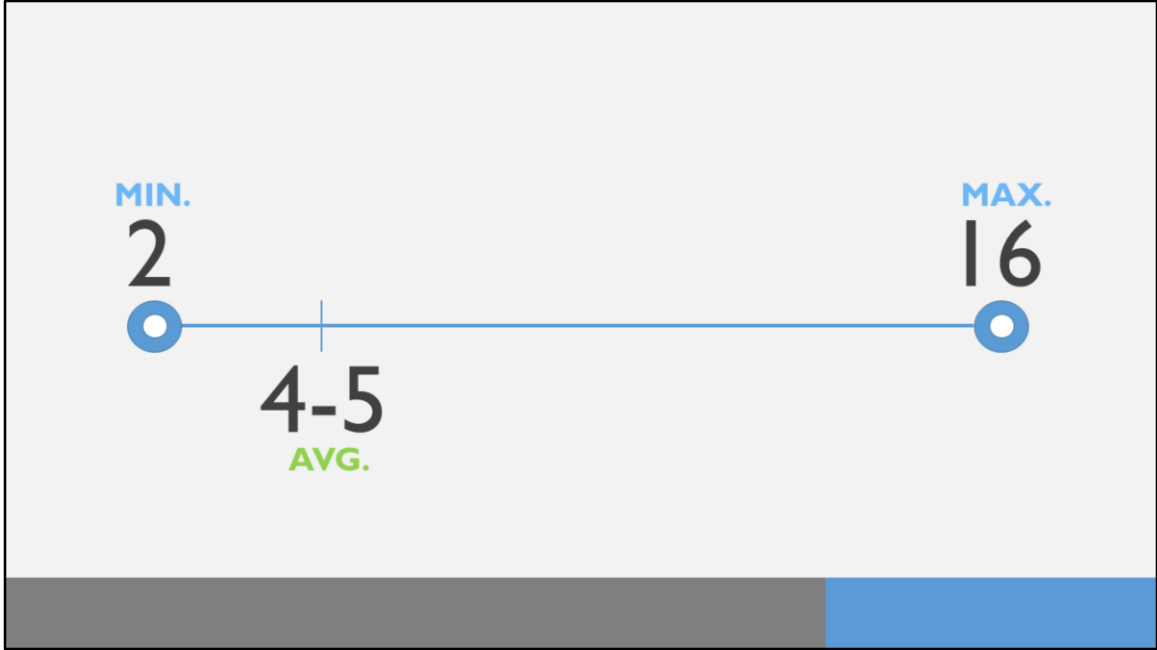


We then looked at how many databases the reviews reported searching. This pie chart illustrates how many databases the 97 systematic reviews searched:

Starting in the 12:00 position we can see that 11 papers searched two databases

Moving around the chart clockwise, we can see that just over half searched only 3 or 4 databases.

The remaining 40% or so, reported searching more than 5...



The actual number of databases ranged from 2 (which we required) to 16; with an average searching 4-5 databases.

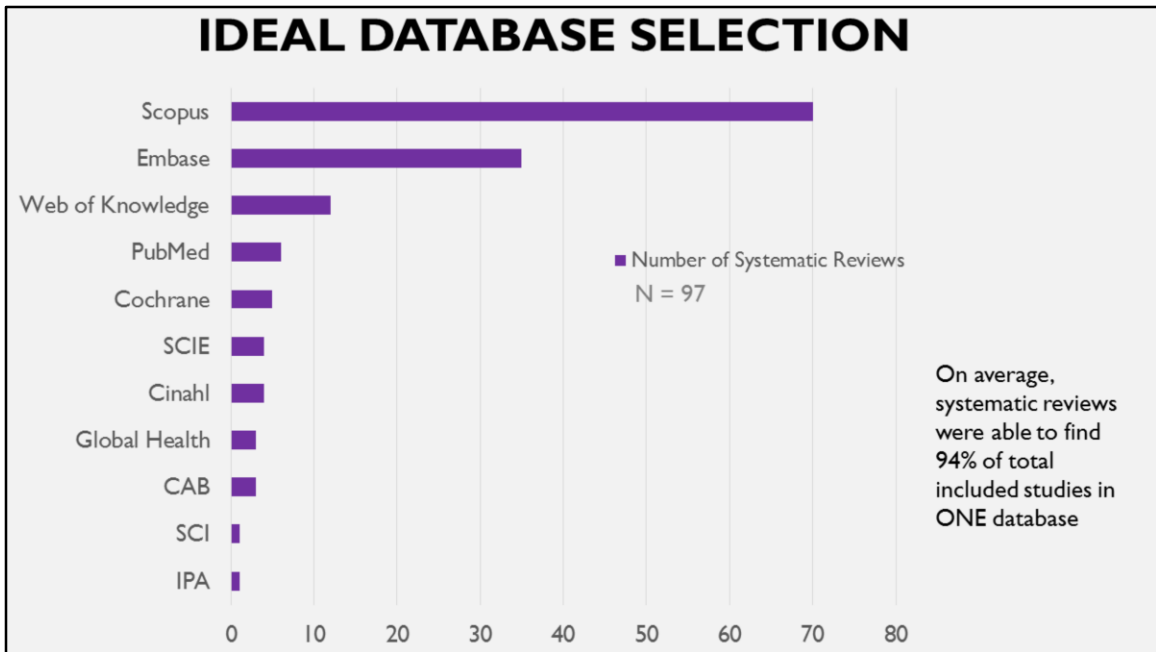
THE ANALYSIS, part I

1. Compared lists of included studies with database coverage
2. Determined in which database or database combinations all included studies could be found
3. Compared coverage in databases actually searched by each SR to the 34 databases for which we had content coverage

So, once we gathered all of these data, what did we do with them?

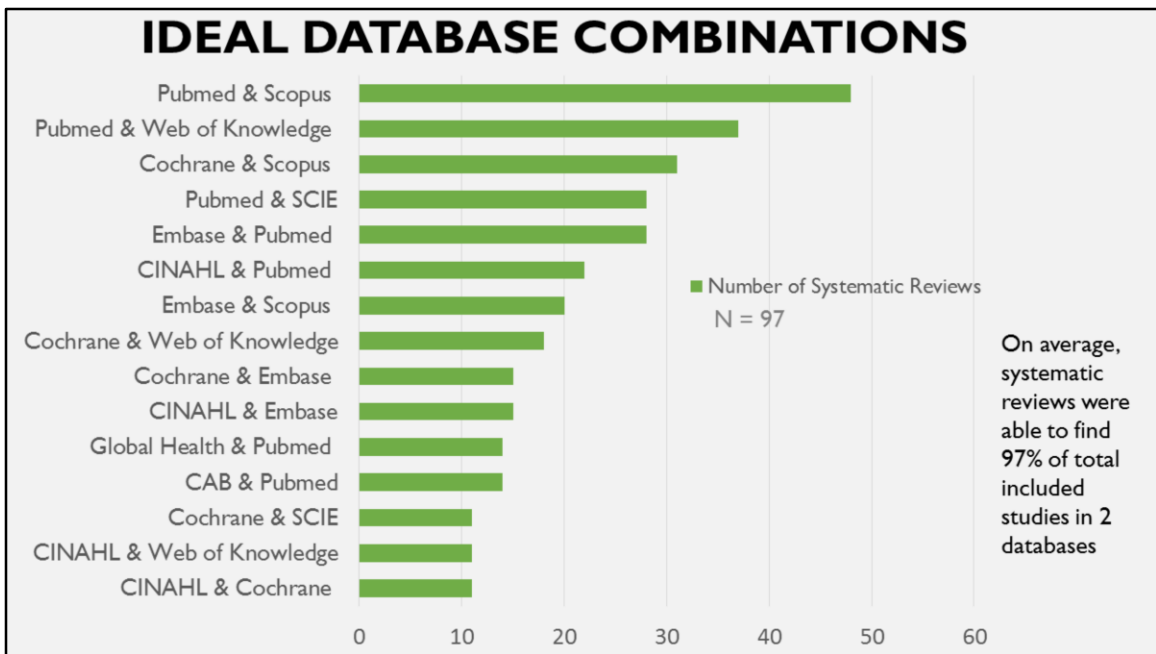
Our first step was to compare the lists of studies included in each systematic review with the overall journal coverage for each of the databases searched. We then determined in which single database each systematic review could find the largest percentage of its included studies and in which database combinations each systematic review could find the largest percentage of its included studies.

We then stratified our findings by ideal coverage, or where the greatest number of included studies could be found if the systematic review had searched any of the 34 databases for which we had content coverage, and by actual coverage, or where the greatest number of included studies could be found for each systematic review looking at only the databases searched by that systematic review.



When looking at ideal coverage, we found that the single database that included the greatest percent of included studies for most of our systematic reviews was Scopus, with 70 SRs finding about 94% of their total included studies in that database. The second best database was Embase, followed by Web of Knowledge, PubMed, and on down the list.

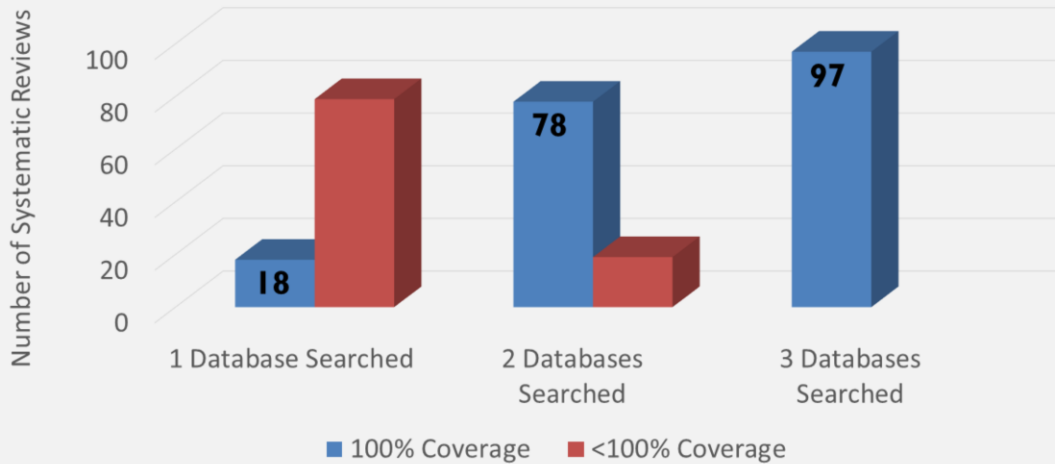
IDEAL DATABASE COMBINATIONS



When you combine two databases, we found that coverage increased to 97% for 2 databases, with the combination of PubMed and Scopus being the best combination of databases for nearly half of our included systematic reviews. The best combination for about 35 of our included SRs was PubMed & Web of Knowledge. The general trend we saw here was that a combination of a large biomedical database like PubMed or Embase with a large general knowledge database like Scopus or Web of Knowledge located all or nearly all of the included studies for most of the SRS we examined.

When you add a third database, the number of possible combinations increases exponentially, so we didn't include a graphic of that, as it would be unreadable, but the trend that we saw was that a combination of a large biomedical database, a large general knowledge database, and a subject-specific database like CINAHL or PsycInfo netted 99 to 100% of included studies for all of the SRs that we examined.

How many databases need to be searched for complete study coverage?



Switching gears now, we're going to take a brief look at overall coverage examining only the databases searched by each systematic review. When you look at only the databases searched by each review, we found that 18 of our included reviews found 100% of their included studies in 1 database.

If you look at the combination of two databases searched by each review, we found that 78 of our 97 SRs could have found 100% of their included studies in a combination of two databases.

When you increase your coverage to a combination of 3 databases, we found that all 97 of our included SRs could find all of their included studies in a combination of three of the databases that they searched.

These numbers do not include studies that could not be located in any of the databases that each review searched. On average, these accounted for about 2 studies per review, and many of these were things like grey literature, conference abstracts, or studies located via other methods like hand searching or cited reference searching.

THE ANALYSIS, part II

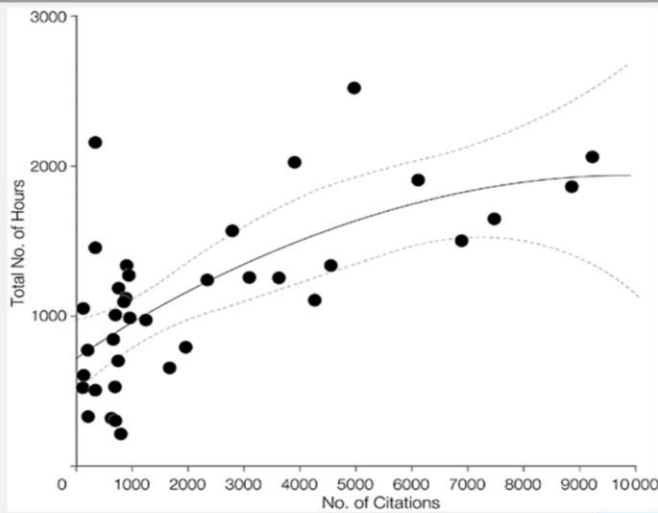
Using the combination of databases needed to achieve full included study coverage, determine

1. How many additional databases were searched
2. How many records were added by each additional database searched
3. How much time was added to the systematic review project for each database added

So, now that we've determined the overall database coverage for each systematic review, what about those extra databases that most of our included SRs searched?

Using the data that we discussed in previous slides, we then went on to determine how many additional databases each systematic review searched that did not yield any unique included studies; how many records were added to the review process by each of these additional databases, and then finally we used a previously published formula to calculate the time added to each systematic review project by each additional database.

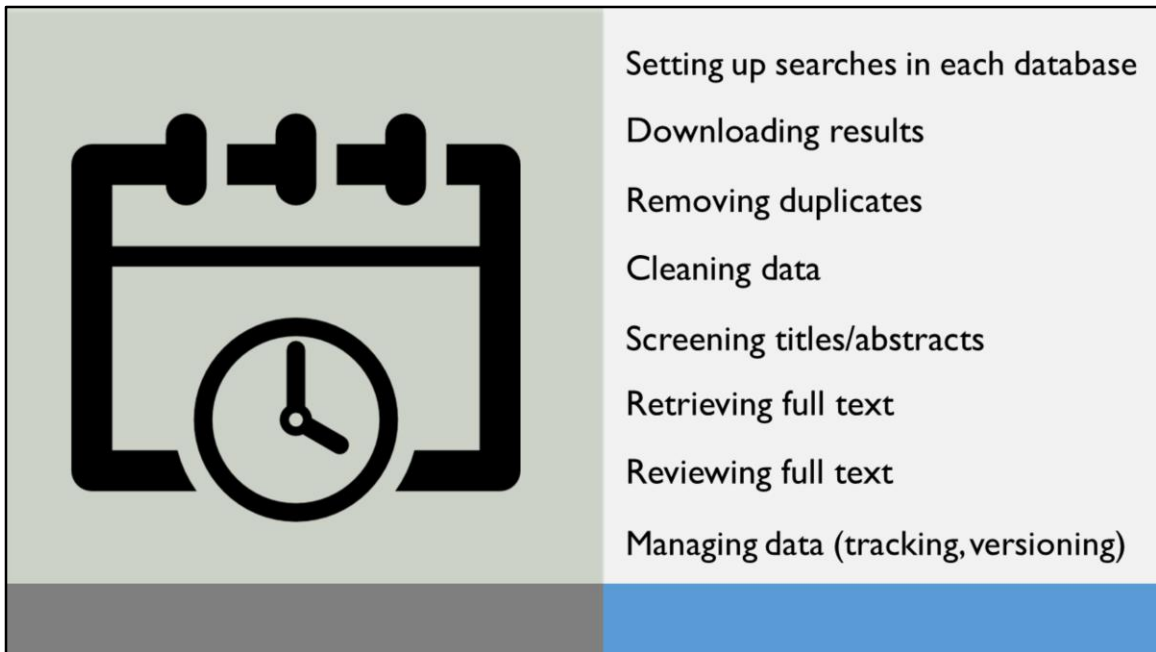
Citations Retrieved for a Meta-analysis and Total Hours Required to Complete the Meta-analysis



Allen, I. E., & Olkin, I. (1999). Estimating time to conduct a meta-analysis from number of citations retrieved. *JAMA*, 282(7), 634-635.

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The formula that we used to calculate the time added to each review was taken from this paper published by Allen and Olkin in JAMA in 1999: Estimating time to conduct a meta-analysis from number of citations retrieved. They looked at a group of 37 meta-analyses and determined the amount of time each task in the systematic review required and compared that to the number of citations retrieved for the systematic review. As you can see, as the number of citations increases, so does the total number of hours required for the review.



When we add records to a systematic review search, we add time to the review in a number of different steps.

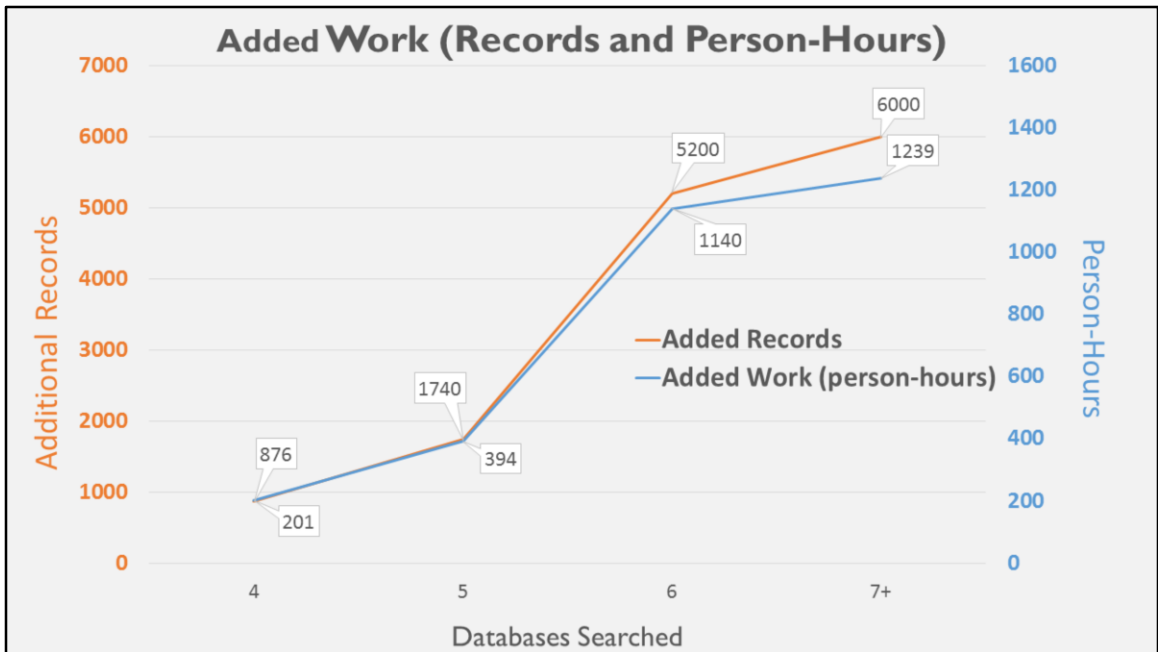
First, it will take the librarian extra time to set up the searches in each database and to download those results. As you get outside of the realm of PubMed and Scopus, it also becomes increasingly difficult to download search results, and the downloads you get tend to get a bit messier, so it will then require extra time to remove the duplicates from your database and to clean up some of the data so that your investigators are working with the best possible dataset.

From there your citations go on to title abstract review. This one is pretty obvious: the more citations you have to review, the longer it takes to review them. When you increase the number of citations you're reviewing, the odds are you're going to have more citations that someone says, "Well, I'm not sure about this one, I need to see the full text."

So then you will be adding additional time for retrieving the full text for these articles and reviewing that full text.

Finally, the more citations you add, the more data you have to manage, and the more

cumbersome that becomes, so you'll be spending extra time in tracking your data, your inclusion/exclusion decisions, and your version control.



So, what did we ultimately find when we analyzed how much work these SRs were adding to their project by searching databases that did not return any unique included studies?

What this chart shows is the number of records added for each added database and the number of person-hours for each added database. The scale for records is on the left in orange, and the scale for work is on the right in blue.

In our analysis of these 97 SRs, we found that the 12 SRs that searched 4 databases added on average an extra 876 records and roughly 200 extra person-hours to their project. The 11 SRs that searched 5 databases added on average an extra 1740 records and nearly 400 extra person-hours to their project, and as you can see, that trend continues for the SRs that searched 6, 7, or more databases.

Does searching more databases add value to the systematic review?



Circling back to our original question, does searching more databases add value to a systematic review?

PUTTING IT TOGETHER

97 SRs searched for studies in 34 databases (2-16 databases each)

All included studies were found in a combination of 3 of the databases searched by each SR

Adding additional databases beyond 3 resulted in additional work for the team at multiple steps of the process, without resulting in additional included studies

Overall, we found that adding additional databases to your literature searches adds records and work to your systematic review without adding additional unique included studies.

To do this, we examined 97 SRs and coverage from 34 databases, and in doing so, we discovered that all included studies could be found in a combination of 3 of the databases that were searched by each SR. Anything beyond that was adding work without adding unique data that could be included in the systematic review's final analysis.

LIMITATIONS

SR topics were highly clinical and biomedical; results may vary by subject area

Quality of reporting within the reviews was not strong, leading to a fairly small dataset

Unable to evaluate non-traditional database sources (e.g., Google Scholar)

Did not examine literature search strategies

There were a few limitations to our analysis. First, the large majority of SRs we found were on biomedical and highly clinical topics. It's possible that the results of our analysis might be different in other subject areas.

We also found that the quality of reporting for a lot of SRs identified by our searches was not thorough enough to be included in our analysis, so we were working with a fairly small dataset, especially when looking at SRs that searched in 6 or more databases. Because of this we had fairly high standard deviations on our findings.

We also were unable to evaluate non-traditional database sources like Google Scholar because there is not a published scope for those sources. A few of the SRs we looked at did search in these non-traditional sources, so we really would have liked to include them in our analysis. However, we did find that of the roughly 4,000 studies we examined, only 8 of them could not be located in one of the 34 databases for which we were able to gather coverage data.

Finally, we did not evaluate the actual search strategies that were used to pull in the studies. We did this in part to avoid introducing the topic of searching skills into our analysis, as we felt that the skills of the searchers could vary pretty widely from

review to review, and we really wanted to look at database coverage as opposed to searching skills. However, we suspect that these results may vary somewhat if the actual literature search strategies had been taken into account.

CONCLUSION

For biomedical systematic reviews, 95% to 100% of your final includes will likely be found by searching in **ONE** medical database, **ONE** general database, and **ONE** subject-specific database.

Adding additional databases to your search will likely result in increased work for the entire systematic review team without yielding appreciable results.

Rather than adding additional databases to your literature search, consider supplementing traditional literature searches with other methods such as hand searching, cited reference searching, and searching grey literature sources.

So, ultimately, what we found in our analysis was that, for clinical systematic reviews, 95 to 100% of your final included studies will likely be found in a combination of 1 medical database, 1 general database, and 1 subject-specific database. Adding additional databases to your search adds additional work for the entire systematic review team without yielding appreciable unique included studies.

Rather than adding additional databases to your literature searches, we would recommend supplementing your traditional searches with other methods like hand searching, cited reference searching, and searching grey literature to get those last couple of studies that might not have shown up in your traditional literature search. Cochrane recommends you use these methods anyway, so they shouldn't be adding additional time to your systematic review.

Acknowledgements & References

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Allen, I. E., & Olkin, I. (1999). Estimating time to conduct a meta-analysis from number of citations retrieved. *JAMA*, 282(7), 634-635.

PMID: 10517715

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Thank you all so much for your time. In conducting this project, we had a little help at a few points along the way, so we'd like to thank Fei Yu for her assistance with data visualization and Matt Ogden for assistance with setting up our Excel files for analysis. If you'd like to read the paper that we reference above, we've also included the full citation here, so you can look it up at your leisure.

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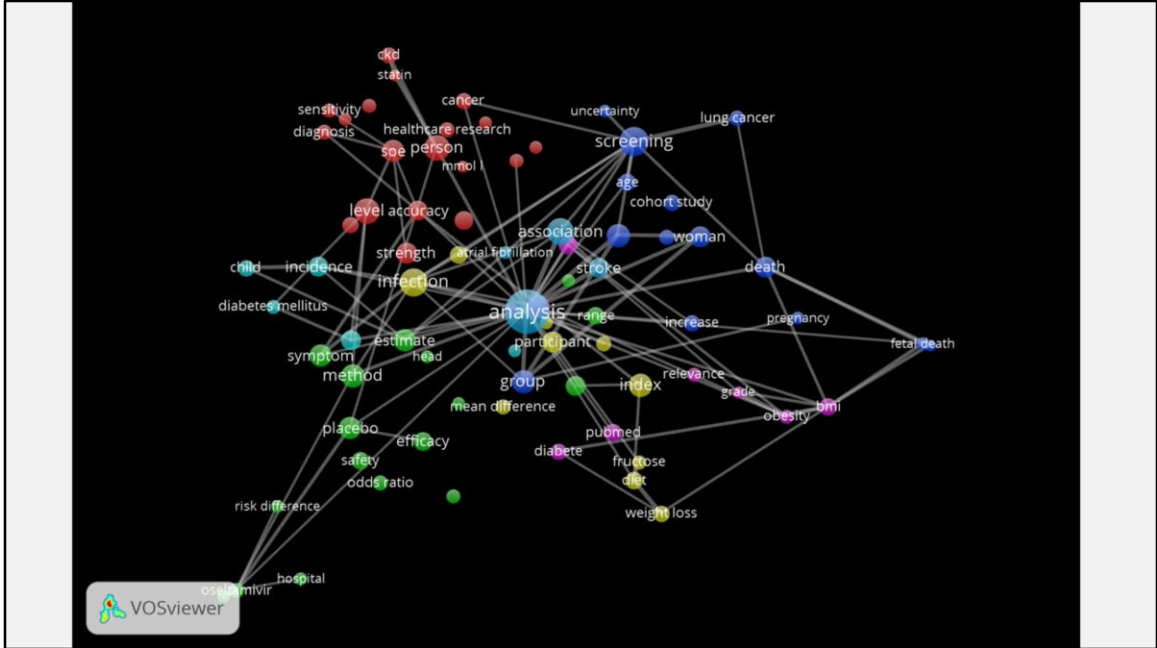
Thanks again for attending our presentation. At this time, I believe we have a few minutes for questions.

Extra slides



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Extra slides to be presented if time and questions necessitate.



The research topics of included systematic review papers

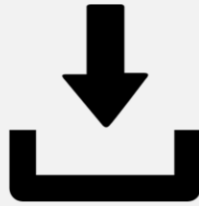
The included papers covered a variety of research topics, which was represented by the nodes (bubbles). Colors represents different clusters based on the similarity of research fields of papers. The size of the nodes shows the number of papers. The lines connects nodes and show the connection of research topics in papers. Overall, this visualization tells us that included 97 papers covers at least 5 categories of research topics: Systematic review analysis (the biggest one), screening (cohort study, women related, etc.), person health (cancer, diagnosis, sensitivity), infection, and method (related to efficacy, placebo, etc.),

FUTURE DIRECTIONS for RESEARCH

Further examination of non-clinical topics is needed

Return on investment (Return on investment number retrieved by each database search compared with by each database searched number included from each each database) needs to be investigated needs to be investigated

An examination of search strategies vs return on investment (could not achieve due to quality of search reporting)

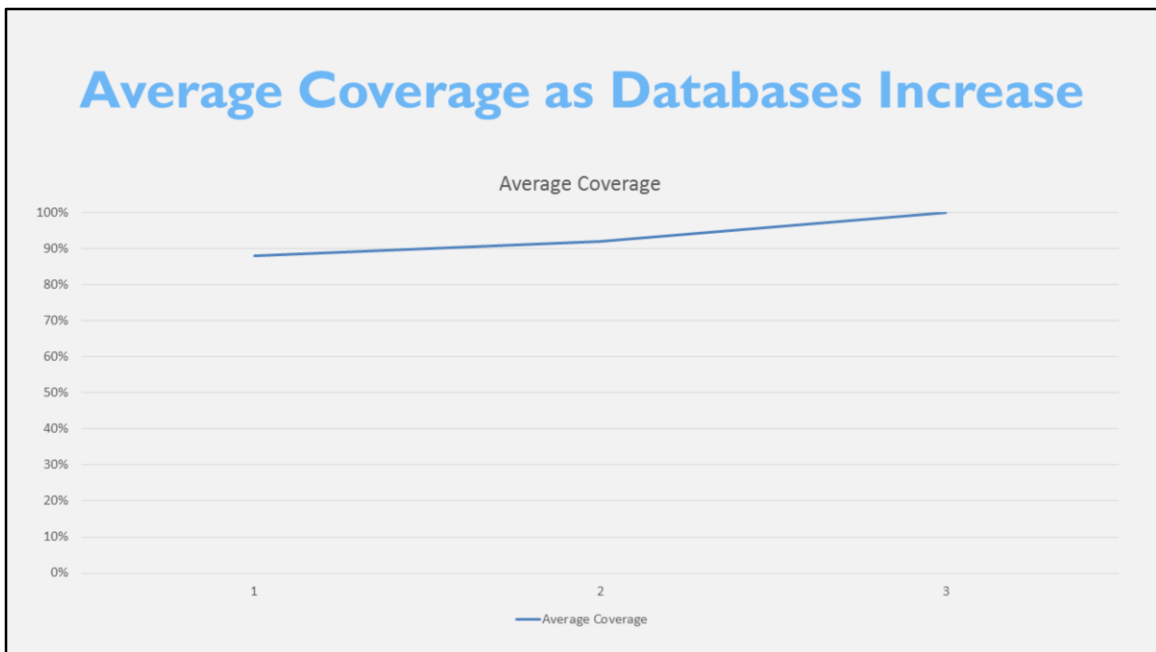


EndNote

Editorial | Commentary | RCT | Clinical trial | Observational study

The results were downloaded into EndNote and used to search keywords and notes field to identify publication types NOT indexed as some sort of review

Average Coverage as Databases Increase



To think about this another way, we found that, if you look only at the databases searched by each review, we found that nearly 90% of the included studies could be located in 1 database. If you add a second database, you increase that coverage to the mid-90s, and adding a 3rd database gets you to 100% coverage.

What this tells us is that nearly all of your included studies are going to come from that 1st database searched, and that the number of included studies for each subsequent database is much smaller.

