Systematic Review Workbook

University of North Carolina at Chapel Hill Health Sciences Library

## Overview

This workbook was created by the University of North Carolina at Chapel Hill (UNC) Health Sciences Library (HSL) and is intended to assist researchers with the systematic review process. Specifically, this workbook is intended to be used in conjunction with the [HSL Systematic Review guide](https://guides.lib.unc.edu/systematic-reviews/process) to assist researchers in successfully completing and publishing systematic reviews on clinical or healthcare topics. This workbook is organized to follow the [Systematic Review Process Map](#_Systematic_Review_Process).

Recommendations in this workbook are based on the following guidelines and standards:

* [Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)](http://www.prisma-statement.org/Extensions/Searching)
* [Cochrane Handbook for Systematic Reviews of Interventions](https://training.cochrane.org/handbook/current/)

Contents

[About systematic reviews 2](#_Toc121985878)

[Step 1: Complete pre-review tasks 4](#_Toc121985879)

[Step 2: Develop a protocol 11](#_Toc121985880)

[Step 3: Conduct literature searches 12](#_Toc121985881)

[Step 4: Manage citations 18](#_Toc121985882)

[Step 5: Screen citations 19](#_Toc121985883)

[Step 6: Assess quality of included studies 21](#_Toc121985884)

[Step 7: Extract data of included studies 24](#_Toc121985885)

[Step 8: Write the review 27](#_Toc121985886)

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# About systematic reviews

## Process map



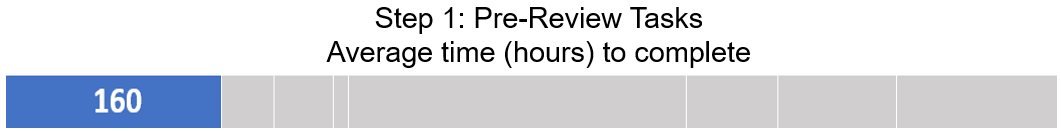
## Average time to complete

The average systematic review takes [1,168 hours](https://www.researchgate.net/publication/328104393_Predicting_the_time_needed_for_environmental_systematic_reviews_and_systematic_maps) to complete. Partnering with a librarian can help you speed up the process. For UNC faculty and staff working on a systematic review for the purpose of publication, there is an option to work with librarians in either a consultative or research partnership capacity. The following table highlights the similarities and differences in these two tiers.

## Partnering with a librarian

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Tasks** | **Tier 1: Consultative** | **Tier 2: Research Partner & Co-author** |
| **Topic Development** | Guidance on process and steps | Yes | Yes |
| Background searching for past and upcoming reviews | Yes | Yes |
| **Development of Eligibility Criteria** | Development and/or refinement of review topic | Yes | Yes |
| Assistance with refinement of PICO (population, intervention(s), comparator(s), and key questions | Yes | Yes |
| Guidance on study types to include | Yes | Yes |
| **Protocol Creation and Registration** | Guidance on protocol registration | Yes | Yes |
| **Searching** | Identification of databases for searches | Yes | Yes |
| Instruction in search techniques and methods | Yes | Yes |
| Training in citation management software use for managing and sharing results | Yes | Yes |
| Development and execution of searches | No | Yes |
| Downloading search results to citation management software and removing duplicates | No | Yes |
| Documentation of search strategies | No | Yes |
| Management of search results | No | Yes |
| **Study Selection and Extraction** | Guidance on methods | Yes | Yes |
| Guidance on data extraction, and management techniques and software | Yes | Yes |
| **Writing and Publishing** | Suggestions of journals to target for publication | Yes | Yes |
| Drafting of literature search description in "Methods" section | No | Yes |
| Creation of PRISMA diagram | No | Yes |
| Drafting of literature search appendix | No | Yes |
| Review other manuscript sections and final draft | No | Yes |
| Librarian contributions warrant co-authorship | No | Yes |

# Step 1: Complete pre-review tasks



|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to complete in the pre-review stage include:**   * Review the HSL’s previously recorded Systematic Review Workshop video series * Determine if a systematic review is appropriate and feasible * Scope the literature * Form a review team * Develop and refine research question(s) * Specify eligibility criteria * Choose review tools * Contact an HSL Librarian |

## Watch the HSL’s pre-recorded lectures on an overview of systematic reviews

This 6-part series provides an introductory overview of systematic review methods. This workshop was previously recorded in October 2020 and each video is under 10 minutes in duration and details a specific aspect of systematic review methodology. [The entire playlist can be viewed on YouTube](https://www.youtube.com/playlist?list=PLr_d6VlHdTSPxYlOvZKHDH_AwTCPpIuc2).

## Determine if a systematic review is appropriate and feasible

* [This table](https://asklib.hsl.unc.edu/faq/366908) details the various types of reviews and how they differ in scope, comprehensiveness, and time needed to complete

|  |  |
| --- | --- |
| Tools outline | Visit our [FAQ page](https://asklib.hsl.unc.edu/faq/366905) for interactive tools to help you choose the right type of review to meet your needs |

## Scope the literature

Does a systematic review already exist on your topic? Is a systematic review currently in progress on the same topic? If the answer to either of these questions is yes, then completing another systematic review may be duplicative and publishing may be a challenge.

### Search for existing reviews and protocols:

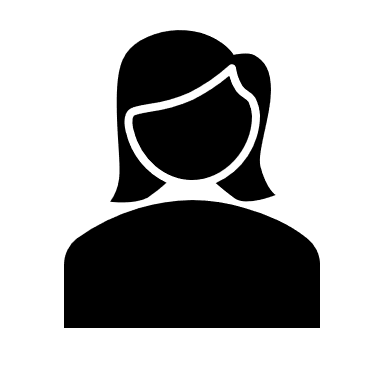
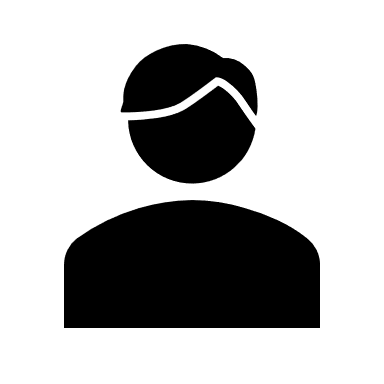
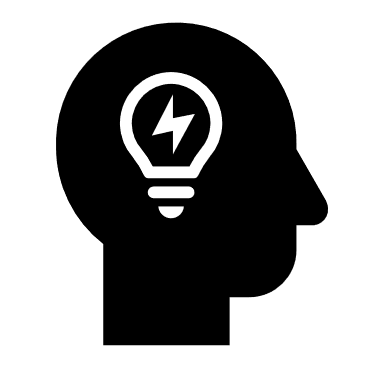
* [PubMed](http://libproxy.lib.unc.edu/login?url=https://www.ncbi.nlm.nih.gov/sites/entrez?otool=uncchlib) - PubMed, a service of the National Library of Medicine covers journal articles about medicine, nursing, dentistry, veterinary medicine, and public health from 1950 to the present.
* [Cochrane Library](https://guides.lib.unc.edu/go.php?c=23608443) - Leading source for full-text systematic reviews in health care
* [PROSPERO](http://www.crd.york.ac.uk/PROSPERO/) - International prospective register of systematic reviews
* If a librarian is a co-authoring your review, ask them to scope the literature for your team

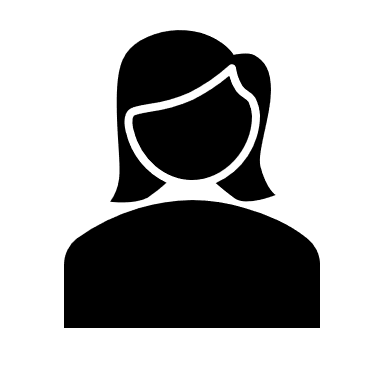
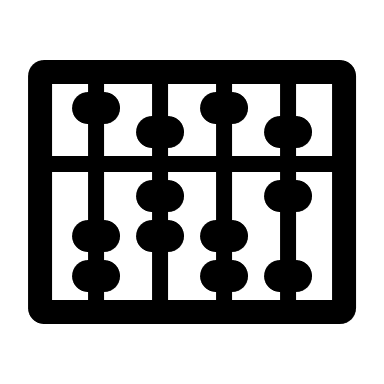
## Form a review team

Keep these guidelines in mind when establishing your systematic review team:

* **Have a minimum of 3 reviewers**, although a higher number will expedite the screening process.
  + Having an odd number of team members simplifies tie-breaking process.
  + Depending on the size of the review, you may want to add additional team members. A team of up to ten or twelve people is not unusual for a large systematic review.
* **Choose experts** in the field.
* **Collaborate with a librarian** to develop a search strategy.
* **Work with a statistician** if conducting a meta-analysis.
* **Define roles and expectations** early in the review process.

The following image lists common roles, with example responsibilities for each, of systematic review teams.





*Describe different tasks on the review and who will be responsible for what. Add as many rows as necessary.*

|  |  |
| --- | --- |
| **Person/Role** | **Task** |
| [enter text here] | [enter text here] |
| [enter text here] | [enter text here] |
| [enter text here] | [enter text here] |
| [enter text here] | [enter text here] |
| [enter text here] | [enter text here] |
| [enter text here] | [enter text here] |

## Develop and refine research question(s)

Systematic reviews aim to answer a specific research question. There are frameworks to help in question development and identification of search terms. PICO is the most popular framework utilized for clinical research topics.

* [Forming Focused Questions with PICO guide](https://guides.lib.unc.edu/pico)
* Use this [PICO Question Development Worksheet](https://guides.lib.unc.edu/ld.php?content_id=55532448)(.doc) to develop and refine your research question
* If PICO does not work well for your research question, use an alternate question framework instead. [More information on alternate question frameworks can be found here.](https://guides.lib.unc.edu/systematic-reviews/pre-review#s-lg-box-28765791)

## Example PICO question

| **Element** | **Definition** | **Questions to consider** | **Example** |
| --- | --- | --- | --- |
| **P**  **P**atient(s) / **P**opulation(s) | Who is the focus of my research question? | * How would you describe this population (age, race, sex, health status, risk factors, previous or current ailments, current medications, etc.)? * How is the condition defined (symptoms, presence and/or severity of disease, diagnostic test, etc.)? * Are there any patients who should be excluded from this population (healthy patients, patients above or below a certain threshold, etc.)? | infants diagnosed with necrotizing enterocolitis (NEC) |
| **I**  **I**ntervention(s) | What is the proposed, new intervention? | * What is the main intervention, prognostic factor, or exposure being considered? * Are you interested in a drug treatment, medical procedure, surgical procedure, or diagnostic test? * For drug interventions, what is the dosage, frequency, and method of administration? | early enteral re-feeding |
| **C**  **C**omparison(s) | What is the current or alternative intervention? | * What is the alternative to the proposed intervention? * Are you considering a different dosage of the same drug? Placebo or alternative drug? Another medical or surgical procedure? * For diagnostic studies, is there a gold standard or another diagnostic tool against which to compare? | late enteral re-feeding |
| **O**  **O**utcome(s) | What measurable outcome is affected? | * What are you hoping to accomplish, measure, improve, or affect? * Do you want to improve quality of life? * Are morbidity or mortality important outcomes to consider? * What are the harms of this intervention and its alternatives? | NEC recurrence |

*Fill out the following PICO table specific to your systematic review topic. You might only need to use some letters of PICO, such as PI or PIC depending on your question. If PICO doesn’t work well for your review, replace PICO with elements from another question framework like PEO or SPIDER.*

## Your team’s PICO question

|  |  |
| --- | --- |
| **Element** | **Question** |
| **P**  **P**atient(s) / **P**opulation(s) | Who is the focus of my research question?  [enter text here] |
| **I**  **I**ntervention(s) | What is the proposed, new intervention?  [enter text here] |
| **C**  **C**omparison(s) | What is the current or alternative intervention?  [enter text here] |
| **O**  **O**utcome(s) | What measurable outcome is affected?  [enter text here] |

## Specify eligibility criteria

The term "eligibility criteria" refers to what you plan to include and exclude from your systematic review. These criteria are decided after the research question is developed but before searches are completed. The following list of criteria may be used to determine inclusion or exclusion. **Note: Keep in mind, adding certain eligibility criteria, like language and/or date restrictions, may introduce bias to your review by unintentionally excluding key research.**

*Fill out the columns to the far right of the table to list inclusion and exclusion criteria for your review.*

| **Criteria** | **Example** | **Your inclusion criteria** | **Your exclusion criteria** |
| --- | --- | --- | --- |
| Date of publication | Date ranges may be applied when updating a systematic review or when there is a specific rationale (i.e., date of a clinical guideline, date an intervention or therapy was introduced, etc.) | [enter text here] | [enter text here] |
| Language of publication | Include studies in any language or limit to those that can be read by the review team | [enter text here] | [enter text here] |
| Participants | May include and exclude specific groups of people or age ranges | [enter text here] | [enter text here] |
| Study design | May include specific study designs and exclude others | [enter text here] | [enter text here] |
| Intervention of interest | Includes interventions of interest and excludes any others | [enter text here] | [enter text here] |
| Outcomes of interest | Includes outcomes of interest and may exclude studies reporting outcomes not of interest | [enter text here] | [enter text here] |
| Setting | May be limited to a specific setting like inpatient, ambulatory, classroom, etc. | [enter text here] | [enter text here] |
| Type of publication | Consider which types of publications to include (i.e., articles, conference abstracts, dissertations, books, specific study designs, etc.) | [enter text here] | [enter text here] |

## Select screening, quality assessment, and data extraction tool(s)

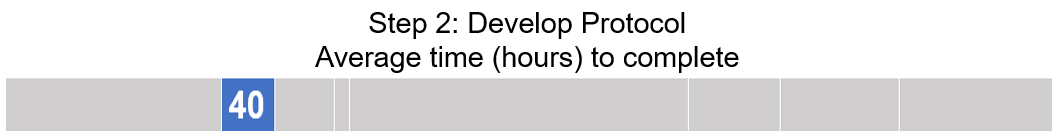
Consider what tools you will need to use to complete the entire review. More information on these stages of the review and associated tools can be found on the [Systematic Review Guide’s](https://guides.lib.unc.edu/systematic-reviews/overview) individual tabs, or in the corresponding sections of this workbook.

|  |  |
| --- | --- |
| Tools outline  Lights On outline | Visit our [FAQ page](https://guides.lib.unc.edu/systematic-reviews/pre-review#s-lg-box-28765299) for a list of tools helpful for completing later stages of the review. Specifically, you can find FAQs on tools for managing citations, screening citations, quality assessment, and data extraction.  *List which tools you plan to use for:*   * Managing citations: [enter text here] * Screening citations: [enter text here] * Quality assessment: [enter text here] * Data extraction: [enter text here] * Repository for study data/supplementary materials: [enter text here]   **Helpful tip – Begin brainstorming data items to extract**  You should plan to extract data that is relevant to answering the question posed in your systematic review.  It may help to consult other similar systematic reviews to identify what data to collect.  You should use your key questions and eligibility criteria as a starting point.  It can also help to think about your question in a [framework such as PICO](https://guides.lib.unc.edu/pico). |

## Contact an HSL librarian

* + - Interested in adding a librarian to your team? This [comparison chart](https://asklib.hsl.unc.edu/faq/229263) details the roles and expectations of adding an HSL Librarian to your team
    - Email us a quick question with [Ask A Librarian](https://asklib.hsl.unc.edu/)
    - Fill out [this form](https://go.unc.edu/SRconsult) to schedule an initial meeting with a HSL librarian

# Step 2: Develop a protocol



Protocols describe the rationale, hypothesis, and planned methods of the project before the review has begun. They allow readers of completed reviews to identify deviations from planned methods and determine whether the bias impacts the interpretation of review results and conclusions (PRISMA - P 2015 Statement). Last, they let others know what reviews are planned or in process. This can also be a way to identify other experts in your field to collaborate or consult on future reviews. Depending on where you plan to publish or register it, the protocol may need to be completed before significant progress on the review has started.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to develop a protocol include:**   * Confirm team roles and responsibilities * [Download a protocol template (.doc and .pdf)](https://asklib.hsl.unc.edu/faq/381083) * Write the protocol * Make protocol accessible via website or registry before beginning your review |

## Write the protocol

Many elements of a systematic review will need to be detailed in advance in the protocol. An example of items included in the protocol are:

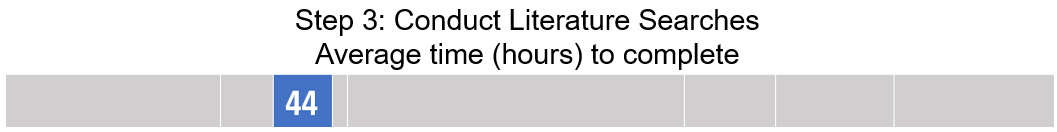
* Team members
* Rationale and objectives of the review
* Eligibility criteria (also referred to as inclusion and exclusion criteria)
* Databases and keyword terms for the search (ideally, a full search strategy for at least one database)
* Process and tools for study selection, quality assessment, and data extraction
* Data items that will be extracted from included studies
* Methods of data synthesis, and more.

|  |  |
| --- | --- |
| Tools outlineDocument outline | **Tools for developing a systematic review protocol:**   * [PRISMA-P 2015 Statement](http://www.prisma-statement.org/Extensions/Protocols) * [PRISMA-P 2015 Elaboration & Explanation](http://www.prisma-statement.org/Extensions/Protocols) * [PRISMA-P 2015 Checklist](http://www.prisma-statement.org/Extensions/Protocols)   **Templates for developing a protocol:**   * [Download a protocol template (.doc and .pdf)](https://asklib.hsl.unc.edu/faq/381083) |

## Make protocol accessible via website or registry

List where you plan to upload the protocol so it is accessible to others. Choose from one of the locations listed on [this page:](https://asklib.hsl.unc.edu/faq/366920) [enter location here]

# Step 3: Conduct literature searches



|  |  |
| --- | --- |
|  | If a librarian is co-authoring your review, skip to “Step 5: Screening Citations.” Your librarian will complete tasks in this phase of the review. |

The goal of a systematic search is to retrieve all results that are relevant to your topic. Librarians are experts trained in literature searching and systematic review methodology. Partnering with a librarian will save you time and improve the quality of your review.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to conduct literature searches include:**   * If you haven’t already – set up a meeting with an HSL librarian * Turn your PICO (or other question framework) into search concepts * Search multiple databases * Document all search methods * Perform other searching methods (e.g., hand searching, forward and backward citation searching, etc.) * Locate grey literature or other unpublished research |

## Set up a meeting with an HSL librarian

Did you know you can send a draft search to HSL librarians for advice on your search terms and databases?

* Email us a quick question with [Ask A Librarian](https://asklib.hsl.unc.edu/)
* Request a full consultation with our systematic review [request form](https://go.unc.edu/SRconsult)
* See how [HSL librarians partner on systematic reviews](https://asklib.hsl.unc.edu/faq/366910) and scoping reviews

## Turn your PICO (or other question framework) into search concepts

Question frameworks, like PICO, help turn research questions into searchable concepts. Searching is an iterative process; all elements of your PICO question may or may not be included in the final search. If you have questions about how to structure the search, or if you feel like the results are unexpected, it is best to [contact a librarian](https://asklib.hsl.unc.edu/) for assistance.

### Identify search concepts and generate a list of synonyms

* Use a combination of the preset topic categories called [controlled vocabulary](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-wrapper-33833671) (or subject headings) to improve the relevancy of search results and [keyword terms](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-wrapper-33833671) to ensure you include the most recent articles and any variations of how the concept is described.

### Combine the terms with [nesting, Boolean operators, and field tags](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-wrapper-33775663).

* **OR** is used to combine search terms for the same concept (i.e., influenza vaccine OR flu shot). **AND** is used to combine different concepts (i.e., influenza vaccine AND older adults AND pneumonia).
* Adding **parentheses** around sets of synonyms helps the database to understand how to group your search terms together (i.e., (influenza vaccine OR flu shot) AND pneumonia ).
* **Field tags** tell the database where to search for the terms in citations. For example, [tiab] searches for terms only in the title and abstract in PubMed.
* Enclose phrases inside **quotation marks** to search for the term in that exact order (i.e., “influenza vaccine” will only return results where both terms are present in that exact order, and searching influenza vaccine [without quotation marks] will return results where the terms influenza and vaccine are used, but not necessarily side by side).
* Some databases have more advanced searching features, such as truncation (searching for multiple word endings at once by using a symbol), wildcards (searching for various letters by use of a symbol), and proximity searching (searching for a term within a certain number of words from another term). [Contact your librarian](https://asklib.hsl.unc.edu/) for more assistance or questions about these advanced searching techniques.

*Question: For patients 65 years and older, does an influenza vaccine reduce the future risk of pneumonia?*

| **PICO element** | **Example** | **Controlled vocabulary** | **Synonyms** | **Search strategies** |
| --- | --- | --- | --- | --- |
| **P**  **P**atient(s) / **P**opulation(s) | patients 65 years and older | "Aged"[Mesh] | elder  elders  elderly  aged  aging  older adult  older adults  older patients  advancing age  geriatric  geriatrics  gerontology  gerontological  senior citizen  senior citizens | (“Aged”[Mesh] OR elder[tiab] OR  elders[tiab] OR  elderly[tw] OR  aged[tw] OR  aging[tiab] OR  “older adult”[tw] OR  “older adults”[tw] OR  “older patients”[tw] OR  “advancing age”[tiab] OR  geriatric[tw] OR  geriatrics[tw] OR  gerontology[tw] OR  gerontological[tw] OR  “senior citizen”[tw] OR  “senior citizens”[tw]) |
| **I**  **I**ntervention(s) | influenza vaccine | "Influenza Vaccines"[Mesh] | influenza vaccines  flu vaccine  flu vaccines  influenza virus vaccine  influenza virus vaccines  ((flu OR influenza) AND (vaccine OR vaccines OR vaccination OR immunization)) | ("Influenza Vaccines"[Mesh] OR “influenza vaccines”[tw] OR  “flu vaccine”[tw] OR  “flu vaccines”[tw] OR  “influenza virus vaccine”[tw] OR “influenza virus vaccines”[tw] OR ((flu[tw] OR influenza[tw]) AND (vaccine[tw] OR vaccines[tw] OR vaccination[tw] OR immunization[tw]))) |
| **C**  **C**omparison(s) | n/a | - | - | - |
| **O**  **O**utcome(s) | pneumonia | "Pneumonia"[Mesh] | pneumonias  pulmonary inflammation | ("Pneumonia"[Mesh] OR pneumonia[tw] OR pneumonias[tw] OR “pulmonary inflammation”[tw]) |

## Address outdated and offensive terminology

Social and cultural norms change rapidly, but library and research terminology changes more slowly, and some commonly used search terms can be considered outdated, unacceptable, or overly clinical for use in conversation or writing.

For our example with people 65 years and older, [APA Style Guidelines](https://apastyle.apa.org/style-grammar-guidelines/bias-free-language/age) recommend that researchers use terms like “older adults” and “older persons” and forgo terms like “senior citizens” and “elderly” that connote stereotypes. Terms such as “elderly” have frequently been used in the literature, however, and removing these terms from the search strategy may result in missed relevant articles.

* Discuss current and outdated terminology with your team and decide which terms to include in the search to be as comprehensive as possible.
* Search for currently preferred terms in glossaries, dictionaries, published guidelines, and governmental or organizational websites.
* Acknowledge the inappropriate and harmful nature of these terms in your manuscript and indicate that the full search strategies include them.

The University of Michigan Library provides [suggested wording](https://deepblue.lib.umich.edu/handle/2027.42/174677) to use in the manuscript when antiquated, non-standard, exclusionary, or potentially offensive terms are included in the search.

|  |  |
| --- | --- |
| Lights On outline | **Helpful tip – Finding terms to use in your systematic review**  Check the methods sections or supplementary materials of published systematic reviews for search strategies to see what terminology those authors used. This can help inform your search strategy by using MeSH terms or keyword terms you may not have thought of. However, be aware that search strategies will differ in their comprehensiveness.  You can also run a preliminary search for your topic, sort the results by Relevance or Best Match, and skim through titles and abstracts to identify terminology from relevant articles that you should include in your search strategy. |

## Search multiple databases

Databases often use their own set of terminology and syntax. When searching multiple databases, you need to adjust the search slightly to retrieve comparable results, especially when using [controlled vocabulary](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-wrapper-33833671). The following resources can help with this process:

* [Choosing databases](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-28722767)
* [Searching specific databases](https://guides.lib.unc.edu/sb.php?subject_id=208012)
* [Translating a search](https://guides.lib.unc.edu/systematic-reviews/search#s-lg-box-28834704) to other databases

*Fill out the following table with databases to search, controlled vocabulary, and keyword terms. Additionally, add any filters you plan to use, if applicable. Add rows as necessary.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Database name** | **Controlled vocabulary (if applicable)** | **Keyword terms** | **Filters (if applicable)** |
| [enter text here] | [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] | [enter text here] |

|  |  |
| --- | --- |
| Tools outline | **Tools for identifying other keyword terms and controlled vocabulary:**   * [PubReMiner](https://hgserver2.amc.nl/cgi-bin/miner/miner2.cgi) * [Yale MeSH Analyzer](https://mesh.med.yale.edu/) * [MeSH on Demand](https://meshb.nlm.nih.gov/MeSHonDemand) |
| Lights On outline | **Helpful tip – Searching Google Scholar**  List relevant articles found in Google Scholar in the hand searching total on your PRISMA flow diagram instead of in the database list. Google Scholar searches often produce thousands of articles and result lists are not reproducible. |

## Document all search methods

Systematic review quality is highly dependent on the literature search(es) used to identify studies. To follow best practices for reporting search strategies and increase reproducibility and transparency, you should document various elements of the literature search for your review. To make this process more clear, a statement and checklist for reporting literature searches has been developed and is available on PRISMA's website.

* [PRISMA-S: Reporting Literature Searches in Systematic Reviews](http://www.prisma-statement.org/Extensions/Searching)
* [Section 4.5 Cochrane Handbook – Documenting and reporting the search process](https://training.cochrane.org/handbook/current/chapter-04#section-4-5)

At a minimum, certain elements of your search process should be documented and reported, such as:

* Where you searched- databases, including name (i.e., Scopus) and platform (i.e. Elsevier), websites, registries, and grey literature. In addition, this also may include [forward and backward citation searching](https://asklib.hsl.unc.edu/faq/377291) and reaching out to experts in the field.
* Search strategies used in each database or source, along with any filters or limits, and the date each search was conducted.
* If a search has been updated or was built upon previous work.
* Which search terms have been tested and decisions made for term inclusion or exclusion by the team, and any peer review process the search underwent.
* The total number of records identified from each source and how deduplication was conducted.

**If the search strategy for your systematic review is being created and run by your review team's librarian, the search documentation will be handled entirely by the librarian.**

You can document search strategies in word processing software you are familiar with like Microsoft Word or Excel, or Google Docs or Sheets. A template and separate example file are provided for convenience.

|  |  |
| --- | --- |
| Document outline | **Templates for literature searching:**   * [Search strategy documentation template](https://guides.lib.unc.edu/ld.php?content_id=63448319) (.doc) * [Search strategy documentation example](https://guides.lib.unc.edu/ld.php?content_id=63448331) (.doc) |

## Hand searching

Literature searches can be supplemented by hand searching. One of the most popular ways this is done with systematic reviews is by [searching the reference list and citing articles](https://asklib.hsl.unc.edu/faq/377291) of studies included in the review. Another method is manually browsing key journals in your field to make sure no relevant articles were missed. Other sources that may be considered for hand searching include clinical trial registries, white papers and other reports, pharmaceutical or other corporate reports, conference proceedings, theses and dissertations, or professional association guidelines.

If applicable, list where and how you plan to conduct hand searching in the following table.

| **Source Name: Source URL**  **(Date Searched)** | **Search terms/ Strategy** | **Number of Results** |
| --- | --- | --- |
| [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] |
| [enter text here] | [enter text here] | [enter text here] |

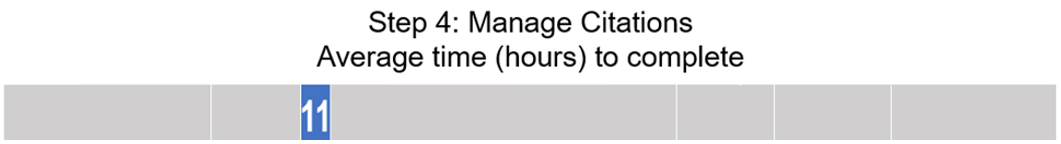
## Locate grey literature or other unpublished research

Grey literature is not published in a traditional manner, such as reports on professional association websites, and is often not retrievable through large databases or other popular resources. Grey literature should be searched to reduce bias and increase thoroughness. There are several databases specific to grey literature that can be searched.

* Grey literature repository websites, such as [Open Grey](https://opengrey.eu/) or [OAIster](http://oaister.worldcat.org/)
* Websites of professional associations or evidence synthesis groups
* Google Scholar

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| Tools outline | **Tools for identifying grey literature or other unpublished reports:**   * [Grey Matters: a practical tool for searching health-related grey literature (CADTH)](https://www.cadth.ca/resources/finding-evidence/grey-matters) * [Guideline Central](https://www.guidelinecentral.com/) * [Guidelines International Network](https://g-i-n.net/) * [NICE Guidance](https://www.nice.org.uk/guidance) * [clinicaltrials.gov](https://clinicaltrials.gov/) * [TRIP database](https://www.tripdatabase.com/) |

# Step 4: Manage citations



|  |  |
| --- | --- |
|  | If a librarian is co-authoring your review, skip to “Step 5: Screen Citations.” Your librarian will complete tasks in this phase of the review. |

We recommend using a citation manager tool to organize citations/references gathered from your literature search. These tools are also helpful in deduplicating citations before uploading them to Covidence (or other review management tool) for screening, and you can also use a citation manager to insert references in your review manuscript in a variety of citation styles when you are writing.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to manage citations include:**   * Choose and download a citation manager * Import citations from databases into citation manger * Deduplicate citations * Download and fill out the PRISMA flow diagram with initial and deduplicated citation counts |

## Choose a citation manager to save time and effort

When choosing a citation manager for a systematic review, in addition to factors such as cost, format, and storage capacity, you will also need to consider how well it will perform on systematic review tasks.

* View this [citation manager comparison chart](https://guides.lib.unc.edu/citation-managers) to understand the differences between those supported by the HSL or our [FAQ about which citation managers work best for systematic reviews](https://asklib.hsl.unc.edu/faq/377892).

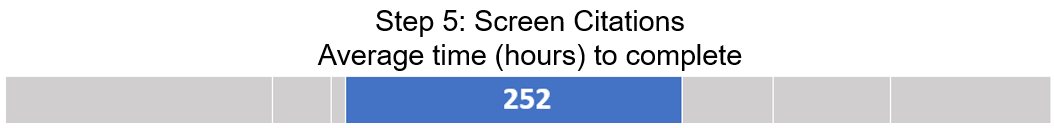
|  |  |
| --- | --- |
| Using Endnote  * [Import into Endnote](https://guides.lib.unc.edu/c.php?g=904856&p=7248754) * [Deduplication using Endnote](https://guides.lib.unc.edu/systematic-reviews/citations#s-lg-box-24767299) | Using Sciwheel  * [Import into Sciwheel](https://guides.lib.unc.edu/sciwheel/references) * [Deduplication using Sciwheel](https://guides.lib.unc.edu/systematic-reviews/citations#s-lg-box-24767309) |

## Download and fill out PRISMA 2020 flow diagram with initial and deduplicated citation counts

There are different PRISMA flow diagram templates to use if you are performing a new review or updating an existing review, as well as if you plan to search the grey literature or not. Choose one of the four templates to meet your needs, or [ask an HSL librarian](https://asklib.hsl.unc.edu/) for help deciding which one will meet your needs.

* [All PRISMA 2020 flow diagrams](http://www.prisma-statement.org/PRISMAStatement/FlowDiagram)
* [Instructions on how to fill out PRISMA 2020 flow diagrams](https://guides.lib.unc.edu/systematic-reviews/write" \l "s-lg-box-28834069)

# Step 5: Screen citations



Once you have completed literature searching and compiled all citations, it is time to screen the results. The purpose of screening is to identify studies that meet your inclusion criteria. Two independent reviewers should screen all studies, starting with a title and abstract screening, followed by a full-text screening. A third reviewer should resolve any conflicts.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to screen citations include:**   * Choose a screening tool if you did not do so in your protocol * Import a deduplicated list of citations from all databases into your screening tool (if a librarian is co-authoring your review, they will complete this step) * Pilot screen a sample of titles/abstracts and evaluate concordance between reviewers (repeat as necessary) * Complete 1st phase (title/abstract) of screening on all citations and record relevant numbers for PRISMA 2020 flow diagram * Upload PDFs of articles for citations that reached the 2nd phase (full-text) of screening * Complete 2nd phase (full-text) of screening on full-text articles and record relevant numbers for PRISMA 2020 flow diagram |

## Choose a review tool to assist with the screening process

* [Comparison chart of select screening tools](https://guides.lib.unc.edu/systematic-reviews/screen#s-lg-box-28831589)
  + [Covidence Guide](https://guides.lib.unc.edu/Covidence) (free to UNC affiliates)
    - [Covidence YouTube Channel](https://www.youtube.com/channel/UCgr_cyJlrKYBjxjyMe2z9mw) and [Help Resources](https://support.covidence.org/help?_gl=1*di8whw*_ga*NzI0MjYyMDM4LjE2NDQyNzI2NDI.*_ga_HXKEQPTFLR*MTY1MTUxNzQyNC41Ni4xLjE2NTE1MTc0MzEuNTM.)
    - [UNC HSL Covidence YouTube videos](https://www.youtube.com/watch?v=TJpDY0bID88&list=PLr_d6VlHdTSOhX6qZ9p76h1U3-R0Oa78J)
  + Publicly available screening tools:
    - [Rayyan](https://libraryguides.mcgill.ca/rayyan/gettingstarted#s-lg-box-13326324)
    - [Abstrackr](https://www.youtube.com/watch?v=XxKaJF0dgJ0)
    - [HAWC](https://hawcproject.org/resources/)
  + [Excel: The VonVille Method](https://www.yopl.info/post/excel-workbooks-and-user-guides-for-systematic-reviews)

## Import deduplicated citations into your preferred screening tool

* [Instructions on importing to Covidence from various citation managers](https://guides.lib.unc.edu/Covidence/preparing-references)

|  |  |
| --- | --- |
| Lights On outline | **Helpful tip – Pilot screen a sample set of citations before live screening**  Pilot screening, or test screening, usually involves choosing a random sample of citations from your results, then having all reviewers screen that sample to ensure consistency across responses. It can be performed in Covidence or Excel. While adding this step may add some time initially, it will most likely expedite both screening phases, as screeners will be more comfortable applying the inclusion and exclusion criteria properly, and will most likely result in less error or conflicts. |

## Complete 1st phase of screening on titles/abstracts

* Screen titles/abstracts against inclusion/exclusion criteria
* Resolve screening conflicts as outlined in the protocol
* Record numbers of duplicates, screened, relevant, and irrelevant articles for your [PRISMA 2020 flow diagram](https://guides.lib.unc.edu/systematic-reviews/write#s-lg-box-28834069) (see our [step-by-step flow diagram instructions](https://guides.lib.unc.edu/systematic-reviews/write#s-lg-box-28834069) if you have questions)

## Find full-text articles and upload into screening tool (if applicable)

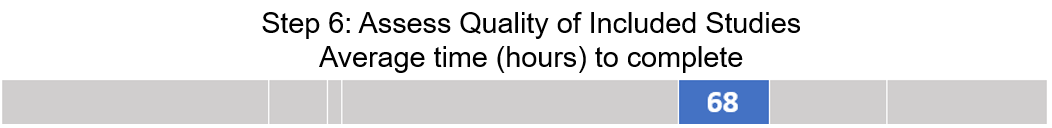
* [How to retrieve full-text articles using a citation manager](https://guides.lib.unc.edu/Covidence/full-text#s-lg-box-20784336)
* Bulk upload full-text articles into Covidence ([Endnote Desktop](https://guides.lib.unc.edu/Covidence/full-text#s-lg-box-21038839) and [Zotero](https://guides.lib.unc.edu/Covidence/full-text#s-lg-box-29157660) only)
* [Request articles not included in UNC subscriptions](https://guides.lib.unc.edu/Covidence/full-text#s-lg-box-20784393) (at no cost to UNC affiliates, must have Onyen and password)

## Complete 2nd phase of screening on full-text articles

* Screen full-text articles against inclusion/exclusion criteria
* Resolve screening conflicts as outlined in the protocol
* Record numbers of screened, not screened, included, and excluded articles (and a primary reason for exclusion) for your [PRISMA 2020 flow diagram](https://guides.lib.unc.edu/systematic-reviews/write#s-lg-box-28834069)

|  |  |
| --- | --- |
| **AI** | There may be an opportunity to use AI or another automation approach to save time depending on the specifics of the review. Ask your librarian for more information. |

# Step 6: Assess quality of included studies



After the screening process is complete, the systematic review team must assess each article for quality and bias. There are many different tools you can use to perform quality assessment, sometimes called critical appraisal. **It is important** **to use a tool specifically designed to assess quality for the study design(s) of your included studies.** This may mean you need to use multiple tools, covering a wide range of study designs, if several types are identified in the included studies list. Refer to the inclusion and exclusion list to determine which study designs are eligible for inclusion and which are not.

|  |  |
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| Clipboard Checked outline | **Tasks to complete for assessing quality of studies include:**   * Choose a quality assessment tool(s) if you did not do so in your protocol * Load the quality assessment tool in Covidence or other systematic review management tool (if applicable) * Perform quality assessment on included studies |

## Quality assessment tool(s) for the review

The following table lists a sample of four popular quality assessment tools and some basic information about each. For more quality assessment tools, organized by study design, please [view this FAQ](https://guides.lib.unc.edu/systematic-reviews/assess-quality#s-lg-box-28897874).

| **Tool** | **Study Design** | **About** |
| --- | --- | --- |
| [Cochrane Risk of Bias 2.0 Tool](http://sites.google.com/site/riskofbiastool/welcome/rob-2-0-tool?authuser=0) | Randomized controlled trials (RCTs) | The Cochrane Risk of Bias 2.0 tool asks questions about five domains of potential bias for individually randomized trials:   * bias arising from the randomization process * bias due to deviations from intended interventions * bias due to missing outcome data * bias in measurement of the outcome * bias in selection of the reported result |
| [Newcastle-Ottawa Scale](http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp) | Non-randomized studies | The Newcastle-Ottawa scale assesses the quality of nonrandomized studies based on three broad perspectives:   * the selection of the study groups * the comparability of the groups * the ascertainment of either the exposure or outcome of interest for case-control or cohort studies respectively |
| [CASP Appraisal Checklists](http://casp-uk.net/casp-tools-checklists/) | Mixed methods | These quality assessment checklists ask 11 or 12 questions each to help you identify   * Is the basic study design valid? * Was the study methodologically sound? * What are the results? * Will the results help locally?   Available study designs include randomized controlled trials, systematic reviews, qualitative studies, cohort studies, diagnostic studies, case control studies, economic evaluations, and clinical prediction rules. |
| [LEGEND Evidence Evaluation Tools](http://www.cincinnatichildrens.org/research/divisions/j/anderson-center/evidence-based-care/legend) | Mixed methods | These evidence evaluation tools ask questions each to help you examine   * validity * reliability * applicability   across the clinical question domains of intervention, diagnosis & assessment, prognosis, etiology & risk factors, incidence, prevalence, and meaning.  Available study designs include systematic review/meta-analysis, meta-synthesis, randomized controlled trials, controlled clinical trials, psychometric studies, cohort-prospective/retrospective, case control, longitudinal, cross sectional, descriptive/epidemiology / case series, qualitative study, quality improvement, mixed methods, decision analysis/economic analysis/computer simulation, case report/n-of-1 study, published expert opinion, bench studies, and guidelines. |

List the quality assessment tool(s) the team has decided to use for the review. Remember to choose tool(s) that correspond with study designs of included articles in your review. You may need to use one tool or multiple tools to complete this step. Insert as many rows as necessary.

|  |  |  |
| --- | --- | --- |
| **Name of QA Tool** | **Study Design** | **Link to Tool** |
| [insert tool name here] | [insert type of study design the QA tool was developed to assess] | [insert link to the QA tool] |
| [insert text here if applicable] | [insert text here if applicable] | [insert text here if applicable] |
| [insert text here if applicable] | [insert text here if applicable] | [insert text here if applicable] |
| [insert text here if applicable] | [insert text here if applicable] | [insert text here if applicable] |

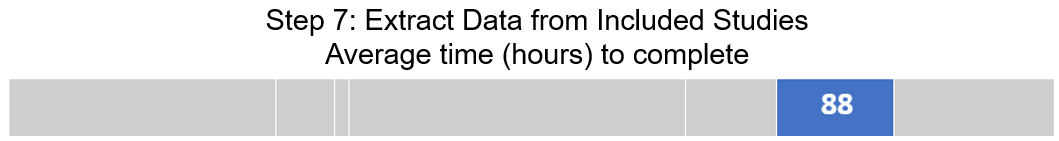
## Load quality assessment tool into Covidence or other systematic review management tool (if applicable)

* Covidence’s default quality assessment template is the Cochrane Risk of Bias (RoB) tool. If you need to use another tool, you can delete the default template and add a new one.
  + [Quality assessment using Covidence](https://support.covidence.org/help/data-extraction-and-quality-assessment)
  + [Create and publish a quality assessment template](https://support.covidence.org/help/create-and-publish-a-quality-assessment-template)
  + [HSL guide on quality assessment and Covidence](https://guides.lib.unc.edu/Covidence/evaluate#s-lg-box-15651491)

## Perform quality assessment, or critical appraisal, on included studies

* [HSL FAQ: Which quality assessment tool should I use?](https://asklib.hsl.unc.edu/faq/366855)

# Step 7: Extract data of included studies



In this step of the systematic review process, you will develop your evidence tables, which give detailed information for each study, and summary tables, which give a high-level overview of the findings of your review. You can create evidence and summary tables to describe study characteristics, results, or both. These tables will help you determine which studies, if any, are eligible for quantitative synthesis.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to extract data include:**   * Choose a data extraction tool to use and items to extract if you did not do so in your protocol * Identify any additional data items to extract * Create the data extraction form in the tool specified in the protocol * Pilot the data extraction form with a small sample and make changes if needed * Extract the data and review it as a team (minimum of 2-3 members) |

## Refer to the data extraction items and tool specified in the protocol

If you still need to choose a data extraction tool, consult the following table for a list of benefits and limitations of popular extraction tools.

| **Tool** | **Benefits** | **Limitations** |
| --- | --- | --- |
| Systematic Review Software (Covidence) | * **Free** for UNC affiliates through UNC Libraries' subscription * Review elements are housed in a single system * Discrepancies are automatically highlighted for resolution * Can calculate interrater reliability * Better assurance of blinding during the extraction process * Read PDFs of articles and extract data in side-by-side panel | * Requires subscription to create more than 3 reviews (but it is provided by UNC Libraries for current UNC affiliates) * Steeper learning curve to create and customize extraction forms |
| Spreadsheets (Excel, Google Sheets) | * Free options available * Easy to learn and use (i.e., extractors will be able to begin quickly compared to using other software) * Easy to customize extraction fields | * Manually review, find, and resolve discrepancies * Increase in potential bias if all extractors are using or have access to the same file (e.g., issues with blinding data extracted) * Potential for more errors and less accuracy due to manual data entry and review |
| Cochrane Revman | * Free * Compatible with Covidence * Capabilities to write the entire review using this software | * Steeper learning curve to learn new software |
| Survey or Form Software (Poll Everywhere, Qualtrics, etc.) | * Free (limited) and paid versions * Better assurance of blinding during the extraction process * Extractors may be more familiar with using this interface compared to systematic review software (Covidence) | * Free versions may have limited question or response options * Need to ensure data is downloadable or able to be exported in a usable format |
| Electronic documents (Word, Google Docs) | * Free options available * Easy to learn and use (i.e., extractors will be able to begin quickly compared to using other software) * Easy to customize extraction fields | * Manually review, find, and resolve discrepancies * Increase in potential bias if all extractors are using or have access to the same file (e.g., issues with blinding data extracted) * Potential for more errors and less accuracy due to manual data entry and review |

## Create the data extraction form in the tool specified in the protocol

* [HSL FAQ: What software can I use for data extraction?](https://asklib.hsl.unc.edu/faq/366852)
* [How to decide when to use Extraction 1 vs Extraction 2 in Covidence](https://support.covidence.org/help/which-version-of-data-extraction-should-i-use)

## Extract data from the included studies

The Cochrane Handbook for Systematic Reviews contains a table of potential items to consider extracting. [View table 5.3.a](https://training.cochrane.org/handbook/current/chapter-05#section-5-3-1) for more information. Helpful data may include:

* Information about the study (author(s), year of publication, title, DOI)
* Demographics (age, sex, ethnicity, diseases/conditions, other characteristics related to the intervention/outcome)
* Methodology (study type, participant recruitment/selection/allocation, level of evidence, study quality)
* Intervention (quantity, dosage, route of administration, format, duration, time frame, setting)
* Outcomes (quantitative and/or qualitative)

If you plan to synthesize data, you will want to collect additional information such as sample sizes, effect sizes, dependent variables, reliability measures, pre-test data, post-test data, follow-up data, and statistical tests used.

* There are some UNC and UNC Health partners for synthesizing data, including the [Odum Institute](https://odum.unc.edu/) and [NC TraCS](https://tracs.unc.edu/). Contact them for assistance synthesizing data or conducting meta-analyses.

Extraction templates and approaches should be determined by the needs of the specific review. For example, if you are extracting qualitative data, you will want to extract data such as theoretical framework, data collection method, or role of the researcher and their potential bias.

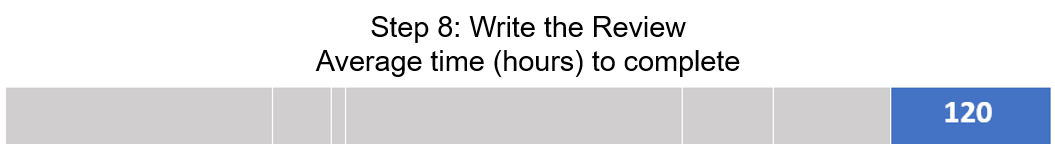
* [Supplementary Guidance for Inclusion of Qualitative Research in Cochrane Systematic Reviews of Interventions (Cochrane Collaboration Qualitative Methods Group)](https://methods.cochrane.org/qi/sites/methods.cochrane.org.qi/files/uploads/Extraction%20chapter_Version1%20final.doc)

|  |  |
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| Lights On outline | **Helpful tip – Preparing for data extraction**   * Look for an existing extraction form or tool to help guide you. Use existing systematic reviews on your topic to identify what information to collect if you are not sure what to record. * Train the review team on the extraction categories and what type of data would be expected. A manual or guide may help your team establish standards. * Pilot the extraction/coding form to ensure data extractors are recording similar data. Revise the extraction form if needed. * Discuss any discrepancies in coding throughout the process. * Document any changes to the process or the form. Keep track of the decisions the team makes and the reasoning behind them. |

Learn more about data extraction by exploring the links at the bottom of [this webpage](https://asklib.hsl.unc.edu/faq/366853).

|  |  |
| --- | --- |
| Tools outline | **Tools for conducting data extraction include:**   * [Systematic review software (Covidence)](https://guides.lib.unc.edu/covidence) * Spreadsheet or database software ([Excel](https://software.sites.unc.edu/software/microsoft-products/), Google Sheets) * [Cochrane RevMan](https://training.cochrane.org/online-learning/core-software-cochrane-reviews/revman/revman-5-download/non-cochrane-reviews) * Survey or form software ([Qualtrics](https://software.sites.unc.edu/qualtrics/), [Poll Everywhere](https://poll.unc.edu/)) * Electronic documents ([Word](https://software.sites.unc.edu/software/microsoft-products/), Google Docs) |

# Step 8: Write the review



Now that the individual tasks and phases of the review have been completed, it is time to compile everything into a written manuscript.

|  |  |
| --- | --- |
| Clipboard Checked outline | **Tasks to complete to write the review include:**   * Choose a journal to submit to and consult their website for information regarding the manuscript structure and citation style for references * If a librarian co-authored your review, contact your librarian about writing the methodology section, and to obtain a copy of the finalized PRISMA diagram and search strategies * Consult the PRISMA 2020 resources while writing the manuscript to ensure best reporting practices are followed * Ensure PRISMA 2020 Flow Diagram is completed * Fill out the PRISMA 2020 Checklist * Cite sources with a citation manager or style guide * Make supplementary content available via a repository (if applicable) |

## Choose a journal to submit to and consult author guidelines

There are several ways to choose a journal if you do not have one in mind. Consult the following resources to help decide.

* [UNC HSL guide on choosing where to publish](https://guides.lib.unc.edu/publish)
* [Ulrich’s journal directory](https://guides.lib.unc.edu/go.php?c=23608594)
* Journals where included studies were published, or that are popular in your field
* [Sherpa Romeo](https://v2.sherpa.ac.uk/romeo/) (directory of journal open access policies)
  + [UNC financial support for open access publishing](https://guides.lib.unc.edu/open-access-and-scholarly-communications/author-support)

Scholarly articles often follow the IMRaD format: Introduction, Methods, Results, and Discussion. You will also need a title and an abstract to summarize your research.

Systematic reviews follow the same structure as original research articles, but you will need to report on your search instead of reporting on details like the participants or sampling. Sections of your manuscript are shown as bold headings in the PRISMA checklist.

Refer to the following guides for more information if you are not familiar with the traditional format of scholarly articles.

* [Structure of Scholarly Articles & Peer Review](https://guides.lib.unc.edu/scholarly-articles)
* [Writing in the Health Sciences (For Students and Instructors)](https://guides.lib.unc.edu/writing)
* [Citing & Writing Tools & Guides](https://guides.lib.unc.edu/citingandwriting)

|  |  |
| --- | --- |
| Title | Describe your manuscript and state whether it is a systematic review, meta-analysis, or both. |
| Abstract | Structure the abstract and include (as applicable): background, objectives, data sources, study eligibility criteria, participants, interventions, quality assessment and synthesis methods, results, limitations, conclusions, implications of key findings, and systematic review registration number. |
| Introduction | Describe the rationale for the review and provide a statement of questions being addressed. |
| Methods | Include details regarding the protocol, eligibility criteria, databases searched, full search strategy of at least one database (often reported in appendix), and the study selection process. Describe how data were extracted and analyzed. If a librarian is co-authoring your review, they may write this section. |
| Results | Report the numbers of articles screened at each stage using a PRISMA diagram. Include information about included study characteristics, risk of bias (quality assessment) within studies, and results across studies. |
| Discussion | Summarize main findings, including the strength of evidence and limitations of the review. Provide a general interpretation of the results and implications for future research. |
| Funding | Describe any sources of funding for the systematic review. |
| Appendix | Include entire search strategy for at least one database in the appendix (include search strategies for all databases searched for more transparency). |

## Consult PRISMA 2020 Statement and Explanation and Elaboration documents

“PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses.” (PRISMA 2020)

* Ensure your manuscript includes a PRISMA Flow Diagram and verify the math in the diagram to ensure all studies are accounted for
* Fill out the [PRISMA 2020 Checklist](http://www.prisma-statement.org/PRISMAStatement/Checklist) with the page numbers where each item is addressed in the manuscript (some journals require this to be submitted as a supplemental document)

## Cite your sources with a citation manager or style guide

There are thousands of citation styles to choose from, so it may help to consult the author guidelines for any journals you plan to submit to before you begin writing and citing.

Most citation managers will have the standard citation styles available, but you may need to install additional citation styles. Visit our [Citing & Writing page](https://hsl.lib.unc.edu/citing) to learn about and compare citation managers supported by HSL.

## Make supplementary content available via a repository (if applicable)

Depending on the journal you are submitting to, you may need to make data and other supplementary content available via an open repository, instead of including in the publication itself. The following links are for open repositories you may consider using to store supplemental content.

* UNC’s institutional repository - [Carolina Digital Repository (CDR)](https://cdr.lib.unc.edu/)
* [Open Science Framework](https://osf.io/)

|  |  |
| --- | --- |
| Tools outline | **Tools for writing the review:**   * [PRISMA 2020 Statement](http://dx.doi.org/10.1136/bmj.n71) * [PRISMA 2020 Explanation and Elaboration document](http://dx.doi.org/10.1136/bmj.n160) * [PRISMA 2020 Flow Diagrams](http://www.prisma-statement.org/PRISMAStatement/FlowDiagram)   + [Which PRISMA 2020 Flow Diagram should I use?](https://guides.lib.unc.edu/systematic-reviews/reporting#s-lg-box-26463900)   + [Instructions on how to fill out the PRISMA 2020 Flow Diagram](https://guides.lib.unc.edu/systematic-reviews/reporting#s-lg-box-26464643)   + [How to document grey literature searches in the PRISMA 2020 Flow Diagram](https://guides.lib.unc.edu/systematic-reviews/reporting#s-lg-box-26756646) * [PRISMA 2020 Checklist](http://www.prisma-statement.org/PRISMAStatement/Checklist) |
| Document outline | **Templates for writing the review:**   * [UNC HSL systematic review manuscript template](https://guides.lib.unc.edu/ld.php?content_id=68945566) (.doc) * [PRISMA 2020 flow diagrams](http://www.prisma-statement.org/PRISMAStatement/FlowDiagram) * [PRISMA 2020 checklist](http://www.prisma-statement.org/PRISMAStatement/Checklist) |