Structure of PhD thesis
Bernt Lindtjørn
What is a thesis?
What is a good thesis?
A PhD is a Research degree
A good thesis: the candidate should be able to address the following:

- Recognise and validate problems
- Show original, independent and critical thinking, and the ability to develop theoretical concepts
- Have knowledge of recent advances within one’s field and in related areas
- Understanding of relevant research methodologies and techniques and their appropriate application within one’s research field
- Critically analyse and evaluate one’s findings and those of others
Thesis

Synthesis
A PhD thesis:
A good example
Variation in Malaria Transmission in Southern Ethiopia
The impact of prevention strategies and a need for targeted intervention

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Dissertation for the degree of philosophiae doctor (PhD)
University of Bergen, Norway
2013
PhD Thesis consists of:

The Thesis

Articles

Supplementary information
The Thesis
What should it contain?
The main parts of a PHD thesis are:

- The title page
- The abstract
- The content
- The introduction
- The objectives
- The methods
- The results
- The discussion
- The conclusion
- The brief summary for policy makers
- The acknowledgements
- The references
- The appendices
Understanding research design is a prerequisite to doing research.
80 -90% of findings of observational studies are false

(see http://niss.org/sites/default/files/Young_Safety_June_2008.pdf)
Randomized Clinical Trial

For RCT, through randomization the effects of bias are largely, but not completely, removed. If there is no treatment effect the two distributions are on top of one another. If treatment has an effect it will move the distribution of the treated patients, red, away from the control patients. If the effect is large enough and if the sample size is large enough, the treatment effect will be detected.
Bias reduction in observational studies

(a) Use confounding variables to reduce bias.

(b) As n get large the standard error of the mean gets small.

All observational studies will be positive!
Two questions

Researchers face two important questions as they do health research:

Is the report believable?
   “Internal validity”

Is it relevant to my practice?
   “External validity”
Internal and external validity

Internal validity
the ability to measure what it sets out to measure

External validity
Can the results from study participants be extrapolated to the reader’s patients?
What to look for in epidemiological studies

Is selection bias present?

Is information bias present?

Is confounding present?

If the results cannot be explained by these three biases, could they be the result of chance?

If the results still cannot be explained away, then (and only then) might the findings be real and worthy of note.
Some reasons why PhD work fails

Inadequate discussion of results
(strengths and limitations)

The research work is not put into the right context

Inadequate sampling
Structure of the PhD thesis

“Expanded IMRaD Structure”
The Thesis: Introduction

Introduction:

«What comes before the Results and Discussion»

Has four parts

What is this thesis about

Background and literature review

Objectives

Methods
Introduction

From the introduction, it should be clear what the candidate’s contribution is.

What is the new knowledge that the candidate wishes to address?

After reading this, the examiner should think:

«How nice that the candidate has done exactly this project»
What is this thesis about?

Before you start writing «Background», I suggest you start by writing: **What is this thesis about?**

Tell the reader which questions you are answering

Why was it important to do this research

Which design and sampling methods did you use

What implications has your research findings?
Thesis

Synthesis
• You need to supplement your articles by defining key definitions and concepts. These need to be discussed.

• Please also discuss the association between dependent and independent variables in models you plan to use.

• Argue for variables you wish to use.
Literature review

You should demonstrate a thorough knowledge of the literature.

You should not only refer to the literature, but also critically evaluate the literature.

Please refer to the databases you have used for literature search.

Please refer to primary articles.

Do not refer to summary of articles.

Review papers? How do I refer to them?

OBS: Be careful with internet references.
The research questions

The questions should be clear, and specific

Please do not use the word cause, if you are measuring associations

The list of objectives should be ordered in a logical way

Use the order of your objectives in your Results and in your Discussion

Do not address objectives that you have not addressed in your introduction
Interventions

If the project deals with an intervention, please define:

- The theoretical concept and rationale behind your intervention
- How was the intervention carried out.
- In which context was the intervention done in
Results

Summary of your articles

You are allowed to add additional data that were not published in your papers
Some additional data

**Interrater agreement**

The interrater agreement of microscopic readings of the first two readers was checked with Kappa statistics, and a better agreement was achieved in the readings of the vivax- than in the falciparum species, 0.87 *versus* 0.80, respectively [Table 2]. All of the discordant readings were confirmed by a third reader.

<table>
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<th>Second reader</th>
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<td><em>P. vivax</em></td>
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</table>

Kappa 0.80 0.87
95% CI for Kappa 0.76–0.84 0.83–0.90
Interpretation§ Good agreement Very good agreement

§Strength of agreement: <0.2 = Poor, 0.21–0.40 = Fair, 0.41–0.60 = Moderate, 0.61–0.80 = Good, and 0.81–1.00 = Very Good
The discussion

Validity
  Internal validity
  External validity

The general discussion
Discussion: Validity

Study design

Sample size

Internal validity

Selection bias (systematic sampling error)

Information (measurement) bias

Confounding

Chance (random sampling error)

External validity (Generalisability)
How to discuss validity

*Information bias*

Information bias refers to whether the information is gathered from the study subjects in the same way regardless of their exposure status, the presence of measurement error or both. In this thesis, a measurement error could arise while diagnosing, documenting and reporting falciparum malaria cases, documenting and reporting meteorological variables [Paper I], interviewing the study participants during census and weekly visits [Papers II, III and IV] and preparing and reading microscopic slides [Papers II and III].
Now, -- the general discussion

Validity: again

Is A the cause of B?
How do I answer this question?
80 -90% of findings of observational studies are false

(see http://niss.org/sites/default/files/Young_Safety_June_2008.pdf)
Weighing the Evidence

Is the association causal?

Weighing the Evidence
## Strength of Evidence

<table>
<thead>
<tr>
<th>TYPE OF STUDY</th>
<th>ABILITY TO “PROVE” CAUSATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomised control trials</td>
<td>Strong</td>
</tr>
<tr>
<td>Cohort Studies</td>
<td>Moderate (when well conducted, bias minimised)</td>
</tr>
<tr>
<td>Case-control studies</td>
<td>Moderate (good evidence for causal nature of an association)</td>
</tr>
<tr>
<td>Cross-sectional studies</td>
<td>Weak (no direct evidence on time sequence)</td>
</tr>
<tr>
<td>Ecological studies</td>
<td>Weak (danger of incorrect extrapolation to individuals from data on regions or countries)</td>
</tr>
</tbody>
</table>
Should I believe my measurement?

Oral contraceptives

Cardiovascular disease

RR = 2.3

True association
- causal
- non-causal

Bias?
Confounding?
Chance?
Confounding

If risk factors is a confounder, then ‘control’ in some appropriate way changes meaningfully the disease-risk factor association

If $RR_{crude} = Rr_{adjusted}$, then no confounding

If $RR_{crude} \neq Rr_{adjusted}$, then confounding present
Criteria for judgment of causal

• Temporal sequence
  – Did exposure precede outcome?

• Strength of association
  – How strong is the effect, measured as relative risk or odds ratio?

• Consistency of association
  – Has effect been seen by others?

• Biological gradient (dose-response relation)
  – Does increased exposure result in more of the outcome?

• Coherence with existing knowledge
  – Is the association consistent with available evidence?

• Experimental evidence
  – Has a randomised controlled trial been done?

• Analogy
  – Is the association similar to others?
To day we have mainly focused on:

- The title page
- The abstract
- The content
- The introduction
- The objectives
- The methods
- The results
- The discussion
- The conclusion
- The brief summary for policy makers
- The acknowledgements
- The references
Someday we may continue discussing:

The title page
The abstract
The content
The introduction, The objectives, The methods, The results
The discussion
The conclusion
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The appendices