

Systematic Review in Evidence-Based Risk Assessment

Supplementary Data

Numerous software tools are available to facilitate and improve the efficiency of systematic reviews. These tools vary in the nature and number of features supported. It is important for review authors to consider the complexity and size of the review undertaken in addition to the funding available before selecting a suitable tool. Available tools are listed in Table S1 below, along with a brief description and the corresponding weblink.

Tab. S1: Software tools available to facilitate the systematic review process

TOOL	DESCRIPTION	LINK
2DSEARCH	This online tool guides the search strategy development process. The interactive user interface allows the creation of search strategies using drag and drop process, and the software automatically provides keyword suggestions. Search queries are then formulated automatically. Free to use.	https://www.2dsearch.com/
ABSTRACTR	An online tool that allows users to screen uploaded abstracts while collaborating with others. Free to use.	http://abstrackr.cebm.brown.edu
BADERI	A web-based application that coordinates handsearching activities of clinical trials. A repository is created containing a list of journals that have been hand searched, the number of articles reviewed, and the number of trials identified. Free to use.	http://www.baderi.com/
BEBOP	A web-based tool for reference management that stores publication in a BibTeX file. Free to use.	http://people.alari.ch/derino/Software/Be-bop/index.php
BIBDESK	A web-based reference management tool for Mac OS X 10.7. It is well suited for LaTeX users. Free to use.	https://bibdesk.sourceforge.io/
BIBUS	A reference management software that supports queries in PubMed. Free to use.	https://sourceforge.net/projects/bibus-biblio/
BIOREADER (BIOMEDICAL RESEARCH ARTICLE DISTILLER)	A web-based tool that ranks up to 1000 PubMed IDs by relevance to make screening more efficient. BioReader can help you distil your reading list by ranking articles by relevance. Free to use.	http://www.cbs.dtu.dk/services/BioReader/
CADIMA	Developed by the Julius-Kühn-Institut, this web-based tool supports multiple stages of a systematic review. Features include automated removal of duplicate references, automated screening, collaboration between multiple reviewers. Free to use.	https://www.cadima.info/
CIENTOPOLIS SCOLR	The web-based application is currently in Beta form. Supports reference management and screening to perform open reviews. Free to use.	http://scolr.cientopolis.org/
CINEMA (CONFIDENCE IN NETWORK META-ANALYSIS)	The web-based application allows the evaluation of confidence in the findings of network meta-analysis. It applies the Salanti approach and adapts the GRADE framework for network meta-analysis. The underlying methods consist of generating a contribution matrix, which displays how much information is contributed by each study in the network meta-analysis. Free to use.	https://cinema.ispm.unibe.ch/
COLANDR	The web-based tool uses machine learning to facilitate screening and data extraction. User input is used to train the machine learning models that rank the articles by relevance, and topic labels for each article are predicted. Free to use.	https://www.colandrapp.com

COMPREHENSIVE META-ANALYSIS (CMA)	Software package for conducting meta-analysis and meta-regression.	https://www.meta-analysis.com
COVIDENCE	Developed by a not-for-profit in partnership with Cochrane, the web-based application supports multiple stages of systematic reviews: screening (abstract and full text), risk of bias assessment, and data extraction. Study data can be exported to RevMan. Free to use.	https://www.covidence.org/
DISTILLERSR	A web-based software that supports reference management, screening, flexible data extraction, risk of bias assessment, and reporting. Multiple reviewers can collaborate on the same project. A feature based on artificial intelligence that can act as a second reviewer was recently added.	https://www.evidencepartners.com/
DOCTOR EVIDENCE	Includes several tools that allow users to search and retrieve references from multiple databases, perform dynamic analyses on data found in the search results, among other features.	https://drevidence.com/products/doc-data/
DTA MA (DIAGNOSTIC TEST ACCURACY META-ANALYSIS)	Users can upload their data to perform meta-analysis using the R package lme4. Plots are customizable and can be downloaded.	https://crsu.shinyapps.io/dta_ma/
ENDNOTE	Reference management software. Desktop and web-based application. Allows sharing of reference libraries between users.	http://endnote.com/
EPISTEMONIKOS	The application enables users to identify all the systematic reviews on a health topic by searching common bibliographic databases. Links to the primary studies in identified systematic reviews are provided to increase efficiency. Features of the program include removal of duplicate references, screening by users and machine-learning algorithm, and the generation of matrices of evidence.	https://www.epistemonikos.org/
EPPI-REVIEWER	Developed by the EPPI Centre. Web-based software that allows managing references, screening studies, data extraction, and meta-analyses, among other features. Multiple users can collaborate on the same project. Text mining features are under development.	http://eppi.ioe.ac.uk/cms/
EVIATLAS	An open-source tool that allows the creation of visualizations from databases of studies such as interactive geographical maps, health maps, descriptive plots and databases that can be easily filtered. The software is built using R, allowing coders to further optimize the visualizations. Free to use.	https://estech.shinyapps.io/eviatlas/
EXACT	A web application that allows users to extract data in a tabular format from ClinicalTrials.gov by searching using the NCT ID, intervention, indication, or general search terms. Free to use.	https://bio-nlp.org/EXACT/
EXACTDEMO	A web application developed by the National Research Council of Canada and the University of California. The tool can extract data from publications of clinical trials such as descriptions of the interventions, population, outcome measures, funding sources, and other key characteristics. Currently available as a trial version.	http://exactdemo.iit.nrc.ca/intro.php
FOREST PLOT GENERATOR	A web-based tool developed by Evidence Partners that allows users to input quantitative findings to quickly create forest plots for use in systematic reviews. Free to use.	https://www.evidencepartners.com/resources/forest-plot-generator/
GRADEPRO	Developed by the GRADE working group, this tool allows the user to create GRADE Evidence Profiles and Cochrane Summary of Findings tables. Free to use.	https://gradepro.org/
HEALTH ASSESSMENT WORKSPACE COLLABORATIVE (HAWC)	Developed by the US Office of Health Assessment and Translation, this software facilitates all stages of environmental human health assessments. It consists of multiple modules that can be used independently or together. It accommodates the complex nature of mechanistic and experimental studies, supports collaboration between multiple users, and is free to use.	https://hawc.readthedocs.io/
IMPORT.IO	This tool can be used to supplement grey literature searching. It is a web crawling software that can extract detailed citations and a short description from a list of URLs. Free to use.	https://www.import.io/
JABREF	An open-source bibliography reference manager using BibTex. Entries in multiple formats can be imported from external database searches. Free to use.	http://www.jabref.org/
JBI-SUMARI	Developed by the Joanna Briggs Institute, this software tool is designed to support all stages of the systematic review process. It is designed to support ten types of reviews (effectiveness, qualitative, prevalence, etc.).	https://www.jbisumari.org/

JSTOR TEXT ANALYSER	Developed by JSTOR Labs, users can upload a document to this web-based tool and search for publications with key topics similar to those in an uploaded document. Search results can be refined by adding, removing, or adjusting the priority of terms. The tool supports 15 languages and is free to use.	https://www.jstor.org/analyze/
LINGO3G	This is a text clustering and visualization tool. It organizes collections of text documents into clearly labelled thematic folders and provides a summary of the topics in a set of documents.	https://carrotsearch.com/lingo3g/
LITSEARCHR	An R package that supports the development of a search strategy by writing Boolean search strings and partially automated keyword selection. It groups keywords into concept groups and writes Boolean searches in up to 53 languages. The tool has been tested in 15 common bibliographic databases. Free to use.	https://elizagrames.github.io/litsearchr/
LITSTREAM	This tool facilitates the development of risk assessments that require systematic review of large bodies of evidence including toxicologic, epidemiologic, and <i>in vitro</i> studies. It supports screening of the literature, flexible data entry forms for complex data, study quality, and assessment management.	https://www.icf.com/technology/litstream
MAVIS	An online tool that performs fixed effects and random effects meta-analysis after data is input to the interactive user interface. Generates forest plots and funnel plots. Free to use.	http://kylehamilton.net/shiny/MAVIS/
MEDLINE TRANSPOSE	Online tool (currently being tested) that supports the development of the search strategy by translating search queries between Ovid MEDLINE and PubMed syntax. Free to use.	https://medlinetranspose.github.io/
MENDELEY	A rapidly growing reference management software and academic social network. Free to use. Reference management features can be used online and offline.	https://www.mendeley.com
META-CART	An R package that allows the identification of interaction effects between moderators in meta-analysis. Free to use.	https://cran.r-project.org/web/packages/metacart/index.html
META-ESSENTIALS	A set of Excel workbooks that automatically produce statistics, tables, and figures for meta-analysis. Free to use.	http://www.erim.eur.nl/research-support/meta-essentials/
METAEASY	An add-in for Microsoft Excel that supports meta-analysis. Free to use.	http://www.statanalysis.co.uk/meta-analysis.html
METAFOR	An R package for conducting meta-analysis (fixed effects, random effects, mixed effects) and meta-regression, in addition to generation of plots. Free to use.	http://www.metafor-project.org/doku.php
METAGENYO	An interactive online tool that supports meta-analysis of genetic association studies. Free to use.	http://bioinfo.genyo.es/metagenyo/
METAINSIGHT	An online tool that allows Bayesian network meta-analysis and frequentist network meta-analysis. It generates forest plots and comparisons of relative treatment effects for all possible treatment pairs from the network meta-analysis among other features. Free to use.	https://crsu.shinyapps.io/metainsightc/
METAMISC	An R package that allows the meta-analysis of diagnostic and prognostic modeling studies, among other features. Free to use.	https://cran.r-project.org/web/packages/metamisc/index.html
METAXL	An add-in for Microsoft Excel that supports meta-analysis. Free to use.	http://www.epigear.com/index_files/metaxl.html
METAVERSE	A collection of R packages intended to work together to support the evidence synthesis process. It is intended to integrate the other packages (litsearchr, revtools, metaDigitise, robvis, and metaverse). Currently under development. Free to use.	https://rmetaverse.github.io/
MIX 2.0	An add-in for Microsoft Excel that supports meta-analysis.	https://www.meta-analysis-made-easy.com/
NETMETAXL	A Microsoft Excel-based tool (uses visual basic) that performs Bayesian network meta-analysis using WinBUGS. Results and diagrams, forest plots, and other plots are displayed in Excel. Free to use.	https://netmetaxl.com/download.html
OPENMEE	A desktop tool for meta-analysis suited for the needs of ecologists and evolutionary biologists. It supports meta-analysis, meta-regression, and the generation of diagrams and plots. Free to use.	http://www.cebm.brown.edu/openmee
ORBIT MATRIX GENERATOR	Developed at the University of Liverpool, this online tool generates an ORBIT outcome matrix to identify missing study outcome data and to assess the risk of outcome reporting bias according to the ORBIT classification system. Free to use.	http://ctrc.liv.ac.uk/ORBIT/
PAPERPILE	A web-based reference management system where users sign in with Google credentials and the software connects to Google Drive and Google Docs.	https://paperpile.com

PAPERS	Reference management software to manage bibliographies and references; contains built-in search engines.	https://www.papersapp.com/
POLYGLOT SEARCH	Developed by Bond University, this tool allows users to translate a search query for PubMed or Ovid MEDLINE into strategies for the following databases: PubMed/Ovid MEDLINE, Cochrane Library, Embase, Web of Science, CINAHL, PsycINFO, Scopus. Free to use.	http://sr-accelerator.com/#/polyglot
PREDICTER	This web-based tool allows the estimation of time required to complete a review to help authors plan the resources needed. It calculates the time needed for each stage of the review in addition to time needed for planning and coordination.	http://predicter.org/
PRISMA FLOW DIAGRAM GENERATOR	An online tool that generates PRISMA diagrams that can be exported to use in the write-up of the review.	http://prisma.thetacollaborative.ca
PYMETA	An online meta-analysis tool that supports meta-analysis, heterogeneity testing, subgroup and sensitivity analysis, and generation of various plots. It is created with Python programming language and is free to use.	http://www.pymeta.com/
QIQQA	A reference management tool.	http://www.qiqqa.com/
RAX	A search tool for identifying scientific literature; uses artificial intelligence to optimize the search and results returned.	https://raxter.io/
RAYYAN	A web-based tool developed by the Qatar Computing Research Institute. Supports independent screening by two reviewers. It also includes a mobile app for screening studies on the go. It supports collaboration between multiple users. Free to use.	https://rayyan.qcri.org/welcome
RCT TAGGER	A web-based tool to facilitate the identification of RCTs in the literature by performing a PubMed query. Free to use.	http://arrowsmith.psych.uic.edu/cgi-bin/arrowsmith_uic/RCT_Tagger.cgi?ID=22379
REFBASE	A web-based reference management software. Free to use.	http://www.refbase.net/index.php/Web_Reference_Database
REFDB	A reference database and bibliography tool for SGML, XML, and LaTeX/BibTeX documents. It allows users to share databases over a network. Free to use.	http://refdb.sourceforge.net/index.html
REFERENCER	An application to organize documents or references and generate a BibTeX bibliography file. Free to use.	https://launchpad.net/referencer
REFWORKS	A web-based reference management tool.	https://www.proquest.com/products-services/refworks.html
RESEARCHR	A web-based tool that supports searching bibliographic database and managing references.	https://researchr.org/
REVIEW MANAGER (REVMAN)	Developed by Cochrane to support all stages of preparing and maintaining a Cochrane review. Facilitates the generation of characteristics of study tables, comparison tables, and study data. Also supports meta-analysis and generation of forest plots and funnel plots. A new online version (RevMan Web) is under development. Free to use.	https://tech.cochrane.org/Revman
RIS EXPORT	A tool that facilitates reference file importing by converting search result files into RIS files that can be directly transferred to reference management software.	https://epi.ioe.ac.uk/cms
ROBOTSEARCH	An online tool that scans through an RIS file to filter out articles that are not RCTs using a machine learning model. Free to use.	https://robotsearch.vortext.systems/
ROBVIS	This web-based tool extends risk of bias assessment, generating high quality figures that summarize the risk of bias assessments performed as part of a systematic review (bias tools supported: RoB 1, ROB 2, ROBINS-I, and QUADAS-2). Free to use.	https://mcguinlu.shinyapps.io/robvis/
SCIRAP	A web-based tool for evaluating the methodological quality and reporting quality of <i>in vivo</i> and <i>in vitro</i> toxicity studies. Free to use.	www.scirap.org/
SCIREF	A reference management tool for Windows.	https://sci-progs.com
SEARCH BUILDER 1.0	A Microsoft Excel-based tool to build search strategies that can be pasted in Embase and Pubmed. Available for PC and Mac. Free to use.	https://www.hopkinsmedicine.org/pulmonary/research/outcomes_after_critical_illness_surgery/oacis_publications.html
SEARCH WHITEBOARD	A Microsoft Excel-based tool to help develop a search strategy. Users assemble search terms (using PICO) on the spreadsheet and can create and run different search strategies.	http://exeterhealth.libguides.com/searching/Resources

SRDB.PRO	This tool supports all stages of systematic reviews, including PubMed searches and data analysis. Some stages can be automated to improve efficiency of the process.	https://www.srdb.pro/srdbpro
SWIFT-ACTIVE SCREENER	Developed by Sciome LLC, this web-based collaborative systematic review software application was designed to reduce screening time by automatically prioritizing articles as they are reviewed by placing the most relevant articles at the top of the screening list.	https://www.sciome.com/swift-activescreener/
SWIFT-REVIEW	Developed by Sciome LLC, this desktop application tool allows the user to search, categorize, and prioritize bodies of literature. The software uses statistical text mining and machine learning methods that allow users to rank documents for manual screening. Free to use.	https://www.sciome.com/swift-review/
SYSREV	A tool to facilitate the collaborative extraction of data from research articles and PDF documents.	https://sysrev.com/
SYSTEMATIC REVIEW ACCELERATOR	A module developed at Bond University to facilitate the systematic review process. Features include a validated tool for detection and removal of duplicates from search results, aid with the development of search strategy, a tool to translate search strategy strings from PubMed/Ovid MEDLINE to other common databases, and a hotkey tool to facilitate screening in EndNote. The module can be integrated into existing SR workflows and other automation tools.	http://sr-accelerator.com/
SYSTEMATIC REVIEW ASSISTANT	A text mining tool to automate risk of bias assessments in systematic reviews. Users upload PDF articles of RCTs, and the software predicts and highlights sections relevant to each risk of bias domain. Articles are assigned a score to denote the risk of bias predicted. Free to use.	http://www.datamining.org.uk/sysreview.html
SYSTEMATIC REVIEW FACILITY (SYRF)	An online tool for systematic reviews of preclinical studies. Users can screen references, extract data, and perform meta-analysis. Allows collaboration between multiple researchers. Free to use.	https://app.syrf.org.uk/home
TABLE BUILDER	A demo version of a web-based tool to generate evidence tables from peer-reviewed literature. The software allows users to extract various data fields including characteristics of studies and results, to comment on elements of study strengths and limitations, and to list potential covariates and confounders in epidemiological studies. Output can be downloaded into Microsoft Excel files or imported into statistical software to produce graphs and plots. Free to use.	https://table-builder.com/
AMSTAR	An online checklist form for assessing the quality of systematic reviews. Calculates an AMSTAR (A Measurement Tool to Assess Systematic Reviews) reliability score.	http://amstar.ca/Amstar_Checklist.php
XMETA	An R package for meta-analysis. It includes functions for implementing robust multivariate meta-analysis of continuous or binary outcomes and for bivariate Egger's test for detecting publication bias.	https://cran.r-project.org/web/packages/xmeta/index.html
ZOTERO	Reference management software.	https://www.zotero.org/

Tab. S2: Software tools that support at least one step (search, study selection, data extraction, quality assessment, or meta-analysis) of the systematic review process

Tools listed in Table S1 that partially support one step are not included in this table.

TOOL	SEARCH	STUDY SELECTION	DATA EXTRACTION	QUALITY ASSESSMENT/RISK OF BIAS	META-ANALYSIS	FREE TO USE
2DSEARCH	x					x
ABSTRACTR		x				x
CADIMA		x	x	x		x
CIENTOPOLIS SCOLR		x				
COMPREHENSIVE META-ANALYSIS (CMA)					x	Free trial
COVIDENCE		x	x	x		Free trial
DISTILLERSR		x	x	x		Free trial for students
DOCTOR EVIDENCE	X				X	
DTA MA					x	x
EPISTEMONIKOS	x					x
EPPI-REVIEWER		x	x	x	x	Free trial
FOREST PLOT GENERATOR					x	x
HAWC	x	x	x	x	x	x
JBI-SUMARI		x	x	x	x	Free version available
LITSEARCHR	x					x
LITSTREAM		x	x	x		Not mentioned
MAVIS					x	x
META-CART					x	x
META-ESSENTIALS					x	x
METAEASY					x	x
METAFOR					x	x
METAGENYO					x	x
METAINSIGHT					x	x
METAMISC					x	x
METAXL					x	x
METAVVERSE	x	x	x	x	x	x
MIX 2.0					x	Free version available
NETMETAXL					x	x
OPENMEE					x	x
ORBIT MATRIX GENERATOR				x		x
PAPERS	x					Free trial
PYMETA					x	x
RAX	x					Free version available
RAYYAN		x				x
RCT TAGGER	x					x
RESEARCHR	x					x
REVIEW MANAGER (REVMAN)		x	x	x	x	x
SEARCH WHITEBOARD	x					x
SRDB.PRO	x	x	x	x	x	Free trial
SWIFT-ACTIVE SCREENER		x				Free trial

TOOL	SEARCH	STUDY SELECTION	DATA EXTRACTION	QUALITY ASSESSMENT/RISK OF BIAS	META- ANALYSIS	FREE TO USE
SYSTEMATIC REVIEW ACCELERATOR	x	x				x
SYSTEMATIC REVIEW FACILITY (SYRF)		x	x		x	x
XMETA					x	x