How to Write a MD Thesis

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This guide to thesis writing gives some simple and practical advice on the problems of getting started, getting organized, and dividing the huge task into less formidable pieces and working on those pieces. It starts after you have finished your work i.e. you have all the data, results and supportive reference papers with you. You should have all the documents that answers the following questions,.

Questions you must have asked when you have chosen the topic for your study:

The first step was to create a sense of interest in a subject, which you had thought could be the topic for your thesis. Your guide might have already told you in the beginning: *Remember you have to present your topic to faculty members in the departmental meetings. You will be asked many questions and the way you handle them will earn you good internal assessment marks.* You should have answered the following questions when you begun to work for your thesis:

- What is the problem?
- What is the relevance of this problem?
- What information is already available?
- What do you hope to achieve by your study?
- What additional data are needed to meet the objectives?
- How these data are collected?
- Is it ethical to conduct the study in the way you want to do?
- How these collected data are going to be analyzed?
- What is the expected outcome and how much it is useful?

During the process of topic identification for your thesis it was essential that you should have read few articles from good international journal. Whenever you read an article your must have answered following questions:

- What are the principal findings
- Strength and weakness of the study.
- How does the article compare in relation to other studies, discussing particularly any differences in results.
- Meaning of the study: possible mechanism and implications for clinicians or policy makers.
- Unanswered questions and future research.

You should have written these answers in paper and attached it to every article you read and started filing according to the alphabetical list. This was the first step towards writing a thesis. If you have already done it, be confident you can write your thesis now.

This article explains the practicalities of surviving the ordeal. It includes a suggested structure and a guide to what should go in each section. The feedback from users is always accepted to improve this note. Please submit your feedback to the Department of Child Health.

Getting Started

When you are about to begin, writing a thesis seems a long, difficult task. That is because it is a long, difficult task. Fortunately, it will seem less daunting once you have a couple of chapters done. Towards the end, you will even find yourself enjoying it - an enjoyment based on satisfaction in the achievement, pleasure in the improvement in your scientific writing, and of course the approaching end. Like many tasks, thesis writing usually seems worst before you begin, so let us look at how you should make a start.

An outline

First make up a thesis outline: several pages containing chapter headings, sub-headings, some figure titles (to indicate which results go where) and perhaps some other note and comments. There is a section on chapter order and thesis structure at the end of this text. Once you have a list of chapters and, under each chapter heading, a reasonably complete list of things to be reported or explained you have struck a great blow against writer's block. When you sit down to type, your aim is no longer a thesis - a daunting goal - but something simpler. Your new aim is just to write a paragraph or section about one of your subheadings. It helps to start with an easy one: this gets you into the habit of writing and gives you self-confidence. Often the Materials and Methods chapter is the easiest to write - just write down what you did; carefully, formally and in a logical order.

How do you make an outline of a chapter? For most of them, you might try the method that I use for writing papers, and which I learned: assemble all the figures that you will use in it and put them in the order that you would use if you were going to explain to someone what they all meant. You might as well rehearse explaining it to someone else - after all you will probably give several talks based on your thesis work. Once you have found the most logical order, note down the key words of your explanation. These key words provide a skeleton for much of your chapter outline.

Once you have an outline, discuss it with your adviser. This step is important: s/he will have useful suggestions, but it also serves notice that s/he can expect a steady flow of chapter drafts that will make high priority demands on his/her time. Once you and your adviser have agreed on a logical structure, s/he will need a copy of this outline for reference when reading the chapters which you will probably present out of order. If you have a co-adviser, discuss the outline with him/her as well, and present all chapters to both advisers for comments.

Organization

It is encouraging and helpful to start a filing system as you will be extremely busy on the topic presentation, seminars, case presentations and performing ward duties and can not sit for hours writing what you have thought. Open a word-processor file for each chapter *and one for the references* in a computer, which is available in the department. Do not forget to keep a floppy with you. You can put notes in these, as well as text. While doing something for Chapter n, you will think "Oh I must refer back to/discuss this in Chapter m" and so you put a note to do so in the Chapter m file. Or you may think of something interesting or relevant for that chapter. When you come to work on that chapter, the more such notes you have accumulated, the easier it will be to write. For further information on computer work contact Mr. Mohan Raj Pradhan at Health Net Nepal, Health Learning Materials Centre.

Make a back-up of these files and do so every day at least (depending on the reliability of your computer and the age of your disk drive). Never keep the back-up disk close to the computer in case the hypothetical thief who fancies your computer is smart enough to think s/he could use some disks as well. You should also have a rotating master back-up: use two disks, back-up one of them every week, and keep them physically separate from your main computer. That way you always have back- ups that are 1 and 2 weeks old, and if a file becomes corrupted you will have an older version of it available.

If you are not competent in typing and with computer you should have a physical filing system: a collection of folders with chapter numbers on them. This will make you feel good about getting started and also help clean up your desk. Your files will contain not just the plots of results and pages of calculations, but all sorts of old notes, references, suppliers' addresses, specifications, speculations, letters from colleagues etc which will suddenly strike you as relevant to one chapter or other. Stick them in that folder. Then put all the folders in a box or a filing cabinet. As you write bits and pieces of text, stick the hard copy, the figures etc in these folders as well. Touch them and feel their thickness from time to time - ah, the thesis is taking shape.

If any of your data exist only on paper, copy them and keep the copy in a different location. Consider making a copy of your lab book. This has another purpose beyond security: usually the lab book stays in the lab, but you may want a copy for your own future use. Further, scientific ethics require you to keep lab books and original data for at least ten years, and a copy is more likely to be found if two copies exist.

A timetable

I strongly recommend sitting down with your guide and making up a timetable for writing it: a list of dates for when you will give the 1st and 2nd drafts of each chapter to your adviser(s), sometimes it is also important to plan for the collections of specimen or patients and do not forget to have a prior appointment for statistical discussion with statisticians at the Department of Community of Medicine. This structures your time and provides intermediate targets. If you merely aim "to have the whole thing done by (some distant date)", you can deceive yourself and procrastinate more easily. If you have told your adviser that you will deliver a first draft of chapter 3 on Wednesday, it focuses your attention.

Beginning to real work

Whenever you sit down to write, it is very important to write *something.* So write something, no matter how rough. It would be nice if clear, precise prose leapt easily from the keyboard, but it usually does not. Most of us find it easier, however, to improve something that is already written than to produce text from nothing. So put down a draft (as rough as you like) for your own purposes, then clean it up for your adviser to read. Word-processors are wonderful in this regard: in the first draft you do not have to start at the beginning, you can leave gaps, you can put in little notes to yourself, and then you can clean it all up later.

Your adviser will expect to read each chapter in draft form. S/he will then return it to you with suggestions and comments. *Do not be upset if a chapter - especially the first one you write - returns covered in red ink.* Your adviser will want your thesis to be as good as possible, because his/her reputation as well as yours is affected. Scientific writing is a difficult art, and it takes a while to learn. As a consequence, there will be many ways in which your first draft can be improved. So take a positive attitude to all the scribbles with which your adviser decorates your text: each comment tells you a way in which you can make your thesis better.

As you write your thesis, your scientific writing is almost certain to improve. The process of writing the thesis is like a course in scientific writing, and in that sense each chapter is like an assignment in which you are taught, but not assessed. Remember, only the final draft is assessed: the more comments your adviser adds to first or second draft, the better.

Before you submit a draft to your adviser, run a spell check so that s/he does not waste time on those. If you have any characteristic grammatical failings, check for them.

What is a thesis? For whom is it written? How should it be written?

Your thesis is a research report. The report concerns a problem or series of problems in an area of medical science and it should describe what was known about it previously, what you did towards solving it, what you think your results mean, and where or how further progress in the field can be made. Do not carry over your ideas from undergraduate assessment: a thesis is not an answer to an assignment question. One important difference is this: the reader of an assignment is usually the one who has set it. S/he already knows the answer (or one of the answers), not to mention the background, the literature, the assumptions and theories and the strengths and weaknesses of them. The readers of a thesis do not know what the "answer" is.

Obviously your external examiners will read the thesis. They will be experts in the general field of your thesis but, on the exact topic of your thesis, you are the world expert. Keep this in mind: you should write to make the topic clear to a reader who has not spent most of the last three years thinking about it.

Your thesis may also be used as a scientific report and consulted by other residents, future workers who will want to know, in detail, what you did. More and more theses are now stored in an entirely digital form (i.e. the figures as well as the text are on a disk). You may give a copy of your floppy to Health Net Nepal for general distribution. A consequence of this is that researchers in Nepal can consult your thesis much more easily. Write with these possibilities in mind.

It is often helpful to have someone other than your adviser(s) read some sections of the thesis, particularly the introduction and conclusion chapters. It may also be appropriate to ask other members of staff to read some sections of the thesis which they may find relevant or of interest, as they may be able to make valuable contributions. In either case, only give them revised versions, so that they do not waste time correcting your grammar, spelling, poor construction or presentation.

Make it clear what is yours

If you use a result, observation or generalization that is not your own, you must usually state where in the scientific literature that result is reported. The only exceptions are cases where every scientist in the field already knows it: tachypnoea in pneumonia, oedema in congestive heat failure. The importance of this practice in science is that it allows the reader to verify your starting position. Now medicine is said to be evidence based medicine: results are built upon results, which in turn are built upon results etc. Good referencing allows us to check the foundations of your additions to the structure of medical science, or at least to trace them back to a level, which we judge to be reliable. Good referencing also tells the reader which parts of the thesis are descriptions of previous knowledge and which parts are your additions to that knowledge. In a thesis, written for the general reader who has little familiarity with the literature of the field, this should be especially clear. It may seem tempting to leave out a reference in the hope that a reader will think that a nice idea or a nice bit of analysis is yours. I advise against this

gamble. The reader will probably think: "What a nice idea - I wonder if it's original?". The reader can probably find out via the library, the net or even just from a phone call.

Style

The text must be clear. Good grammar and thoughtful writing will make the thesis easier to read. Scientific writing has to be a little formal - more formal than this text..

Short, simple phrases and words are often better than long ones. Some politicians use "at this point in time" instead of "now" precisely because it takes longer to convey the same meaning. They do not care about elegance or efficient communication. You should. On the other hand, there will be times when you need a complicated sentence because the idea is complicated. If your primary statement requires several qualifications, each of these may need a subordinate clause: "When [qualification], and where [proviso], and if [condition] then [statement]". Some time lengthy technical words will also be necessary in many theses. "Incidence of acute respiratory infections in the age group of 2 months to 5 years children attending the Kanti Children's Hospital" is longer, but, it has the advantage of being true.

Sometimes it is easier to present information and arguments as a series of numbered points, rather than as one or more long and awkward paragraphs. A list of points is usually easier to write. You should be careful not to use this presentation too much: your thesis must be a connected, convincing argument, not just a list of facts and observations.

Presentation

There is no need for a thesis to be a masterpiece of desk-top publishing. Your time can be more productively spent improving the content than the appearance.

In many cases, a reasonably neat diagram can be drawn by hand faster than with a graphics package. Either is usually satisfactory. The computer-generated figure has the advantage that it can be stored in the text and transmitted electronically, but this advantage disappears if you are not going to store your thesis as a file for transmission.

In general, students spend too much time on diagrams - time that could have been spent on examining the arguments, making the explanations clearer, thinking more about the significance and checking for errors in the algebra. The reason, of course, is that drawing is easier than thinking.

I do not think that there is a strong correlation (either way) between length and quality. There is no need to leave big gaps to make the thesis thicker. Readers will not appreciate large amounts of vague or unnecessary text.

Approaching the end

A deadline is very useful in some ways. You must hand in the thesis, even if you think that you need one more draft of that chapter, or someone else's comments on this section, or some other refinement. If you do not have a deadline, or if you are thinking about postponing it, please take note of this: *A thesis is so large a work that you cannot make it*

perfect in a finite time. There will inevitably be things in it that you could have done better. There will be inevitably be some typos. Indeed, by some law related to Murphy's, you will discover one when you first flip open the bound copy. No matter how much you reflect and how many times you proofread it, there will be some things that could be improved. There is no point hoping that the examiners will not notice: many examiners feel obliged to find some examples of improvements (if not outright errors) just to show how thoroughly they have read it. So set yourself a deadline and stick to it. Make it as good as you can in that time, and then hand it in! (In retrospect, there was an advantage in writing a thesis in the days before word processors, spelling checkers and typing programs. Nearly all students paid a typist to produce the final draft and we could only afford to do that once.)

How many copies?

Talk to your adviser about this. Usually for the Institute of Medicine, three copies have to be submitted to the examination section, you may want to give one copy to your advisor, one copy is kept in the department and you may keep two copies, thus seven copies is ideal at preset situation.

Personal

In the ideal situation, you will be able to spend a large part - perhaps a majority - of your time writing your thesis. This may be bad for your physical and mental health.

Typing

If you do not touch type, you should learn to do so for the sake of your neck as well as for productivity. There are several good software packages that teach touch typing interactively. If you use one for say 30 minutes a day for a couple of weeks, you will be able to touch type. By the time you finish the thesis, you will be able to touch type quickly and accurately and your six hour investment will have paid for itself. Be careful not to use the typing exercises as a displacement activity.

Exercise

Do not give up exercise for the interim. Lack of exercise makes you feel bad, and you do not need anything else making you feel bad while writing a thesis. 30-60 minutes of exercise per day is probably not time lost from your thesis: I find that if I do not get regular exercise, I sleep less soundly and longer. How about walking to work and home again? (Walk part of the way if your home is distant.) Many people opine that a walk helps them think, or clears the head. You may find that an occasional stroll improves your productivity.

Food

Do not forget to eat, and make an effort to eat healthy food. You should not lose fitness or risk illness at this critical time. Exercise is good for keeping your appetite at a healthy level. I know that you have little time for cooking, but keep a supply of fresh fruit, vegetables and bread. It takes less time to make a sandwich than to go to the local fast

food outlet, and you will feel better afterwards.

Drugs

Thesis writers have a long tradition of using coffee as a stimulant or some drugs . Used in moderation, they do not seem to have ill effects on the quality of thesis produced. Excesses, however, are obviously counter-productive: several expression and you will be buzzing too much to sit down and work; several drinks at night will slow you down next day.

Others

Other people will be sympathetic, but do not take them for granted. Spouses, lovers, family and friends should not be undervalued. Spend some time with them and, when you do, have a good time. Do not spend your time together complaining about your thesis: they already resent the thesis because it is keeping you away from them. If you can find another student writing a thesis, then you may find it therapeutic to complain to each other about advisers and difficulties. S/he need not be in the same discipline as you are.

A suggested thesis structure

The list of contents and chapter headings below is appropriate for some theses. In some cases, one or two of them may be irrelevant. Results and Discussion are usually combined in several chapters of a thesis. Think about the plan of chapters and decide what is best to report your work. Then make a list, in point form, of what will go in each chapter. Try to make this rather detailed, so that you end up with a list of points that corresponds to subsections or even to the paragraphs of your thesis. At this stage, think hard about the logic of the presentation: within chapters, it is often possible to present the ideas in different order, and not all arrangements will be equally easy to follow. If you make a plan of each chapter and section before you sit down to write, the result will probably be clearer and easier to read. It will also be easier to write.

Declaration

Department of Child Health of the Institute of Medicine require something like: "I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of MD (Paediatrics) Degree of the Tribhuvan University, Institute of Medicine": (signature/name/date)"

Title page

This may vary among institutions, but as an example: Title/author/"A thesis submitted for the the degree of Doctor of Medicine (Paediatrics) in the Institute of Medicine/Tribhuvan University, Kathmandu, Nepal

Abstract

It is best written towards the end, but not at the very last minute because you will probably need several drafts. It should be a distillation of the thesis: a concise description of the problem(s) addressed, your method of solving it/them, your results and conclusions. An abstract must be self-contained. Usually they do not contain references. When a reference is necessary, its details should be included in the text of the abstract.

Guidelines for producing a good abstracts:

- The abstract should contain the essence of the whole paper and should stand alone.
- It should consist of four basic parts:

  Why the study was done?

  What was done?

  What was found?

  What was concluded?
- Stick to a maximum of 300 words for a structured abstract.
- Be clear and concise and avoid unnecessary detail.

Acknowledgements

Most thesis authors put in a page of thanks to those who have helped them in matters scientific, and also indirectly by providing such essentials as food, education, genes, money, help, advice, friendship etc. *If any of your work is collaborative, you should make it quite clear who did which sections.*

Table of contents

The introduction starts on page 1, the earlier pages should have roman numerals. It helps to have the subheadings of each chapter, as well as the chapter titles. Remember that the thesis may be used as a reference in the lab, so it helps to be able to find things easily.

Introduction

What is the topic and why is it important? State the problem(s) as simply as you can.

Remember that you have been working on this project for a few years, so you will be very close to it. Try to step back mentally and take a broader view of the problem. How does it fit into the broader world of medicine? Especially in the introduction, do not overestimate the reader's familiarity with your topic. You are writing for medical professionals in the general area, but not all of them need be specialists in your particular topic. It may help to imagine such a person - think of some paediatrician whom you might have met at a conference for your subject, but who was working in a different area. S/he is intelligent, has the same general background, but knows little of the literature or tricks that apply to your particular topic. The introduction should be interesting. If you bore the reader here, then you are unlikely to revive his/her interest in the materials and methods section. For the first paragraph or two, tradition permits prose that is less dry than the scientific norm. If want to wax lyrical about your topic, here is the place to do it. Try to make the reader want to read the kilogram of A4 that has arrived uninvited on his/her desk. Go to the library and read several thesis introductions. Did any make you want to read on? Which ones were boring? This section might go through several drafts to make it read well and logically, while keeping it short. For this section, I think that it is a good idea to ask someone who is not a specialist to read it and to comment. Is it an adequate introduction? Is it easy to follow? There is an argument for writing this section - or least making a major revision of it - towards the end of the thesis writing. Your introduction should tell where the thesis is going, and this may become clearer during the writing.

Literature review

Where did the problem come from? What is already known about this problem? What other methods have been tried to solve it? Ideally, you will already have much of the hard work done, if you have been keeping up with the literature as you vowed to do three years ago, and if you have made notes about important papers over the years. If you have summarized those papers, then you have some good starting points for the review. How many papers? How relevant do they have to be before you include them. Well, that is a matter of judgement. On the order of a hundred is reasonable, but it will depend on the field. You are the world expert on the (narrow) topic of your thesis: you must demonstrate this. Always do the literature search through the internet as it is the fastest and cheapest way to enter in the world of your topic. You may contact Health Net Nepal for further information on the literature search, which is located in the building of Health Learning Materials Centre at the premises of the Institute of Medicine, Maharajgunj, Kathmandu.

Following questions should be answered when you review an article for your literature review:

- What is the research question?

  If the reported results are true, is the information useful? The summary or the abstract helps to determine this.

  If the answer is negative, no further reading is necessary.

- What is the population about which the research questions is being asked?

  Who is included and who is excluded?

  Are the subjects a sample of the target population? If not why?

  How has the sample been selected?

  Is there is evidence of random selection, as opposed to systemic selection or self-selection by volunteers?

  What possible sources of bias are there in selection?

  How might selection process affect the selection?

  How might selection process affect the results?

  Is the sample large enough to answer the questions being tested?

For an experiment the following questions are relevant:

  How are the subjects assigned to treatments: randomly or in some other way/

  What control groups were included (placebo, untreated controls, both or neither)?

  How are the treatments compared? Was the outcome or response objectively measured?

  Was any chemical analysis or other measurement supported by quality assurance procedures?

For a survey the following questions are appropriate?

  Was the data collection process adequate (including questionnaire design and pre-testing)?

  What techniques were used to handle nonresponse and/or incomplete data?

  What possible sources of bias are evident?

  Was any chemical analysis or other measurement supported by quality assurance procedures?

- How are the data presented?

  Are there sufficient clear graphs and or tables? Are the numbers consistent? Is the entire sample accounted for/

  Are the standard deviations presented with means, confidence intervals,

regression coefficients or other statistics, as well as the raw data?

Is the sample adequately described in terms of variables related to the questions being posed?

Is there sufficient evidence that treatment groups were similar in important respects before treatments were applied?

- How results are interpreted and evaluated?

  Is the hypothesis under test clearly stated in statistical terms?

  Does the statistical analysis appear to be appropriate?

  Is the statistical analysis is presented in sufficient detail?

  Are all the people who entered the study accounted for in the analysis?

  Have statistical test procedures been interpreted correctly?

  Does the epidemiological analysis answer the research questions?

- Final evaluation

  Were the research questions worth asking in the first place, and what could be the consequences of the various possible answers? Did the research provide suggestions for action?

  Has the author made an adequate attempt to answer the question?

  Could the study design have been improved in any important way?

  Does the absence of any information from the report prevent an adequate evaluation of the study?

  Did the author take into account the results of previous studies on similar topics?

Hypothesis / Objectives

The objectives summarize what is to be achieved by the study. The general objective states what is expected to be achieved by the study in general terms. Objectives should be closely related to the statement of the problem. When you state your objective try to take care of the following:

- Cover the different aspects of the problem and its contributing factors in a coherent way and in a logical sequence.
- Clearly phrase in operational terms, specifying exactly what you are going to do, where and for what purpose.
- Use action verbs that are specific enough to be evaluated.

When you are reporting theoretical work that is not original, you will usually need to include sufficient material to allow the reader to understand the arguments used and their epidemiological or clinical basis. Sometimes you will be able to present the theory *in detail*, but you should not reproduce two pages of pathophysiology that the reader could find in a standard textbook. Do not include theory that you are not going to relate to the work you have done. When writing this section, concentrate at least as much on the physical signs as on the laboratory investigations. What do the investigations mean? What are the important signs? When you are reporting your own clinical or epidemiological work, you must include rather more detail, but you should consider moving lengthy derivations to appendices. Think too about the order and style of presentation: the order in which you did the work may not be the clearest presentation. Suspense is not necessary in reporting science: you should tell the reader where you are going before you start.

At the end of this topic you may write the specific objectives. Remember these objectives should not be the list of works that you have done during your research.

Materials and Methods

This varies enormously from thesis to thesis, and may be absent in theoretical theses. It should be possible for a competent paediatrican to reproduce exactly what you have done by following your description. There is a good chance that this test will be applied: sometime after you have left, another researcher will want to do a similar experiment either with your gear, or on a new set-up in a foreign country. Please write for the benefit of that researcher. In some theses, particularly multi-disciplinary or developmental ones, there may be more than one such chapter. In this case, the different disciplines should be indicated in the chapter titles.

What to include in the method section?:

1. *How the study was designed?*

   Keep the description brief.

   Say how randomization was done.

   Use names to identify parts of a study sequence.

2. *How the study was carried out?*

   Describe how subjects were recruited and chosen.

   Give reasons for excluding subjects.

   Consider mentioning ethical features.

   Give accurate details of materials used.

   Give exact drug dosage.

   Give the exact form of treatment and accessible details of unusual

apparatus.

3. *How the data were analyzed?*

   Use p value to disprove the null hypothesis.

   Give an estimate of the power of the study (the likelihood of a false negative β error)

   Give the exact tests used for statistical analysis.

At the end of your methods section think if your writing has answered the following questions: does the text describe what question was being asked? What was being tested, and how trustworthy the measurements of the variable under consideration would be? Where these trustworthy measurements recorded, analyzed and interpreted correctly? Would a suitably qualified reader to able to repeat the experiment in the same way?

Results and discussion

You must enter your data in the computer and use the EPI6 program. This program will calculate your data and will give you all the statistical data including the p value, mean, standard deviations etc. This will also help you to formulate the desired diagrams that you may want to use in your thesis. The findings can be discussed by objectives or clustered of related variables. The discussion should also mention findings from other related studies that support or contradict your own. It is important as well to present and discuss the limitations of the study. In the discussion of findings some general conclusions may be included as well. The results and discussion are very often combined in theses. This is sensible because of the length of a thesis: you may have several chapters of results and, if you wait till they are all presented before you begin discussion, the reader may have difficulty remembering what you are talking about. The division of Results and Discussion material into chapters is usually best done according to subject matter. Make sure that you have described the conditions, which obtained for each set of results. What was held constant? What were the other relevant parameters? Make sure too that you have used appropriate statistical analyses. Where applicable, show measurement errors and standard errors on the graphs. Use appropriate statistical tests. Take care in plotting graphs. The origin and intercepts are often important so, unless the ranges of your data make it impractical, the zeros of one or both scales should usually appear on the graph. You should show error bars on the data, unless the errors are very small. For single measurements, the bars should be your best estimate of the experimental errors in each coordinate. For multiple measurements these should include the standard error in the data. The errors in different data are often different, so, where this is the case, regressions and fits should be weighted (i.e. they should minimize the sum of squares of the differences weighted inversely as the size of the errors Try to distance yourself from your usual perspective and look at your work. Do not just ask yourself what it means in terms of the orthodoxy of your own research, but also how other people in the field might see it. Does it have any implications that do not relate to the questions that you set out to answer?

Guidelines for presenting results:

- Use a mixture of text, tables and figures.
- Give the actual numbers of the results that are plotted.
- Establish how comparable your groups are.
- Describe the unexpected results also.
- Do not give results to a greater degree of accuracy than that of the measurement.
- Avoid using percentage unless the groups have more than 100 subjects.
- When considering results give the number of subjects, the range of results, the central tendency (mean± SD), and the spread (confidence interval for the mean)
- If you have done an analysis of variance give the estimates with their degrees of freedom and *F* values. Do not forget to mention the p value.
- Tables and illustrations should have an appropriate legend and stand alone
- Don't give carried away with the computer graphics if they do not add anything.

Final chapter, references and appendices

Conclusions and suggestions for further work

The systemic presentation of your findings and conclusions in relation to the research objectives is the crucial part of your report. Your abstract should include your conclusions in very brief form, because it must also include some other material. A summary of conclusions is usually longer than the final section of the abstract, and you have the space to be more explicit and more careful with qualifications. You might find it helpful to put your conclusions in point form. It is often the case with scientific investigations that more questions than answers are produced. Does your work suggest any interesting further avenues? Are there ways in which your work could be improved by future workers? What are the practical implications of your work? This chapter should usually be reasonably short - a few pages perhaps. As with the introduction, I think that it is a good idea to ask someone who is not a specialist to read this section and to comment.

References (See also under literature review)

The references in your text can be numbered in the sequence in which they appear, then listed in this order in the reference section. Another possibility is to list the author's name in the text followed by the date of publication in brackets, for example (Sharma 1997). In the list of references, the publications are then arranged in alphabetical order by the principal author's last name. It is tempting to omit the titles of the articles cited, but think of all the times when you have seen a reference in a paper and gone to look it up only to find that it was not helpful after

all. Following is an example to write the references it should follow this sequence: names of authors, title of the article, name of the journal, year of publication, volume and page number.

For an article:

Pandey MR; Sharma PR; Gubhaju BB et al. Impact of a pilot acute respiratory infection (ARI) control programme in a rural community of the hill region of Nepal. Annals of Tropical Paediatrics, 1989: 9: 212-220

For a book:

Behrman RE, Kliegmann RM; Arvin AM (Eds). Nelsons Textbook of Pediatrics. 15th Ed. W.B. Saunders Co. 1996; 378.

For a chapter in a book:

Shapiro LJ. Inheritence Patterns. In: Behrman RE; Kliegmann RM; Arvin AM (Eds). Nelson's Textbook of Pediatrics. 15th Ed. W.B. Saunders Co. 1996; 308-312

Appendices

If there is material that should be in the thesis but which would break up the flow or bore the reader unbearably, include it as an appendix. Some things which are typically included in appendices are: important and original computer programs, data files that are too large to be represented simply in the results chapters, forms used for data collection, pictures or diagrams of results which are not important enough to keep in the main text.

Most important notes for you!

You have to remember that your thesis reviewer/ examiner will probably seek answers for these following 11 questions in your finished work, which you have submitted to the examination section *before the due date*:

1. **Why did you want to do this study?**

- What is the problem and why it should be studied?
- Literature reviewed.

2. **What were the study objectives?**

- What were the study purpose and the scientific hypothesis to be tested?
- Is the objective clearly formulated?

3. **What was the study about?**

- How were the subject recruited?

- Describe the study site and study population: hospital or community
- What were the inclusion and exclusion criteria?

4. What was the design of the study?

- Describe the study design: randomized controlled trials; case control, prospective, retrospective etc.
- What specific interventions were considered, what was it compared with?
- What was measured and how?

5. How were the preliminary questions dealt with?

- Was the sample size or power calculation described?
- What is the duration of the follow-up?
- Completeness of the follow-up?
- Was the method of randomization adequately described?

6. How did the author measure the outcome?

- Are primary and other outcomes clearly defined?
- Is a gold standard for outcome assessment described?

7. Quality control issues?

- How were the quality control and validation procedures for the intervention and outcome assessment described?
- Was assessment blind?

8. Data analysis:

- What sort of data authors examining?
- Which statistical tests were done?
- Were the statistical tests were appropriate?
- Are the data analyzed according to the original protocol?

9. Was systemic bias avoided or minimized?

10. Ethical issues:

- Are the ethical issues adequately described?

11.Conclusion and their use?

- Which were the generalizable conclusions: statistical significance or clinical significance.
- Are there new questions arising from the paper?
- Does this research as to the literature in any way?

Some important definitions you should remember while doing a thesis work.

Age specific death rate: Death rates can be obtained for specific age groups in order to compare mortality at different ages or a change in mortality at the same age over time. Comparison could also be made between areas.

$$\frac{\text{Deaths of people in the age group}}{\text{Total population ages}} \times 1{,}000$$

Case control study: It is a longitudinal studies of the people with disease of interest and a suitable control of people unaffected by the disease or outcome variable.

Case fatality: It is the proportion of cases of a specified disease or condition, which are fatal within a specified time.

Case fatality rate:

$$\frac{\text{Number of persons dying from disease}}{\text{Number of persons developing the disease}} \times 100$$

Cause specific death rates: Basic cause specific death rates are usually expressed in deaths per 100,000 because for most causes of deaths, the rates of occurrence are very low.

$$\frac{\text{Number of deaths from specific disease}}{\text{Total population}} \times 100{,}000$$

Cohort study: It begins with a group of people free of disease, who are classified into subgroups according to the exposure potential cause of disease or outcome.

Comfounding: In a study of the association between exposure to a cause (or risk factor) and the occurrence of the disease, confounding can occur when another exposure exists in the study population and is associated both with the disease and the exposure being studied. The methods used to control confounding are: randomization, restriction and matching. And at the analysis stage it can be controlled by: stratification and statistical modeling.

***Community trials*:** Here the treatment groups are communities rather than individuals.

Cumulative incidence rate or risk: It is the simpler measure of the occurrence of a disease or health status. It measures the denominator only at the beginning of the study.

Cross sectional study: It measures the prevalence of disease. The measurement of exposure and effect are made at the same time.

Death rate: The death rate (also called the crude death rate) is the number of deaths per 1000 population in a given year.

Number of deaths X 1,000

Total population

Field trial: This is the study done in the field where data are collected involving people who are disease free but presumed to be at risk.

Household: A household is usually defined as one or more persons who occupy a single housing unit.

Average size of house holds:

Persons living in households

Total households

Incidence: It is the number of new cases arising in a given period in a specified population.

Incidence rate:

Number of persons developing a disease

during a given time period X 100,000

Total population at risk

Mean: It is designated as $\bar{x}$ and can be calculated from the frequency distribution by summing the values of all the observations (x_i) and dividing by the number of observations (n).

Mean age: The mathematical average age of all the members of the population.

Median value**:** It is the value on the scale that divides the distribution into two equal parts. Half of the observations have value less than or equal to median and half have a value greater than or equal to the median.

Mode: It is the most frequently occurring value in a set of observations.

Negative predictive value: It answers the questions " of all people with the negative test, how many will not have the disease?".

Null hypothesis: It states that any observed differences are entirely due to sampling errors (e.g. to chance).

Observational study: The investigator measures but does not intervene.

Odds ratio**:** It is the ratio of the odds of exposure among the cases to the odds in favour of exposure among the controls. It identifies the association of an exposure and a disease measured in a case control study.

p-Value: It is used to calculate the probability that differences at least at large as those found in the observed data would have occurred by chance. If the p-value is low this indicates that differences at least as large as those observed occur by chance in only a small proportion of all possible samples. It is usual to choose either 0.05 (5%) or 0.01 (1%) as significance levels or testing the null hypothesis.

Positive predictive value: It answers the questions " of all people with a positive test, how many will have the disease?"

Prevalence: It is the number of cases in a defined population at a specified point of time.

Prevalence rate:

$$\frac{\text{Number of persons with a specific disease}}{\text{Total population at risk}} \times 1{,}000$$

Prospective study: It is looking forward from the possible cause to a disease.

Proportion dying of a specific cause: Deaths from specific cause can be expressed as a percentage of all deaths.

Number of deaths from specific disease X 100

Total deaths

Randomized control trials: It is an experimental study where the population are randomly allocated to groups, usually called treatment and control groups and the results are assessed by comparing the outcome in the two or more groups.

***Random* error:** It is the divergence due to chance alone of an observation on a sample from the true population value, leading to lack of precision in the measurement of an association.

Regression analysis: It is the method of finding the best mathematical model for predicting one variable from another.

Retrospective study: It is looking backwards from the disease to a possible cause.

Risk difference: It is the difference in rates of occurrence between exposed and unexposed groups.

Risk ratio: It is the ratio of the risk of occurrence of a disease among exposed people to that among the unexposed.

Sample size: A value calculated from a sample is called a statistic such as mean, standard deviation and proportions. The two main objectives of sampling are: a) estimation of population parameter (mean, proportions etc) and b) to test the hypothesis about the population from which the sample is drawn. Sample is any part of the population. Inferences or conclusions drawn from a sample are only valid if the sample size is sufficiently large and unbiased. Therefore it is essential to calculate the sample size so that the result can be generalized.

For qualitative data***:*** For finding the suitable size of the sample, the assumption usually made is that the allowable error does not exceed 10% or the 20% of the positive character. The size can be calculated by the following formula with a desired allowable error (L) at 5% risk that the true estimate will exceed allowable error by 10% or 20% of 'p'

$n = \frac{4pq}{L^2}$ where p is the positive character and q =1-p

L = allowable error, 10% or 20% of 'p'

Example: Hookworm prevalence rate was 30% before the specific treatment. Calculating the size of the samples required to find out the prevalence rate with the allowable error of 10%

L = 10% of p = $\frac{30 \times 10}{100}$ *=3*

at 5% risk $n = \frac{4pq}{L^2} = \frac{4X30x70}{3 \times 3} = 933.3$

For quantitative data: If the standard deviation (δ) in a population is known from the past experience the size of the sample can be calculated by the following formula with the desired allowable error (L). At 5% risk the true estimates will lie beyond the allowable error. It is essential to decide how large an error can be tolerated or allowed in the estimates. Other important that has to be taken into account is to express the allowable error in terms of confidence limits.

$L = \frac{2\delta}{\sqrt{n}}$ or $\sqrt{n} = \frac{2\delta}{L}$ or $n = \frac{4\delta^2}{L^2}$

Example: Mean pulse rate of a population is believed to be 70 per minute with a standard of deviation of 8 beats. To calculate the minimum size of the sample to verify this, if allowable error L = ± 1 beat at 5% risk:

$n = \frac{4 \text{ X } 8 \text{ X } 8}{1 \text{ X } 1} = 256$

Sensitivity: It is the measurement that answers the question " of all people with the disease, how many will have a positive test?"

Specificity: It answers the questions " of all people without disease, how many will have a negative test?"

Standard deviation: It is the square root of variance. To calculate the variance, the squares of the differences of the individual observations from the mean are added together, and the resulting sum squares is divided by the number of observations minus one.

Systematic error: It occurs when there is a tendency to produce results that differ in a systematic manner from the true values. The possible sources of this error are: selection bias and measurement bias. Selection bias occurs when there is a systematic difference between the characteristics of the people selected for a study and the characteristics of those who are not. Measurement bias occurs when the individual measurements or classifications of disease or exposure are inaccurate (they do not measure correctly what they are supposed to measure).

Validity: It is an expression of the degree to which a test is capable of measuring what it is intended to measure.

	Disease present	Disease absent	
Test positive	a	b	a + b
Test negative	c	d	c + d

a + c	b + d

a = true positive; b = false positive; c = false negative; d = true negative

Sensitivity = a /a +c; Specificity = d / c+d

Negative predictive value = a /a+b

Positive predictive value = d /c+d

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GOOD LUCK

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