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

Eskindir Loha Shumbullo

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

UNIVERSITY OF BERGEN

PhD Thesis consists of:

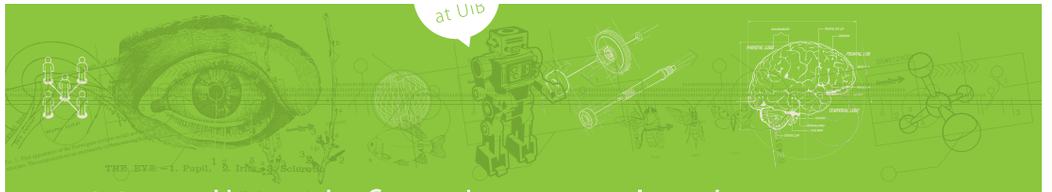
The Thesis

Articles

Supplementary information

The Thesis

What should it contain?



Handbook for doctoral education (PhD) University of Bergen

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

Contents

Understanding research design is a prerequisite to doing research

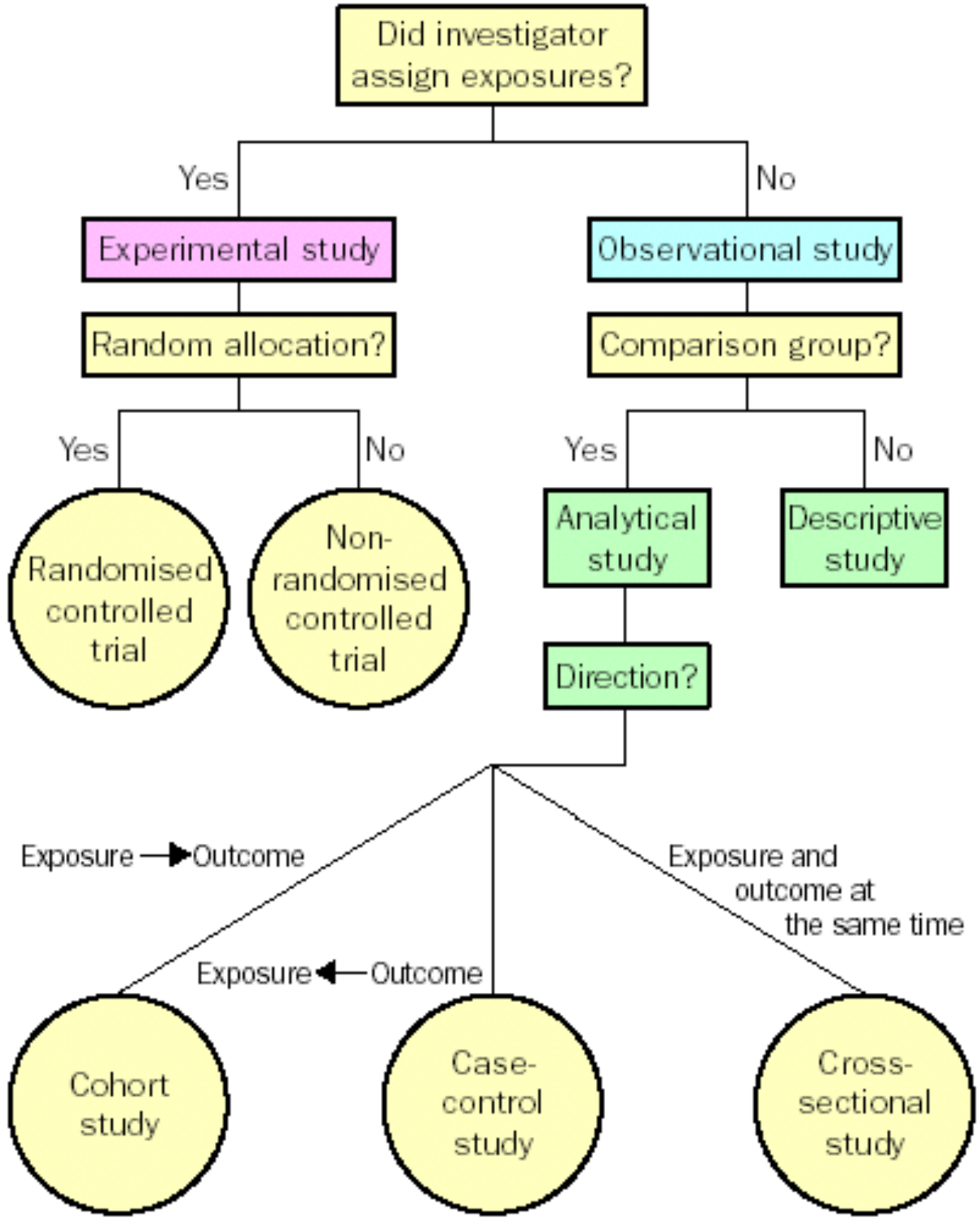
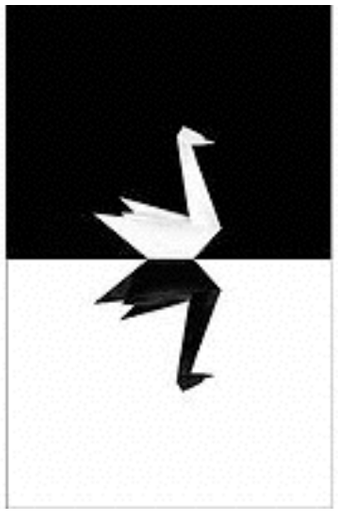


Figure 1: **Algorithm for classification of types of clinical research**



OBS .....

80 -90% of findings of observational studies are false

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

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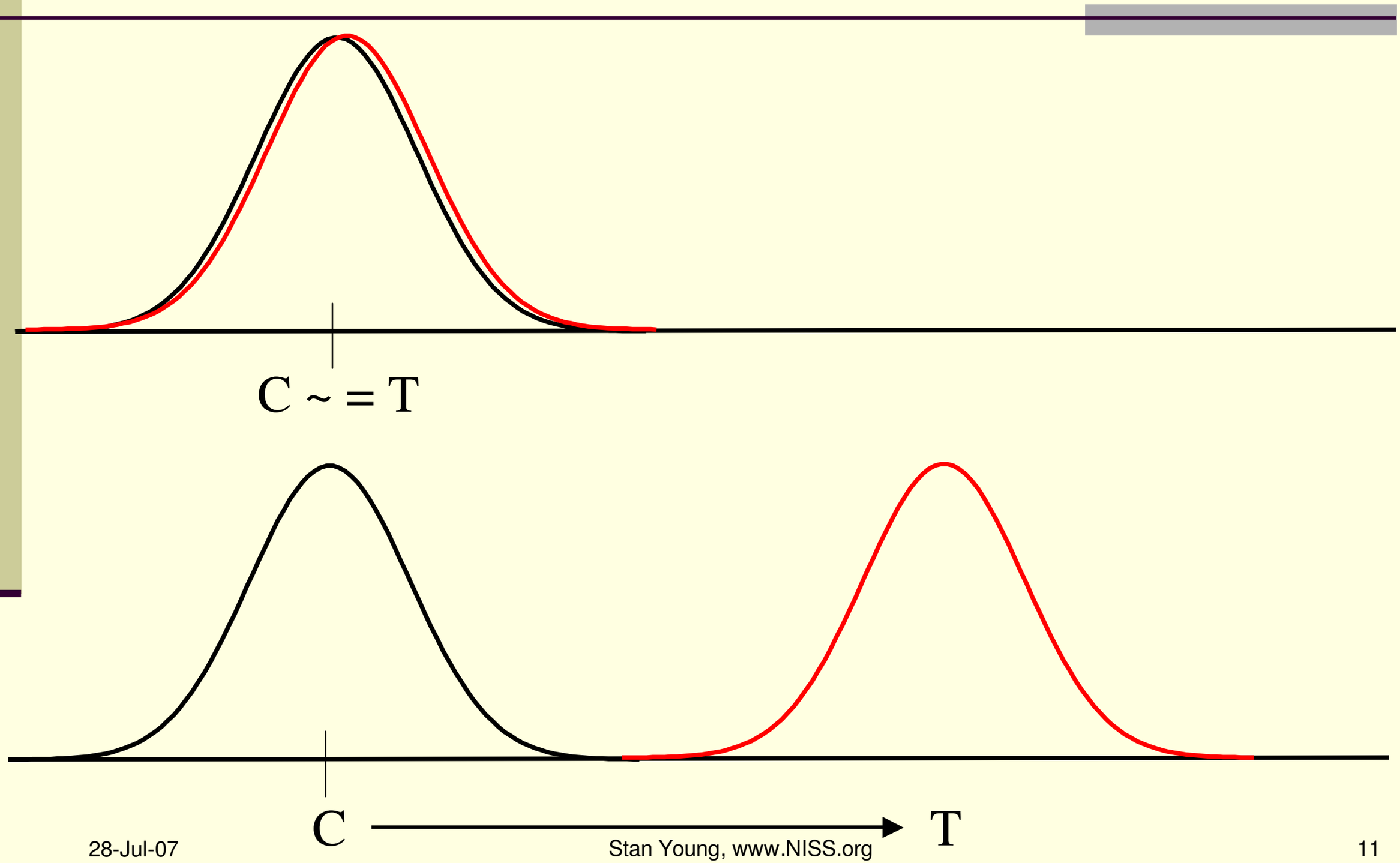
Essay

Why Most Published Research Findings Are False

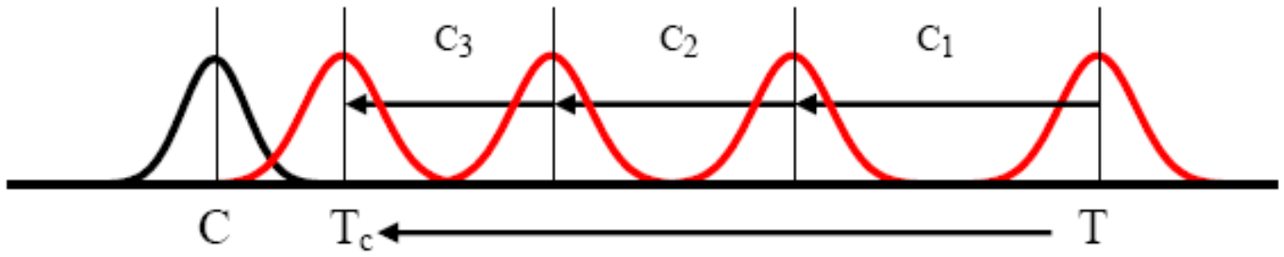
John P. A. Ioannidis

Randomized Clinical Trial

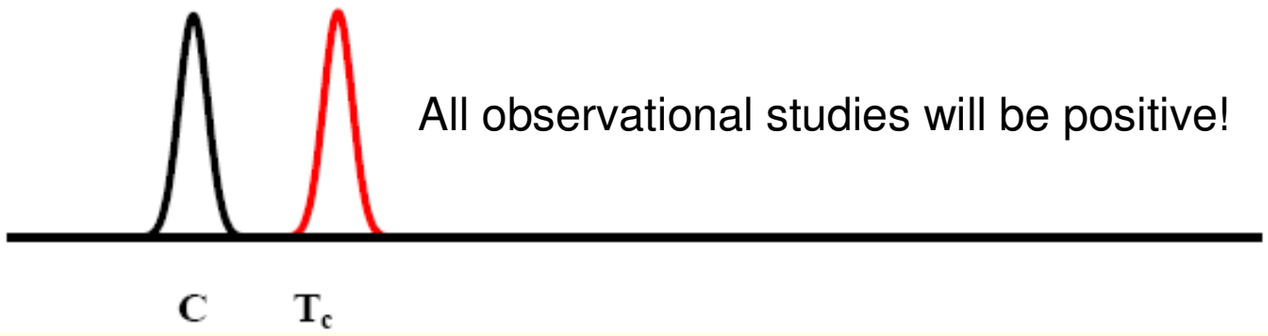


Bias reduction in observational studies

(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

Background

- 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 2: Interrater agreement for the readings of 2,573 microscopic slides

		Second reader					
		P. falciparum			*P. vivax*		
		Positive	Negative	Total	Positive	Negative	Total
First reader	Positive	255	49	304	265	41	306
	Negative	59	2,210	2,269	31	2,236	2,267
	Total	314	2,259	2,573	296	2,277	2,573
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[152]: <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

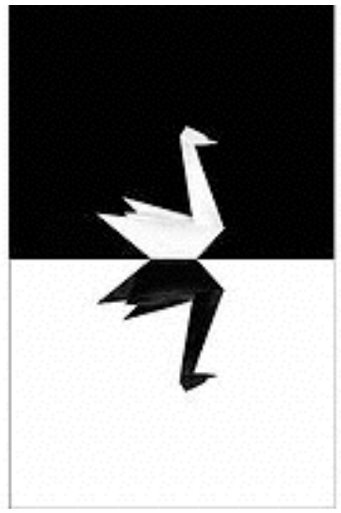
Information bias refers to whether the information is gathered from the study subjects in the same way regardless of their exposure status,[158] the presence of measurement error[154] or both. In this thesis, a measurement error could arise while diagnosing, documenting and reporting falciparum malaria 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?



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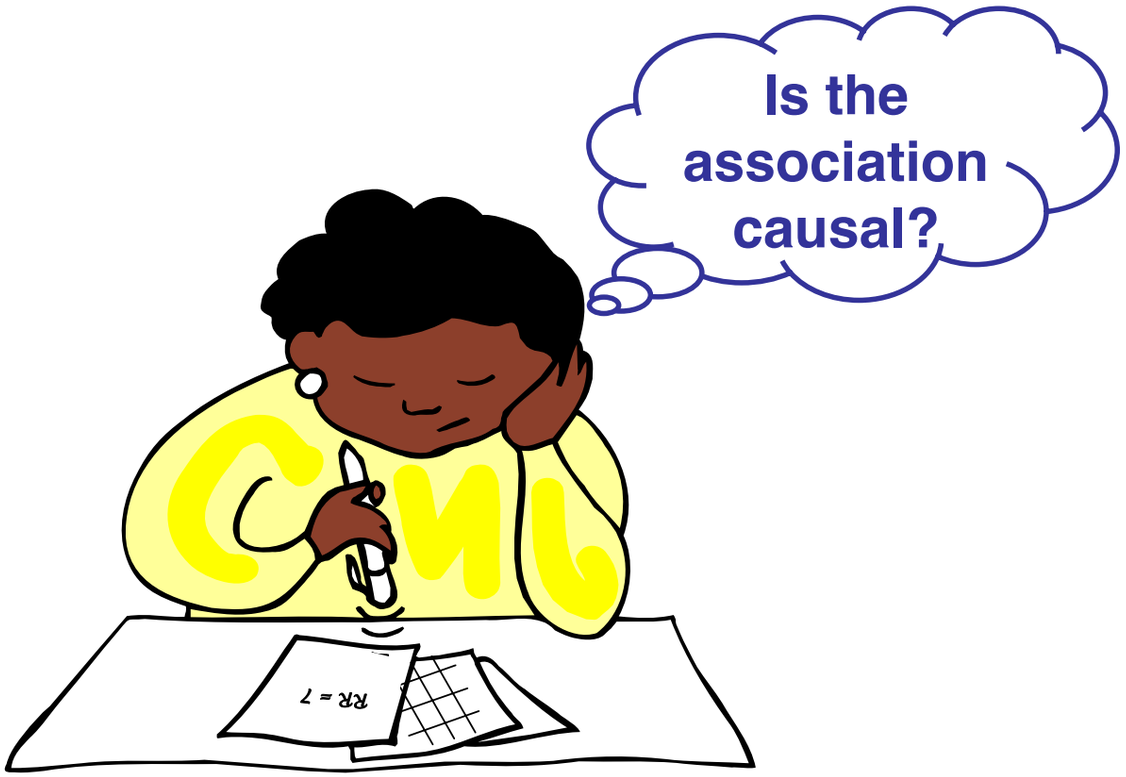
Weighing the Evidence



Weighing the Evidence

Strength of Evidence

TYPE OF STUDY	ABILITY TO “PROVE” CAUSATION
Randomised control trials	Strong
Cohort Studies	Moderate (when well conducted, bias minimised)
Case-control studies	Moderate (good evidence for causal nature of an association)
Cross-sectional studies	Weak (no direct evidence on time sequence)
Ecological studies	Weak (danger of incorrect extrapolation to individuals from data on regions or countries)

Should I believe my measurement?

Oral contraceptives → RR = 2.3 → Cardiovascular disease

- **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

The brief summary for policy makers

The acknowledgements

The references

The appendices