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Writing a literature review

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Abstract:
Formal literature reviews are a critical appraisal of a subject and are not only an academic requirement but essential when planning a research project and for placing research findings into context. Understanding the landscape in which you are working will enable you to make a valuable contribution to your field. Writing a literature review requires a range of skills to gather, sort, evaluate and summarise peer-reviewed published data into a relevant and informative unbiased narrative. Digital access to research papers, academic texts, review articles, reference databases and public data sets are all sources of information that are available to enrich your review.

Introduction:

A formal literature review is an evidence-based in depth analysis of a subject. There are many reasons for writing one and these will influence the length and style of your review but in essence a literature review is a critical appraisal of the current collective knowledge on a subject. Rather than just being an exhaustive list of all that has been published, a literature review should be an informative, personal but unbiased synopsis of the information, providing a balanced view that includes conflicting findings and inconsistencies, as well as established and current thinking. A literature review differs from a systematic review, which addresses a specific clinical question by combining the results of multiple clinical trials (an article on this topic will follow as part of this series of publications). A formal literature review is also an extension of the information gathering you might do to get a personal insight to the background of a topic and requires more than a quick scan of the literature and a few summary bullet points.

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Conducting a literature review is essential for developing a research idea, to consolidate what is already known about a subject and to enable you to identify any knowledge gaps and how your research could contribute to further understanding. This will help you develop hypotheses and to frame your research question (see Anastasiadis *et al.,* 2015[1] for further reading). Once you've carried out a piece of research, a literature review is also crucial for evaluating your data and determining their relevance and clinical utility. Research data without context can be meaningless. A literature review will enable you to identify other research that supports or corroborates your findings as well as results that differ, enabling you to position your research in the field. The dissemination of your research findings, whether by publication in a peer-reviewed paper or by oral presentation, will use the information gathered for a literature review. Thus providing reference points for your new data and helping to identify and deliver the potential impact of your research.

This is also important for obtaining funding to support research. Not only do grant funders require background information on your research to illustrate its' scientific relevance but identifying beneficiaries and the potential impact of your results in addressing an area of unmet need are often key areas in grant applications.

You may be required to write a literature review as coursework and this is certainly the case if you undertake a post-graduate research degree (e.g. MSc, MD or PhD). Not only will you write a literature review during the initial phase or first year of study, but it will form a major part of your dissertation or thesis. As well as being the introduction to your own work, demonstrating your knowledge and understanding of your field, it will also be used in the discussion of your results. Thereby putting your research findings into context with published data.

Your motivation for conducting a literature review might be personal interest in a subject of relevance to your clinical specialty. In this case you are likely to know the background to your field and be more interested in recent findings and new advances that could impact on patient treatment and care. A less formal approach may be adopted for scanning the literature in such a case or when collation of information is required for a colloquial setting such as a journal club or consolidating basic background information.

Finally, you may have been commissioned to write a literature review by a journal editor or choose to submit your own formal literature review for publication.

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How to conduct a literature review

Conducting a literature review requires you to gather information on a subject or evidence to support a hypothesis in order to contextualise research data. These days knowledge is at our fingertips and we can readily access online information via sophisticated search engines, such as Google[2], without even having to enter a library.

The first step is to identify broad keywords relevant to your subject. These require careful consideration, as they are responsible for directing your literature search and affect the material you will acquire to read. They have the additional function of being used by search engines to construct and index their archived references, enabling you to access a vast catalogue of information online. Later on these keywords can be expanded to refine the search into specific subheadings and enable you to structure your review. A convenient way to start your literature search can be to use published review articles or academic text books to learn the background to a subject. This might help you to compile your list of keywords, identify areas that you want to explore further and to see which articles other people have read. However it is important to remember that reviews are written from someone else's viewpoint and should not be the foundation of your literature review.

It is essential to read published peer-reviewed original research articles to formulate your literature review. Try to strike a balance between old established papers with current ones, which refute as well as support a particular idea or research finding. Generate a reading list by searching online citation databases such as PubMed®[3], which incorporates MEDLINE®[4] or Europe PubMed Central[5] (PMC). The text-mining capabilities of these sites allow you to identify peer-reviewed original research articles, review papers, book chapters, and in the case of Europe PMC patents and NHS guidelines, that encompass your keywords. As well as generating a list of articles, both PubMed® and Europe PMC provide free access to the associated abstracts. This is really useful as one can quickly determine whether the paper is of interest or relevant to your literature review. However it is essential to read the entire article so that you can assess the evidence and summarise the findings in your own words. Many articles are now published with open access and so can be obtained directly from a journal's website for free. In addition Europe PMC has over 3.5 million full text articles available directly. Use your medical school or university library's subscription to journals to obtain older articles that are not available digitally or those that are not published under open access. In some cases these libraries may also be able to obtain papers from other libraries, such as the British Library.

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Another source of information is searchable online reference databases like MalaCards[6], the human disease database that integrates a wealth of clinical information with data on clinical trials, molecular bases of disease and experimental resources from other reference databases and published research. Online pathway tools, such as Reactome[7], can also be used to access collective knowledge of molecular interactions with disease. Mining large public data sets, both clinical and molecular, has in recent years become far more achievable and can provide information to strengthen your review. Querying such large community resources in a relevant manner for your review is often possible using online tools, for example, c-BioPortal[8] to interrogate The Cancer Genome Atlas[9].

Reducing bias in a literature review

It is important to be mindful of introducing bias, as preconceived ideas about your subject area, whether intentional or not, can affect all stages of writing a literature review, from identifying literature sources, selecting articles to include and your evaluation of the evidence. Using a protocol can be a useful approach to reduce bias. Begin by determining the objectives and scope of your review as this will help to set boundaries and focus your keyword selection. This will also aid the structuring of your review into sections that address specific areas or research questions. Next identify multiple sources for your reference material to obtain a more comprehensive collection of information. Selection of articles to include is where bias in literature reviews is often most apparent. Avoid “cherry picking” articles that only support your hypothesis, agree with your opinion on a subject or corroborate your research findings. Including inclusion or exclusion criteria in your protocol may circumvent this and result in a more consistent and unbiased approach to material selection. Evaluation of the quality of studies and assessment of factors, such as study design, data collection, data analysis and interpretation and the conclusions drawn by article authors, are also essential. Finally bias can be introduced by your own interpretation of published research data.

How to write a literature review:

When writing a literature review it is important to start with a brief introduction, followed by the text broken up into subsections and conclude with a summary to bring everything together. A summary table including title, author, publication date and key findings is a useful figure to present in your review (see Table 1 for an example). This will make your article informative and manageable to read. You should group similar findings and comment on differences in results or study outcomes. This may be due to differences in subjects, experimental materials, methodology or how the data were

analysed. Remember to consider negative findings by consulting sources such as the Journal of Negative Results in Biomedicine[10].

A literature review is not just about reporting published facts it requires careful consideration of the published literature, to construct an unbiased narrative supported by published evidence. Whilst summarising published findings it is important for you to add perspective by commenting on the quality of the evidence presented. Whilst not as formal as a systematic review, interpretation of the data and assessment of the data quality are essential to give your literature review gravitas and to reduce bias. For clinical research this can be the evidence level, using guidelines such as those developed by the Centre for Evidence Based Medicine (CEBM)[11]. The CEBM Level enables individuals to assess the strength of evidence relating to clinical questions by following a series of steps. For laboratory-based research consideration of experimental protocols, data collection, data processing and statistical analysis can give an indication of data quality, reliability and reproducibility.

Be careful not to plagiarise other authors' text by acknowledging work that is not your own, ensuring your opinions can be clearly recognised by the reader[12]. Writing notes as you read the reference articles, keeping track of these references, citing correctly and writing your review from these notes can help with this. Understanding your target audience is useful for pitching the depth and content of your literature review. Ultimately your literature review should be a critical appraisal of a subject, with your perspective on the merit of the literature you have read.

Take home messages:

A literature review should set the scene, demonstrate current knowledge, gaps in the field and if relevant demonstrate where your research fits.

It should be a personal critical appraisal of the current knowledge in a subject area.

It should be evidence-based, using a variety of peer-reviewed original research articles, reporting facts, commenting on similarities or discrepancies and highlighting knowledge gaps or areas of unmet need.

Structure your review with an introduction, subsections and a summary table.

Summarise information in your own words and give appropriate credit to other authors' work.

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A systematic approach to writing a literature review should be used to reduce bias.

References:

1. Anastasiadis E., Rajan P. and Winchester CL. Framing a research question: The first and most vital step in planning research. *J. Clin. Urol.* 2015; 8(6): 409–411.
2. Google. https://www.google.co.uk. Accessed (9th May 2016)
3. PubMed®. http://www.ncbi.nlm.nih.gov/pubmed. Accessed (9th May 2016)
4. Medline®. https://www.nlm.nih.gov/pubs/factsheets/medline.html. Accessed (9th May 2016)
5. Europe PubMed Central. https://europepmc.org. Accessed (9th May 2016)
6. MalaCards. http://www.malacards.org. Accessed (9th May 2016)
7. Reactome. http://www.reactome.org. Accessed (9th May 2016)
8. c-BioPortal. http://www.cbioportal.org. Accessed (9th May 2016)
9. The Cancer Genome Atlas. http://cancergenome.nih.gov. Accessed (9th May 2016)
10. Journal of Negative Results in Biomedicine. http://jnrbm.biomedcentral.com. Accessed (9th May 2016)
11. Oxford Centre for Evidence Based Medicine. http://www.cebm.net/ocebm-levels-of-evidence. Accessed (9th May 2016)
12. What is plagiarism? http://www.gla.ac.uk/services/sls/plagiarism/whatisplagiarism/. Accessed (9th May 2016)
13. NICE. https://www.nice.org.uk/guidance/indevelopment/gid-dt20. Accessed (9th May 2016)
14. Cochrane. http://www.cochrane.org. Accessed (9th May 2016)
15. Prostate Cancer UK. http://prostatecanceruk.org. Accessed (9th May 2016)
16. Luo Y, Gou X, Huang P and Mou C. Prostate cancer antigen 3 test for prostate biopsy decision: a systematic review and meta analysis. *Chin. Med. J.* 2014; 127: 1768–74.

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Stages	**Example**
Select review topic/title	Biomarkers for prostate cancer
Identify keywords and search terms	biomarkers for prostate cancer, prostate cancer screening and disease monitoring, prostate specific antigen (PSA), prostate cancer antigen 3 (PCA3), prostate health index (PHI), genetic markers for prostate cancer (*TMPRSS2-ERG*), new protein biomarkers for prostate cancer (KLK2), tissue (urine/blood)
Identify information sources	Online **search engines**: Google[2] Online **citation databases**: Europe PubMed Central[5] Online **reference databases**: MalaCards[6] **Clinical** resources: NICE[13], Cochrane[14] **Charity** websites: Prostate Cancer UK[15]
Generate reading list and collect articles	• Start with broad search term: 'biomarkers for prostate cancer' • Use online resources: **Google results**: journal articles, pharmaceutical and biotechnology company websites **Europe PMC results**: 23,220 articles, 7253 reviews, 180 patents, 97 documents **MalaCards results**: MCID: PRS040 webpage (68 reference sources) **NICE results**: Diagnostic guidance DG17 **Cochrane results**: 6,593 articles **Prostate Cancer UK results:** 26 articles • Scan article titles and abstracts to generate an unbiased reading list • Collect articles to read; open access, journal subscriptions,

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	inter-library loans, freely available
Make notes in your own words	• Group and collate information relating to keywords and search terms: e.g. utility of biomarkers, established biomarkers, new biomarkers, biological samples, development of new biomarkers • Evaluate data in peer reviewed research articles • Compare and contrast similarities and differences • Keep track of information sources
Write literature review	• Summarise findings e.g. PCA3 in early detection of prostate cancer: Sensitivity range 46-82% and Specificity range 52-92%[16] • Expand into full review using keywords and search terms to structure the text into sections. • Generate a citation list

Table 1: Key stages of writing a literature review

Declarations:
Conflicting interests: The Authors declare that there are no conflicts of interest.

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Trial registration: Not applicable.

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Guarantor: CW

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