

Supplementary materials: Information manual for students and supervisors

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Literature review

A literature review is **not** writing an essay on the topic. It is meant to be a critical review of the information available concerning the topic in light of research methodology and scientific principles. It is not simply quoting the findings of previous studies or authors opinions but weighing up the evidence that a study was well designed and controlled before accepting the results. A literature review should be unbiased - that is arguments both for and against your research question or principles should be given equal merit. It is misleading to knowingly omit studies that directly refute your preferred belief. Explanations of shortcomings of studies or alternative interpretations of results is evidence that the writer has considered the appropriateness of studies. Therefore, in a literature review the author aims to review the current information available, to make judgments about the relative merits of previous work and then present considered statements.

Why review the literature?

According to Polit and Hungler (1993 p 67) reasons which literature should be reviewed prior to commencing a research project include:

1. clarification or formulation of the research question
2. acquaints the researcher with what has been done, thereby minimizing the possibility of unintentional duplication and increasing the probability that a new study will make a distinctive contribution to knowledge
3. acquaints the researcher with relevant theory and points out research strategies, specific procedures and instruments that might be productive in pursuing the problem
4. highlights shortcomings in previous work so that these can be avoided, corrected in the current study
5. acquaints the researcher with possible mechanisms which explain findings and points out possible associated areas which may require consideration

Remember that just because something is in print does not mean that you have to automatically accept it. All written material is ultimately somebody's opinion which should be based on scientifically justifiable principles, argument or studies. The interpretation of studies, as you should be aware, is very dependent on the readers' understanding of research methods and a critical, inquiring mind.

Where do I find information on this subject?

The whole point of acquiring information on a topic is to provide a basis for thinking and reasoning. While you may be initially acquiring information to write your own review, keep in mind that your review will be read by others who may wish to verify a point or concept and will therefore need to be able to establish where you got the information from and whether their own interpretation is in accordance with your interpretation or reporting of the material. Accurate and specific referencing of material is essential for both the writer (beware plagiarism and misquoting) and reader (verification of original material). Information is generally available from five main sources:

1. **Text books** - Recent text books are good places to find established theories and explanations for principles as most texts aim to provide "standards" or "conventional" beliefs, expectations and knowledge. The short-comings of textbooks include the fact that the information contained within them is generally "out of date" within a year or so of publication.
2. **Refereed journal articles.** A refereed journal is one which requires all articles to be scrutinized by a panel of "experts" in the topic area prior to publication. This process is meant to reduce the chance that papers that are poorly written, designed or analyzed are published within the journal. It does not mean that articles which appear in refereed journals are faultless. Examples of refereed journals are those which appear in Index Medicus or The Australian Journal of Physiotherapy, Spine, Paediatric Research, British Medical Journal, Lancet, Chest. Refereed journals are generally viewed as providing more valid and reliable studies than unrefereed journals. An unrefereed journal is one which publishes articles without scientific review (Newsletters, Special groups papers). A quick way to check whether a journal is refereed or not is to look for the information for authors section in each journal. This

will inform you as to the requirements for authors in order to submit papers to a journal and specifically state whether papers are sent to reviewers or not.

3. **Conferences and Scientific meeting proceedings.** These generally provide the most recent and up-to-date studies. Abstracts are generally provided in the form of the Conference Proceedings. These abstracts or reports generally provide material prior to publication in a refereed journal. Unfortunately, many conference proceeding books are not available unless you attend the conference, though in some cases, the proceedings themselves are published as a supplement to specific journals or may be available in libraries. Abstracts provide very limited information concerning specific research methodologies and results.
4. **Lectures and special presentations** - unless you have a written copy of the speakers presentation , these avenues should be used as starting points for further acquisition of material rather than the source *per se*, as the true record and documentation of what has been said / implied is not available to other investigators.
5. **Internet access** - this is rapidly becoming the quickest way to communicate with investigators and other researchers interested in the same. You may be able to contact the researcher direct (referenced as personal communication) or contact any number of groups interested in your topic and ask specific questions about information available.

Care should be taken to use only information which can be accessed by the reader regardless of geography or time of reading.

How to start?

When you are preparing to write a literature review particularly in an area where you have limited knowledge there are a number of possible ways to start.

- Locate a recent article on the topic - someone working in the area of interest should be able to provide you with at least one article on a topic regardless of how specialized or obscure the topic is that you are interested in. Check the references from this article and select the ones which seem to provide further information or clarification. A review article is generally a great way to see the topic in context of historical development, related areas and possible mechanisms of action.
- CD-ROM Medline search - now is the time to learn how to use the CD-ROM Medline search facilities. These are invaluable methods of acquiring information on all topics and related areas.
- Current contents is another computer data-base system which provides information on all articles published in major journals over the past four years. It has a number of options such as seeking by topic name, topic name and related topics, authors, and journal titles. You can select to search only journal volumes published this year or review over the past four years.
- Previous theses - the David Murray has a copy of every Honours, Masters and Ph.D thesis completed over the past decade within the School of Physiotherapy and possibly the Faculty of Health and Biomedical Science. Reviewing the reference lists of theses related to your topic should provide you with numerous opportunities for material. Remember that these theses will contain only references for the years preceding their submission.

Once you have some information on your topic, sit down and write a list of key topics and possible related topics which might provide you with further information. A broad view of material which might provide insight into your area is invaluable in the early stages of a literature review. If you stick to a very narrow view of possibilities you may well miss information which is directly applicable or which may help explain alternative viewpoints. You may need to consider physiology, pathophysiology, clinical studies, measurement techniques and equipment.

For example:

If your project was concerned with the use of ankle airsplints for reducing injuries in haemophiliacs, the main topics you might search for would be;

Haemophilic pathology and physiology

Joint damage and repair in haemophiliacs - specifically the ankle

Air splints -principles and mechanisms for reducing injuries

But you might also find very useful information pertinent to this topic if you searched for information on;

Prosthetics for the ankle

Compression mechanics - effect on lymphatics and inflammation

Pharmacology of inflammation

Neurophysiology of joint damage especially altered joints due to recurrent injury or chronic inflammation

How to organize information as you are collecting

One of the more practical difficulties with writing a literature occurs when you have started to collect a number of articles / books. You need to organize a system where by you know what you have and where it fits in. One of the very common sights for most people when they start writing their first literature review, is a room full of photocopied articles and books that looks very impressive but is very intimidating. **Where do I start? I don't know if I've already got this article, I'll copy it just in case. When am I going to read all this stuff? I've read all these articles but I can't remember what they said?**

There is not definitive way to collect and collate all the material that you have collected but here are few useful tips:

- Keep a small address book in your bag. Every time you go to the library to track down an article make a note of the Journal name and call number. Add any new journal names and call numbers to you book as you go - it will save you time in searching for journals. Some people also keep an address book with journal articles in it. Each time they photocopy an article they write the authors, journal abbreviation and year on the page of the first authors name. This keeps a running check on which material they already have not only when they are in the library but when they are reading articles at home - it provides a quick reference system rather than pulling out all their photocopies and checking whether they have that article.
- Summary cards. Some people find that keeping a brief summary card-index system helps them keep track of the articles and other information. These summary cards usually have the authors, title, reference and year on the top and then a brief summary of the subjects, methods, measures and outcomes. Any additional points like very detailed discussion section with particular pathology well explained may be added. This is a good way to summarize information but does require the investigator to be diligent in keeping the system up-to date with new articles as they are acquired.
- Manila folders. Most people keep a series of manila folders with specific topics in each. This is a useful way of combining different aspects of the same review. For example, you might have a folder for pathology / physiology articles, studies that refute your topic, studies that support your topic, measurement articles etc. Again, you need to keep a list of which articles are included within each folder for easy reference and checking whether you have them.
- Summary tables. These tables can be formatted and planned in advance and with each successful article read, the information is added to the table (See Table 1). It provides a clear overview of similarities and differences between studies and helps to build up a picture of the information available for each topic. you could have a number of these tables for each area of your literature review (clinical studies, methodologies, measurements) or you may incorporate all of these in one table.

Author / ref	subjects	design	method / measures	main outcome
Smith et al (1996) Arch. Phys.Med. Rehab 68(2):23-56	OA n= 12 (56=90 year male)	Repeated measures, double blind,no control group	MRI Exercise prog (12 weeks) Depression scales ADL scale	MRI No Sig Diff (NSD) Depression scales Sig Improve ADL scale No Sig diff
Jones (1995) Physio 12(3) 45-46	OA n=30 (24-45 year males)	Group cross-over	Six week Ex progr (hydro) vs six week aerobic progr ADL scales and cybex	ADL scales for both NSD Cybex (SD ↑ for hydro, NSD for aerobics))

Table 1: Example of summary of articles concerned with exercise and osteoarthritis.

- Wall charts. These are very simple, easy charts which help keep track of the information. These generally consist of foolscap pages stuck up on the wall and connected by arrows. These can be extremely useful when you start to write your review as well (not terribly stimulating decor though!).

How to plan the literature review

Again, there is no definitive way to write a literature review. Reviews vary depending on their aim, topic and content. A review of the historical development of spinal manipulative therapy should be quite different to a review of the clinical efficacy of spinal manipulative therapy though some of the information contained within both of these may overlap. In the case of the literature that you will be writing for your thesis, the aim is to prepare and provide the reader with sufficient background to understand and justify your project and methodology.

Before you start writing you need to formulate a plan.

What does the reader need to know before getting to my methodology section?

What are the key parts of my research question (What is measured, How is it measured and who is it measured on?)

Does the reader need a clear anatomical explanation to understand the research question?

How much or how little anatomy / physiology does the reader need?

What are the really important anatomical/physiological principles?
 What measurement principles should I cover? Do I need to justify my choice of measurement tool and should I compare it to other measurement tools used in clinical studies?
 How important are the clinical studies undertaken previously? Since mine is an extension of these should I cover these and there shortcomings early in the review or leave it till the last part?
 What order should I present things in? Anatomy, physiology, clinical studies then measurement or should I present the clinical studies and there shortcomings first and then lead into different ways of measuring and tie this bit into the speculated mechanisms of action?

Possibilities for writing reviews

Historical approach

Sometimes, it is very useful to create a time-line for the studies which have been completed prior to yours. This may help put all the clinical studies in context and demonstrate why the literature is confusing. If possible, always access the original source paper. This is generally the paper that most of the studies refer to, then add the next published paper and so on. This may point of changes of direction, innovations in equipment or differences of opinion between authors.

For example:

	1900 - Original paper Anecdotal single case report	
1905 - Anecdotal report of treatment principle based on initial report		1920- Repeated measures design supports original report (small subject numbers, questionable measurement validity and reliability)
	1970 - New equipment for measurement	
1978 - Using new equipment / methodology; small descriptive study supports original work		1981 - Using new equipment; well designed placebo-controlled study refutes original work

See attached page for a further example of a historical flow-chart

Studies that support versus studies that refute

Combining information into groups of studies that support the basic principle and studies that refute this principles can be a way of presenting the background information and context. This can be achieved by either discussing the supporting articles followed by the refuting articles or by creating one or more tables to summarize the studies. Table 2 is an example of how clinical studies may be summarized (note that this table is too detailed and complex for an oral presentation).

The information contained within Table two is from a literature review concerning the relative merits of assisted and independent physiotherapy management of chronic productive respiratory disease. The review was structured as follows:

- Incidence and epidemiology of productive lung disease.
- Pathophysiology / mechanics of chronic respiratory disease
- Role of physiotherapy on chronic lung disease including the controversy concerning whether patients should perform their own treatments or whether patients should be assisted by a physiotherapists.
- Clinical studies concerning this controversy (Table 2)
- Studies that support independent management
- Studies that support physiotherapy-assisted management
- Shortcomings of these studies (diversity of pathologies studied, small sample sizes, problems with Type 2 errors, study design, effects of carry-over , discrepancies in physiotherapy management, problems with outcome measures.
- Summary of information and conclusions.

Study	Subjects	Technique comparison	Design	Statistical analysis	Outcomes
Sutton et al (1983)	n = 10 5 bronchiectatic 4 Cystic fibrosis 1 Asthma	• Control • Cough upright • FET upright	Randomized block (2 - 5 days)	Non-parametric Freidman two-way ANOVA (carry-over not)	PFT no difference day to day Sputum volume FET+PD > FET alone

		• FET + PD		mentioned	Radioisotope clearance FET and FET+PD > control
Bateman et al (1981)	n = 6 3 chronic bronchitis 3 Bronchiectasis	• control • CPT = PD + vibes + perc + shaking + cough • cough	Randomised block (1-2 days)	Non-parametric (carry-over not mentioned)	Cough + CPT increased central Isotope clearance CPT increased peripheral isotope clearance
Bateman et al (1979)	n = 10 6 chronic bronchitis 4 Bronchiectasis	• CPT = PD + vibes + perc + shaking + cough • control	Cross-over (1-2 days)	Wilcoxon paired (carry-over not mentioned)	CPT increased central, intermediate and peripheral lung > control Sputum : CPT > control
Webber et al (1985)	n = 16 Cystic fibrosis (studied at end of admission for exacerbation)	• PD, TEX, self-perc, FET. • PD, TEX, FET.	Randomised block (2 days each)	Wilcoxon ranked sums (No carry-over mentioned- but PFTs improved each day)	Sputum volume no difference between treatments FEV1 + FVC improved each day but no difference between treatments
Sutton et al (1985)	n = 8 5 Bronchiectasis 2 chronic bronchitis 1 Cystic fibrosis	• Control + PD • Vibes/shaking + PD • Perc+ DB+PD • Perc + TB+PD	Randomized block (1-4 days)	Freidman 2-way ANOVA Wilcoxon test for paired differences (carry-over not mentioned)	No difference between treatments for isotopic clearance Sputum volume increased with Vibes/shaking+PD and perc+DB
Murphy et al (1983)	n = 2 Cystic fibrosis exacerbation	• Mech perc • PD + manual perc • PD + FET	Random order across 2 days (two treatments per day)	? unknown	Increased sputum expectorated with PD + FET No difference between treatments for PFTs
Gallon (1991)	n = 10 Bronchiectasis stable	• PD, DBE, FET and fast manual perc • PD, TDE, FET, manual slow perc • PD, TEX, FET.	Randomized order across 3 weeks	ANOVA Duncan's Multiple Range Test (No carry-over mentioned)	No difference PFTs Increased rate of sputum production for fast perc and slow perc.
Pryor et al (1979)	n = 16 Cystic fibrosis (Studied at the end of admission for exacerbation)	• PD, TEX, self-perc, and assistant perc, cough • PD, TEX, FET, self-perc, cough	Randomized block (over 4 days)	Wilcoxon matched pairs, sign rank test (Carry-over not mentioned, though day effect noted for sputum)	Independent treatment time shorter, increased sputum weight, increased rate of production. No day effect Greater increase in FEV1 with Independent Rx
McDonnell et al (1986)	n = 9 CF exacerbated	• PD, perc, DBE, cough on room air • PD, perc, DBE cough on supplemental Oxygen	Cross-over (2 days)	ANOVA (Student Neuman Keuls method) Paired t-test (Carry-over not mentioned)	Significant decrease in SaO2 both treatments
Pryor and Webber (1979)	n = 24 CF (Studied at the end of an admission for exacerbation)	• PD, TEX, cough, self perc (A) • PD, FET, TEX, self perc, cough (B) • PD, FET, cough assisted perc, self perc (C)	Randomised block A+B B+C (over 4 days)	Wilcoxon matched pairs signed rank test (Carry-over not mentioned)	Treatment time decreased sputum weight increased and rate of sputum production increased with FET

CPT	Chest physiotherapy	PD	Postural drainage
PFTs	Pulmonary function tests	DBE	Deep breathing exercises
Mech	Mechanical	Vibes	Vibrations
FET	Forced expiratory technique	Perc	Percussion
TEX	Thoracic expansion exercises		

Table 2 : Summary of previous studies comparing independent and assisted physiotherapy management

Tips on writing the review

- Avoid double or even triple citations (Brown et al 1956 cited by Williams et al 1996), unless the original source material is in Russian or has been out of print for years. Citations of readily available material only indicate that you could not be bothered tracking down the information and that you are willing to take the authors word for the interpretation. Likewise, when the literature review is peppered with double-citations it creates a very unfavorable impression of the writers critical abilities.

- Use tables and diagrams to summarize information - it is very difficult to read and follow paragraph after paragraph of Williams et al (1996) found..... but Brown et al (1996) found.....If this information is summarized in a table, then use to table to clarify the methodology and findings and the text to comment on the design and shortcomings of the study.
- One thought to a paragraph.
- Avoid one sentence paragraphs as they disrupt the flow of reading. either the information should be expanded upon, inserted into another paragraph or deleted.
- Try to start paragraph with the topic. It should be immediately apparent to the reader what substance is to be presented in each paragraph rather than wading through two to five lines of text. For example, if the topic of the paragraph is the mutability of muscle fibres with training the paragraph should present this early - “Mutability of skeletal muscle fibres has been demonstrated to occur with training” rather than “Williams et al 1990, and Jones 1945 both determined that six weeks of exhaustive training in pre-adolescent males resulted in mutability of muscle fibres”. The emphasis in the first example is on the topic (muscle mutability) whereas the emphasis in the second example is on the authors and their respective studies.
- Avoid excessive reliance on standard textbooks. As mentioned earlier, these are good sources of standard or conventional information but are not viewed as strong sources for current or new information.
- Avoid excessive inclusion of anatomy / physiology unless this is the main point of your study. Include only what is required to understand your project regardless of how interesting you have personally found it.
- Flow-diagrams are useful ways of summarizing concepts and related information.
- The review should be able to be read by intelligent people not only by specialists in your topic areas. Jargon and abbreviations should be clearly explained. It is up to the writer to make sense for the reader not the reader to decipher what the writer means.
- Avoid repetition of information. Careful planning prior to writing should make it clear what information will be included and in what order. The order may vary as you write successive drafts. The literature review should move forward with each section, so you may need to decide on which principles information does the reader need to know to begin with and then where do they move on to.

USEFUL REFERENCES FOR CRITIQUING ARTICLES AND REVIEWING LITERATURE

Altman DG. Practical statistics for Medical Research. Chapman & Hall, London 1991 pg:477-499

Hart DL, Poston WR and Perry JF (1980): Critically reading a research article. *Journal of Orthopaedic and Sports Physical Therapy* 2: 72-76.

Jenkins S. (1995) How to write a paper for a scientific journal. *Australian Journal of Physiotherapy* 41:285 - 290

Lister MJ (1989): Writing manuscripts for a scientific journal. *Physiotherapy Practice* 5: 147-155.

Shilling LM (1984): Ten myths about professional writing. *Physical Therapy* 64: 1417-1423.

Shilling LM (1985): Twenty tips for conquering writing anxiety. *Physical Therapy* 65: 1113-1115.

American Journal of Physical Medicine and Rehabilitation (1991)- Article series on research methodology - Topics include;

- The conceptual review of the literature or how to read more articles than you ever want to see in your entire life. Findley TW S17 - 22
- A framework for writing and / or evaluating research papers. Braddom CL. S169 - 171

Cole B, Finch E, Gowland C, Mayo N. (1990) Physical Rehabilitation Outcome Measures. Canadian Physiotherapy Association.

(This book is available in the David Murray Library. It is extremely useful as it is a review of the commonest measurement tools and their validity / reliability).

References:

Polit D, Hungler B. Essentials of Nursing Research Methods, Appraisal and Utilization.(3rd Edition) 1993
J.B.Lippincott Company, Philadelphia

1920	1960	1970	1980
Postural drainage	Conventional multimodality CPT (PD, percussion, vibration, breathing exercises, cough)	Pre and post CPT studies Detrimental effects of CPT Investigations into components of conventional CPT Assisted versus Independent treatment techniques <ul style="list-style-type: none"> • Forced expiration technique (FET) • Exercise • Autogenic drainage (AD) • Exercise 	Immediate versus long term effects of CPT <ul style="list-style-type: none"> • Active cycle of breathing technique (ACBT) • Positive expiratory pressure mask (PEP)

Figure 1: Overview of the development of physiotherapy techniques used in the treatment of cystic fibrosis