

Referencing Made Easy: Reference Management Softwares

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Reference management softwares are a powerful tool in the researchers' armamentarium. They primarily help in re-sequencing, re-styling and reformatting of the citation content in the research manuscripts. They also enable multi-user collaboration on research and allow the researcher to manage database searches and digital libraries. Using these softwares allows synchronization of cloud based digital libraries on multiple electronic devices enabling remote access, and also allows for management of online portfolios. We, herein, describe the basic principles, functions, and limitations of various reference management softwares.

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Researchers often use existing medical literature as books, journal articles, monographs and internet sites as a base for new research articles. The researcher should duly acknowledge and give credit to the previous researcher for their contribution by citing the referenced literature sources at the end of one's article. Referencing enables the research work to be compared in the light of existing evidence base to generate more constructive and generalizable data. Correctly cited, valid and easily accessible references allow the readers to cross-verify and interpret existing literature base to further their understanding. Appropriately referenced articles enable the journal editors to identify potential researchers who could review the manuscript or write an editorial for the research, for their journal. It also helps the reviewers and editors run appropriate plagiarism checks in keeping with journal policies [1].

The task of repeated re-sequencing of hundreds of references for thesis and literature review necessitated by multiple revisions is an ordeal. All such data and articles needs to be stored, cross referenced and sequentially cited in a proper target journal format and style. Fortunately, citation management has evolved and has never been as easy as it is today. Reference management softwares (RMS) (alternatively called citation management software, or biblio-graphic management software) allow authors to search, record, manage, write, and utilize bibliographic citations/references in an appropriate format to meet the publishing requirements of various journals and publishers.

Over the last 30 years, RMS have evolved beyond their basic functions to allow the user to create their databases, create in-text citations and share databases, enabling collaboration with fellow researchers [2-6]. Popular RMS available today include Zotero, EndNote, Mendeley, F1000 Workspace, JabRef, Citavi, Bibsonomy, WizFolio, Docear, Qiqqa, ReadCube Papers, Colwiz, Paperpile, and Microsoft word [7].

Reference management system

Though there exist multiple RMS in the market, few popular ones include Zotero, Mendeley and EndNote (Table I) [8-10]. EndNote was first released in 1988 (Thomson Reuters). It is one of the most popular software, and allows users to store files on remote server (via EndNote Web) [8-10]. Its manuscript matcher allows matching of the research manuscript to relevant journals. Its latest version (EndNote 20) allows de-duplication of references by digital object identifier (DOI) and/or PubMed Central Identifier (PMCID) and allows for annotation in a portable document format (PDF) [9,11]. Zotero is a free citation manager which was developed at George Mason University in 2006 and has since evolved into a stand-alone software [9]. Mendeley was released in 2008 and has evolved into both online (Mendeley web) and desktop components (Mendeley Desktop) [12]. Microsoft Word (Windows) also offers a built-in feature for creating bibliographies. One can select the citation style, insert citations, add new sources and insert bibliographies in its references tab [9].

A recent survey on graduate students showed that Mendeley (39%), EndNote (20%), Zotero (16%) and

Table I Comparison of Various Reference Management Softwares

<i>Parameter</i>	<i>EndNote</i>	<i>Mendeley</i>	<i>Zotero</i>
Cost	Paid	Basic version free, with paid additional storage	Basic version free, with additional paid storage
Storage	Basic: 2 GB Paid version: unlimited	Free plan 2 GB Various paid plans	300 MB Free Various paid plans
Work without internet	Yes ^a	Yes	Yes
Organize records into folders	Yes	Yes	Yes
Customizable display	Yes ^a	No	no
Offline availability	References files stored locally ^a	References files stored locally	References files stored locally
Duplicate checking	Yes	Yes	yes
Direct export from databases	Yes	Yes	yes
Reference sharing	Yes, via email (also pdf)	Yes, via email ; Sharing folders: in public groups only references	No
Creates formatted bibliographies in text citation	Yes ^a	Yes	Yes
Store PDFs	Yes ^a	Yes	Yes
Extract data from PDF	Yes ^a	Yes	Yes

^aEndNote basic does not have these features. PDF: portable document format.

RefWorks (10%) were the most common RMS used. While other surveys have shown that faculty were more likely to use EndNote (48%) than graduate students (31%) [9]. Among those undertaking systematic reviews, 80% were found to use an Endnote RMS [10]. Cross-sectional surveys of different specialities reveal popularity of Endnote and Mendeley, amongst health sciences, while Zotero was more popular in social science disciplines [8]. There are several factors that determine the choice of RMS among various researchers (**Box I**).

Functions of RMS

Creating bibliographies: RMS provides a platform where we can save the article explored in the web browser can be saved. This creates a list of bibliography for that searched topic. It allows for batch of references accessed from PubMed to be saved. Writing a research paper or research project report can require deletion and inclusion of more data leading to frequent alteration of reference sequence. RMS are best known for their ability to help researchers generate properly sequenced bibliographies towards research papers, in any desired format as per target journal policies (e.g., AMA style, Vancouver style). They enable in-text reference insertion, addition or deletion, and automatic resequencing of the citation order in the manuscript [13]. Among few studies which compared RMS in terms of bibliographic accuracy, one review concluded that Zotero generated most accurate bibliographies [3].

Many RMS offer options to search external databases (Endnote, Mendeley, Paperpile, Sciwheel, Refworks), but few (Sciwheel, EndNote desktop) recommend articles of interest on the basis of what's already in the user's library [14]. Few RMS e.g., EndNote (desktop version) help the researcher find full text options for the citations imported from search alerts. This tool is especially a boon for teams undertaking systematic reviews [15].

Storing and managing references and full text content: RMS allows for storage of articles in an appropriate retrievable format, for ease of referencing and sequencing, right from the stage of protocol preparation until the final manuscript submission. It also allows the researcher to undertake simultaneous projects by creation of parallel folders in the software. These digital libraries of stored references can be backed up on cloud storage (web based versions), allowing access from multiple computers. It is important to note that as one's digital library grows, it may necessitate purchase of additional storage space.

RMS may offer single station software (desktop based) interfaces or web-based programs. Both have their own advantages. While desktop based softwares are not limited by website time lags and offer offline accessibility, web based versions offer cloud storage, accessibility across multiple computers and enhanced networking [10,13,16-18]. Fortunately, most RMSs such as EndNote, Zotero and Mendeley offer both web-based and single station platforms [7].

Box I Factors to be Considered While Choosing a Reference Management Software (RMS)

- Should allow import of citations from bibliographic databases and websites and allow organisation of citations into groups within the RMS.
- Should allow annotation of citations.
- Should have appropriate writing styles, pertinent to field of interest and construction of unavailable writing styles.
- Cost of the program should be affordable, including cost for upgrading storage (Free or paid by university).
- Should be able to interface with available word processing software e.g., Microsoft word, LibreOffice, google docs, to facilitate in-text citation with appropriate plugins.
- Should have ability to process PDF (Portable Document Format), annotate and retrieve metadata when using drag and drop feature.
- Should allow interchange of data with other reference managers through standard metadata formats (e.g., RIS, BibTeX)
- Should be compatible across available operating systems Mac, Windows.
- Should have ability to screen electronic libraries and transfer appropriate references into the program.
- Training resources and technical support should be easily available.
- Should allow portability of references through cloud storage with syncing of data files and attachments, allowing access across multiple electronic devices.
- Should have a user friendly, customisable interface and occupy less disk space.
- Compatible with smart phones: availability of mobile apps.
- Should allow sharing of data (RMS database or portions of it) with other collaborators.
- Should have offline accessibility.
- Should have web and desktop based versions
- Should have other features as removing duplicate references etc.

Drag and drop feature: Often the researchers store PDF formats of the references at the time of literature review. Some RMS allow appropriate citation to be generated by just a drag and drop of the PDFs into the RMS. This is accomplished by identification of metadata as DOI or international standard book number (ISBN) in the PDF [5,13,19]. These identifiers also enable RMS to obtain citation information and avoid duplication [20]. Researchers can use annotations as sticky notes and text marking in their PDFs stored in the RMS for clarity. This feature is supported by Endnote, Mendeley and Citavi, but not by other RMS, which need external editors as adobe acrobat reader [7].

Sharing the data with other collaborators: Most RMSs (web based) permit enhanced networking functionality, allowing users to share references and PDFs enabling collaboration on research. But it can get tricky to share across different RMS as one is prompted to do so in various formats like BibLaTeX, BibTeX (.bib), CSLJSON (JavaScript Object Notation), RIS (Research Information Systems) (.ris), Endnote XML (.xml) (Extensible Markup Language) among others. Amongst these, RIS (.ris) is a standard citation format across EndNote, Mendeley, and Zotero. On downloading the database, PDFs and other attachments are not directly exported and links to word processor plugins maybe lost [21,22].

When doing collaborative researches, references maybe shared and edited with other researchers in

Endnote, Mendeley, Papers (enterprise version), Bibsonomy and Citavi [7]. However, desktop and web-based user interfaces may differ towards group management as addition of people in groups, and permission for selective record viewing.

Researchers often utilize social networking, to publicize their research work and communicate with like-minded researchers. But only few RMS like Bibsonomy, Mendeley and Zotero support this function, by allowing publication of a personal profile/curriculum vitae, following of other researchers, and communication in similar interest groups [7].

Password protection: It is available in software as EndNote, Zotero, Mendeley but is absent in others like KBibTeX, JabRef and BeboP [6,23].

Word processor integration: Most researchers prefer to work and create their articles in Microsoft word (windows), LibreOffice and Google docs. It is therefore essential for these RMSs to have plugins to interact with these softwares, enabling incorporation and auto sequencing of citations. Most software such as EndNote, Mendeley, Citavi, Zotero, Sente have this compatibility unlike Refbase and RefDB. Very few RMSs are compatible with google docs (e.g., Zotero, Papers and RefWorks). Similarly, LibreOffice is compatible with systems such as Mendeley and Zotero [6,23].

Searching and retrieving references from online

KEY MESSAGES

- Reference management software can help create and store the research article databases, create in-text citations, and enable collaboration with fellow researchers.
- Bibliography created by RMS needs to be checked for possible errors as per the requirement of the journal or the assignment.

databases: Some RMS import literature from online external databases. They offer in-app searching of databases with web browser plugins to allow identification of reference data from journal websites. This automatic entry of references minimises typographical errors with all essential citation related information (as title, author, journal, date of publication etc.) being downloaded directly into the RMS library [13]. Searching online databases via RMS may miss some citations as compared to searching native databases (as PubMed, Ovid) [24].

Maintaining portfolios: Many programs require students to maintain academic portfolios, where documentation of competencies and documents can be undertaken. Few RMS such as Papers allow for creation of such portfolios [25].

Exportation to Excel: It is important to share the citation searches between collaborators, in various formats as Excel, especially when undertaking systematic reviews. This functionality is offered by managers like Zotero and Endnote where appropriate formats (RIS, Research information systems format and CSV, comma-separated values format) maybe exported in external files (Excel) [26,27]

Tool for summative assessment: Some RMS such as EndNote, offer unique features that allow for their use towards summative assessment. Herein, each examination details may be stored as a citation with multiple files attached in any format as needed. Similar examinations maybe integ-rated as group sets, data backed up on cloud servers or offline on hard-drives, and confidential documents pass-word protected. But certain features expected in examination management systems as certificate authentication and multilayer authentication are not available in RMSs [28].

Mobile applications: Some referencing software have their own mobile apps as Mendeley and EndNote. Others as Zotero, have third party apps for iOS and android. There are short YouTube videos available guiding their use.

PROBLEMS WITH RMS USE

The use of citation management software does not

guarantee the absence of referencing errors within a manuscript. The author should verify each citation as per journal specific author guidelines. Studies have shown citation errors in RMS output, when compared to journal requirements, particularly in author names, capitalization, punctuation, journal title and dates [4,29]. References often get duplicated when they are stored in different group sets, which may result in duplication of inserted citation in the bibliography [30].

Every researcher needs to meet the specific citation requirements (APA, Chicago, Vancouver etc.) of target journal to submit an article. An open XML (extensible markup language) based citation style language (CSL) enables the formatting of citations and bibliographies. If the required format is missing in the RMS, the researcher may need to learn the use of the style editor function of the RMS to create bibliography in the missing format [20].

Various file formats are available for storing bibliographic data which include Research information systems (RIS), BibTeX, Endnote XML and Citeproc JSON. Often RMS do not recognise all these formats. This hinders migration from one RMS to another and of multiple RMS simultaneously [19,20].

Although, there exist many unique identification numbers and schematics for journal articles, as DOI, PubMed identifier (PMID), ISBN, PMCID, or the ArXiv ID [19,20]. There are no uniformly acceptable article identifiers that are acceptable across databases and libraries. This complicates de-duplication and metadata retrieval by RMS [31].

IMPLICATIONS FOR PRACTICE

Users often find RMSs challenging. Researchers often neither have knowledge about various RMS, nor have time to learn them [8,32]. For ease of self-taught researchers, step-by-step usage guides are available on the net, as either YouTube videos or RMS specific webpages and blogs. Researchers may post their specific queries on these blogs, which may then be answered by technical staff or their co-researchers. Self-help options such as online tutorials and webpages, are favored by graduate students in learning RMS [8]. This self-taught mode can be

complemented by library services in large institutions. A core group of librarians of an academic library can act as an invaluable resource. A webpage with resources can be created in institutions with links to RMS vendor webpages and online support forums. Since different users have varied needs and resources, tools as workshops, one-to-one consultations, online tutorials, creation of webpages with resources, email and online chat assistance, can be utilized to enable training of students and faculty in the use of RMSs [8]. Workshops customized to basic and advanced training serve an important role in RMS adoption by researchers [32].

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