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TITLE PAGE

TITLE:
Finding, retrieving, and evaluating journal and web-based information for evidence-based optometry

SHORT TITLE:
Finding and evaluating evidence

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ABSTRACT:
How can optometrists ensure they are basing their advice to patients on the most reliable information available? This paper discusses search tools, databases, websites and journals which provide free, full-text, web-based access to evidence-based literature. Brief tips on searching these resources are provided for the time-poor practitioner or researcher. Criteria, such as credibility, currency and bias, are used to evaluate written material and will be discussed with particular reference to the problems inherent in evaluating webpages.

KEY WORDS:
Evidence-based practice, information retrieval, optometry, search strategies
When using evidence-based principles to examine the best outcome for the patient, the optometrist considers the patient’s history, their own observations and relevant research. But how can the optometrist ensure they have the best available evidence to inform clinical judgements? This paper discusses web-based search tools which can be used to find research literature, and notes databases, websites and journals which provide free, full-text, web-based access. In addition to having the skills to locate relevant and reliable journal articles and websites, the clinician needs the ability to read the material with a critical eye. With this in mind, criteria used to evaluate literature will be discussed with particular attention to the evaluation of webpage content.

**PRIMARY AND SECONDARY EVIDENCE – WHAT’S THE DIFFERENCE?**

Clinical research literature can be broadly divided into primary and secondary types and different search tools need to be utilised to access each. Primary research takes the form of clinical trials, experiments or surveys. Primary research literature is written by the researchers themselves and therefore provides first-hand explanation of the methodology and findings of the study. When searching the literature using an evidence-based approach, it is necessary to understand that a particular question may be best answered by a particular primary research design. Greenhalgh’s series entitled *How to read a paper* are useful. Originally published in 1997 in the British Medical Journal(1-9) and now published as a book(10), they offer guidance for interpreting different types of articles.

The disadvantage to using primary research is the time required to evaluate the findings of multiple research projects to ensure that the findings of an individual research project are born out in similar studies. To overcome this disadvantage a body of secondary literature is available which summarises and condenses the findings of multiple primary studies. Types of secondary research include decision analyses(11) and economic analyses(12), reviews (systematic or narrative), meta-
analyses and clinical practice guidelines. Clinical practice guidelines, systematic reviews and meta-analyses will be discussed in this paper.

Clinical practice guidelines integrate evidence from systematic and other reviews to make explicit recommendations on the interventions to be used or the procedures to be followed in optometric practice. Recommendations are decided by consensus among experts in the field and guidelines are often produced by professional associations and health bodies. For example, the Office for Aboriginal and Torres Strait Islander Health (OATSIH), a Division of the Commonwealth Department of Health and Aged Care, published a group of guidelines called Specialist eye health guidelines for use in Aboriginal and Torres Strait Islander populations.\(^{(13)}\)

A systematic review is “an overview of primary studies which contains an explicit statement of objectives, materials and methods and has been conducted according to explicit and reproducible methodology”\(^{(1)}\). A systematic review may contain a meta-analysis but not necessarily\(^{(14)}\).

A meta-analysis compares the numerical data from a number of studies and provides a statistical interpretation of whether the intervention is useful or not\(^{(1)}\). A meta-analysis may be attached to a systematic review or it may stand alone.

Narrative or non-systematic reviews are the most common type of review and are primarily a summary of findings reflecting current thinking on a topic, written by an expert in the field. The reviewer may, or may not, have reviewed literature collected via a thorough and systematic process.

WHERE DO I START?
Clinical practice guidelines are a good place to start if they are current, deal with the issue in question, and are endorsed by a relevant professional body. They are produced for questions and conditions that optometrists regularly encounter and so
are a time-saving device. Clinical practice guidelines are not all produced in the same way. Some are based on systematic reviews of the evidence which are then applied to clinical practice, while others are founded on consensus between practitioners based on their practical experience. The latter is used when research is unable to provide clear evidence for using a particular course of action in preference to another.

A number of websites provide free access to clinical practice guidelines for optometry and ophthalmology. Web addresses for the following sites can be found in the reference list. The Optometrists Association of Australia\(^\text{(15)}\) provides clinical practice guidelines for its members. The American Optometric Association provides Optometric Clinical Practice Guidelines and Quick Reference Guides from the Clinical Care subsection\(^\text{(16)}\) of its homepage. The American Academy of Optometry\(^\text{(17)}\) has a link to “position papers” under the About tab on the homepage although there is no statement on when these were last updated. The American Academy of Ophthalmology\(^\text{(18)}\) contains a section called Quality of Care which can be found under the Clinical Education heading on the left of the homepage. The Quality of Care section connect to preferred practice patterns\(^\text{(19)}\), the Compendium of Evidence Based Eye Care\(^\text{(20)}\), Ophthalmic Technology Assessments\(^\text{(21)}\) and Complementary Therapy Assessments\(^\text{(22)}\). Documents in the subsections mentioned are available for download at no cost. Citations to published guidelines are also found in databases such as PubMed by using the Limit function and choosing the “practice guidelines” publication type. The TRIP (Turning Research into Practice) database mentioned below also provides links to practice guidelines from many countries.

Clinical Evidence\(^\text{(23)}\) is a website produced by the BMJ Publishing Group which provides recommendations on the prevention and treatment of clinical conditions. It has a section on eye disorders. The advice given is based on consensus but uses the best available evidence from systematic reviews, randomised controlled trials, and observational studies where appropriate. If there is no firm evidence to support a
particular course of action, this is indicated. Payment is required. Subscription to
the website enables access to all articles for the period of the subscription whereas
the pay-per-view option provides one-off access to a single article.

If there are no relevant clinical practice guidelines available, systematic reviews are
the next best alternative because the work of finding and comparing multiple studies
is done, and the standardized structure provides recommendations in any easily
digestible format. The Cochrane Library provides access to a suite of databases which
are available free to all Australians as a result of Australian Government funding.
One of these, the Cochrane Database of Systematic Reviews (CDSR\textsuperscript{24}), is a collection
of systematic reviews which are seen as highly reliable sources of evidence. The
systematic reviews use transparent and rigorous methodology to compare results
from individual studies, and are published in full, with meta-analyses, in the
database. CDSR contains an “eyes and vision” subsection.

The Database of Abstracts of Reviews of Effects (DARE), also part of the Cochrane
Library, provides structured abstracts for systematic reviews not produced by the
Cochrane Collaboration. The abstracts are very thorough summaries of the
methodology, findings and recommendations of the original review, for which full
details are also provided.

The TRIP (Turning Research into Practice) database\textsuperscript{25} amalgamates reviews from a
number of separate providers of evidence-based material into the one database and is
free to search. Links are provided to the online, full-text where this is available. The
results from each search are categorised into systematic reviews, answers to clinical
questions, practice guidelines from various countries, and core primary research
articles on the topic.

If no relevant secondary research is available using the sources mentioned, it will be
necessary to scan the primary research literature. The most widely used tools for
finding citations to primary (and secondary) biomedical literature are the Medline and PubMed\textsuperscript{(26)} databases. The content of both is assembled by the National Institutes of Health in the United States and is essentially the same. However, access to Medline is via (expensive) subscription whereas PubMed is the free, web-based version of the database. Access to the full-text of many articles cited in Medline/PubMed is available via the PubMedCentral\textsuperscript{(27)} database to which there is a direct link from PubMed. However, full-text is available in the PubMedCentral database only where the publisher has agreed to participate. Even when permission to provide the full-text through PubMed Central is given, some publishers impose a six to twelve month embargo on release of the latest material.

When searching Medline and PubMed, limit the search to particular types of article such as “controlled trial”, “meta-analysis”, “practice guideline”, “randomized control trial” or “review”. However, there is also an option called Clinical Queries available from the side menu of PubMed which allows the search to be simply limited to systematic reviews (Cochrane and others), or to studies investigating aetiology, diagnosis, prognosis, therapy or clinical prediction guidelines. These shortcuts assist in retrieving only the most relevant articles. The Journal of the American Medical Association (JAMA) published a series of articles called \textit{Users’ Guides to the Medical Literature} which is now available from a website called \textit{Users’ Guides to Evidence-Based Practice}\textsuperscript{(28)} which is maintained and updated by the Canadian Centre for Health Evidence. These guides provide explanations of the various research designs and are useful for evaluating how particular types of research may be applied to practice.

\textit{Google Scholar}\textsuperscript{(29)} is a version of the well-known \textit{Google} database but contains only scholarly literature including peer-reviewed papers from academic publishers. After searching for a topic in \textit{Google Scholar}, click on the \textbf{Web Search} link below a reference and you will be provided with a list of links to potential sources of the full-text. There may also be a link called \textbf{BL Direct} which allows you to pay for and
receive articles direct from the British Library to your computer. The charges are quite high and there are often less expensive options available. Some of these are discussed below.

Google Scholar duplicates material available in PubMedCentral, to which it links when appropriate, but an advantage of Google Scholar is that it includes links to papers in eprint repositories. Eprint repositories such as those accessed via ARROW (Australian Research Repositories Online to the World)\(^{(30)}\) and OAIster\(^{(31)}\) contain either the version of a paper which has been submitted to a journal or conference for peer review, and which may then be changed as a result of the reviewer’s comments (preprint), or the final draft of a paper which has been peer-reviewed and accepted for publication (postprint). Many eprint repositories are operated by universities, government departments and research institutions for the purpose of providing open access to their research and other output. With the consent of the publisher, these versions of articles are made available via the Internet and free of charge. To locate papers from these repositories, search Google Scholar using the author’s name and then use the Web Search link to see if there is any preprint or postprint material available. Look for web addresses containing gov or edu.

If free full-text cannot be found and payment options do not appeal, there are other possibilities. University and research libraries with print collections of optometry or ophthalmology journals may allow access by non-members to read and/or photocopy articles. Access to electronic subscriptions is governed by license agreements with publishers and these may not allow access to non-staff and students. Public libraries may have reciprocal arrangements with academic libraries or document repositories whereby they can access articles for members of the public. Whilst there may still be a fee for getting documents through a library it may be lower than a pay-per-view fee. Contact libraries directly about options for document access.

**BUT FIRST - WHAT’S THE QUESTION?**
In order to find relevant information in these databases the optometrist must clearly understand the problem, and be able to formulate an answerable question. For each problem two types of information are required – background knowledge about a disorder and specific knowledge relating to this patient with the disorder. Optometrists already possess the background knowledge which comes from formal study and experience, and the PICO process developed at McMaster University provides a framework for developing an answerable question.

PICO relates to the four elements of the process: **Population/Patient**, **Intervention**, **Comparison** and **Outcomes**\(^{(32)}\). An example of a clinical question written using these elements would be: “In children under 5 years with amblyopia (Population) is the use of eye patches (Intervention) more effective in increasing visual acuity in the effected eye (Outcome) than the use of eye exercises (Comparison)?”. In addition to clarifying the problem for the clinician, the presence of these elements in the clinical question provides focus when searching the literature for relevant articles.

After the clinical question is formulated, it is translated into a search strategy which can be interpreted by an electronic database. The search strategy combines key terms from the clinical question using operators such as AND and OR which have a specific function. By combining search terms with AND, the database reduces the number of citations retrieved to those which contain both those words. For example a search using \(\text{amblyopia AND eye patches}\) would retrieve citations containing the terms in the abstract, title or subject headings. A search such as \(\text{eye patches OR eye exercises}\) would return records containing either one or both terms. A more sophisticated search based on the clinical question would look like:

\[
\text{amblyopia AND ("eye exercises" OR "eye patches") AND "visual acuity".}
\]

In this example, the search in the round brackets is performed first and the results then combined with the remaining search terms. Inverted commas ensure that the term is searched as a phrase rather than two separate words. The search is further refined by using the LIMIT function. For example, PubMed and Medline allow the search to
be limited to only those documents with a publication type of “review” or “clinical guideline”. Another popular way of limiting searches is by publication date (eg articles published in the past two years). Further tips for searching PubMed are available from the help pages for the database.(33)

**SHOULD I USE THIS ARTICLE?**

Once the list of potentially useful articles has been retrieved, the decision needs to be made about which ones to use. The same criteria are used to evaluate articles whether they are published in print or online journals, or on webpages. However, because the web evolved without the editorial oversight common to traditional sources of written literature, many of the characteristics which are integral in establishing the credibility of information, such as authorship, peer-review, publication date and publishing body are hidden or missing from webpages. Strategies for uncovering this information will be discussed, as will the criteria used in the evaluation process.

The major issues to consider when evaluating a journal article or a webpage are (i) whether the content and findings can be trusted and (ii) whether the content is applicable to the patient in question. Criteria for evaluating the trustworthiness of a document include the credibility of the author and the publishing or sponsoring body and the accuracy and impartiality of the content.

To assist in judging the credibility of the author, journal articles provide brief biographical information and list the institution with which the author is affiliated. A search of that institution’s homepage may elicit further biographical information. People who are considered experts have often published widely in their field and are routinely asked to present at conferences, undertake peer-review, edit professional journals, or may hold positions in their professional associations. In online databases when viewing a potentially useful article, click on the author’s name to be linked to other articles they’ve written. Webpages may also contain links to author information.
Ascertain whether web-based information about an author is linked to a recognisable institution. Many internet service providers provide their subscribers with space for a personal homepage and information linked from there should be read critically, as there is no peer-review or editorial body governing the content. Web addresses which include a name (eg http://www.myspace.com/graham or http://www.optus.com.au/smith or http://www.malcolmturnbull.com.au/) indicate a personal page. Information linked from a personal page is not necessarily false or misleading but should be evaluated in light of other available information.

Evaluating the trustworthiness of the author is difficult when no name is given. Organizational websites rarely assign authorship to individuals. The webmaster, for whom there is often a link at the bottom of each webpage, is not usually the author of the page. If there is no readily recognisable author for a page, attempt to ascertain the reputation of the site and its sponsoring body. Such information is usually found on the homepage or behind a link entitled “About us” or similar. If there is no direct link back to the homepage, reduce the web address to its base [eg http://www.optometrists.asn.au/] to view the homepage of the sponsoring body. Even if you can find information about the site, links from pages may connect to a different site (check if the base web address changes) which will need to be assessed separately.

In addition to the credibility of the author, the credibility of the source is also important. The reader can have some confidence in the accuracy of articles submitted to a journal or written for a website that are subject to peer- or editorial review. Journals provide this submission and inclusion information in the “Instructions to Authors” and “About this Journal” sections of journal homepages, or print copies of the journal. Similarly, if there is a content statement or review policy for a webpage it is usually behind a link such as “About us”.
Much of the uncertainty about whether articles are credible and relevant is reduced by first choosing an appropriate and reliable search tool. Reputable databases and homepages clearly explain their editorial policies for including journals or webpages. The Medline fact sheet is one example and is available from the webpages of the National Library of Medicine\(^{(34)}\).

Citations retrieved from the database search need to be relevant and accurate. Articles may be relevant in terms of subject coverage but rendered irrelevant because of their geographical or population coverage. A piece of research may be relevant in terms of subject, place and population but be useless because of its time coverage or because the findings are now out-dated.

Journal articles clearly display a publication date while webpages rarely do. If no publication date is available, there may be an indication of when the webpage was last updated. The page footer often contains this information. However, the update may have been editorial (eg correcting spelling mistakes) rather than a major update to the content. Alternatively, it may refer to the date when a page somewhere on the website was updated rather than when the webpage being viewed was changed. If there is no date on the webpage, contextual clues may provide the best indication of whether the content is current or obsolete. If in doubt, find other sources that either support, counter or update the claims being made. Even when an article has a recent publication date, there may have been a delay between when an article was accepted for publication and when it was actually published. Many journals indicate these dates separately and the publication date for the references will provide further indication of the currency of the information in the article.

Another aspect to consider when evaluating the trustworthiness of information is that of bias. Information is rarely neutral and, in this general context, bias means to the way information is interpreted or distorted for a particular purpose. Bias is evaluated using multiple clues. Your professional knowledge of the topic will alert you in some
cases. Critical appraisal of the list of references included with a journal article or a link to “related information” or “more on this topic” from a webpage, will show the depth of the author’s investigation into supportive or alternate viewpoints. Comparison of the author’s findings with those of other authors will indicate whether the author’s personal views or their affiliation with a research or commercial body has influenced the slant of their writing. Another indicator of bias and an area of significant difference between journals and webpages is that journals require acknowledgement of sponsorship, grants or other assistance received by the author. Webpages rarely contain such a statement although they may contain a disclaimer about how the information should be used. The concept of research bias has a specific meaning and is discussed elsewhere. (8, 35)

Accuracy of spelling and grammar and a consistent writing style indicate care in preparation of the document and/or thorough editorial review. The content of a research article is judged by evaluating the methodology and the findings. The reader uses their knowledge and experience to evaluate the reliability of the methodology used and compares the article with other articles on the topic to ascertain the accuracy of the findings. If the research is not corroborated in other studies, does the author make a coherent argument supporting their conclusions, or are they ignored?

CONCLUSION
The quality of content available via the Internet is variable and requires evaluation. However, the ease of access and time-saving involved means many of us find it an extremely simple way to meet our information needs. Many resources are now available via the Internet and the quality of content and depth of coverage continues to improve. With this in mind and the desire to provide the best service to patients, the resources mentioned will provide a basis for the practice of evidence-based optometry.
(iv) Acknowledgements

No financial or material assistance received.
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