Research Methodology

Assoc. Prof. Dr. Jamalludin Ab Rahman
B.Med.Sc., MD, MPH
Department of Community Medicine
Kulliyyah of Medicine
International Islamic University Malaysia

The lectures will answer the following questions

- Why we do research?
- How to plan a scientific research?
- What is the best design for my research?
- How to select subjects for research?
- How to plan for data collection?
- How to manage & analyse data?
- How to report the findings?

Research Methodology Workshop

for Oral Health Division, JKNP
22-24th April 2014

Programme

- Day 1 – Reason, rationale & conceptual framework; Study design & Sampling plan
- Day 2 – Data collection & data dictionary; Statistical analysis & dummy table
- Day 3 – Writing proposal & report

Part 1 – Reasons & Rationale

Research Methodology Workshop
22-24 April 2014

Why we do research?

- To answer curiosity
- To solve problem
- To find alternative
- To fulfil academic requirements
- To get promotion

When the topic is important?

- When it fulfils the need
- Humankind need
- Country need
- Service need
- But never a personal need

Type of research

- Descriptive – e.g. prevalence study
- Discovery – e.g. new biomarker, new pathway (mostly lab study)
- Proof causality (hypothesis testing) – e.g. cause/causes of a disease or abnormality, reason for certain behaviour, clinical trial (a drug is better than others) etc

Research Methodology Workshop
22-24 April 2014

The steps

1. Organise research idea
2. Understand the problem → do literature review, construct conceptual framework
3. Formulate objective
4. Know your target population
5. Choose best study design
6. Choose best sampling method
7. Calculate sample size
8. Determine variables to collect → prepare data dictionary
9. Validate research instrument
10. Plan data collection, plan for quality control
11. Plan statistical analysis, prepare dummy table
12. Estimate & secure budget
13. Get approval
14. Collect data, monitor quality
15. Analyse data
16. Report finding

Literature review

- Search strategically
  - Identify important keywords
  - Identify authorities in the subject matter
  - Observe the dates
- Manage bibliographic well – use software (e.g. EndNote, Mendeley, Papers)

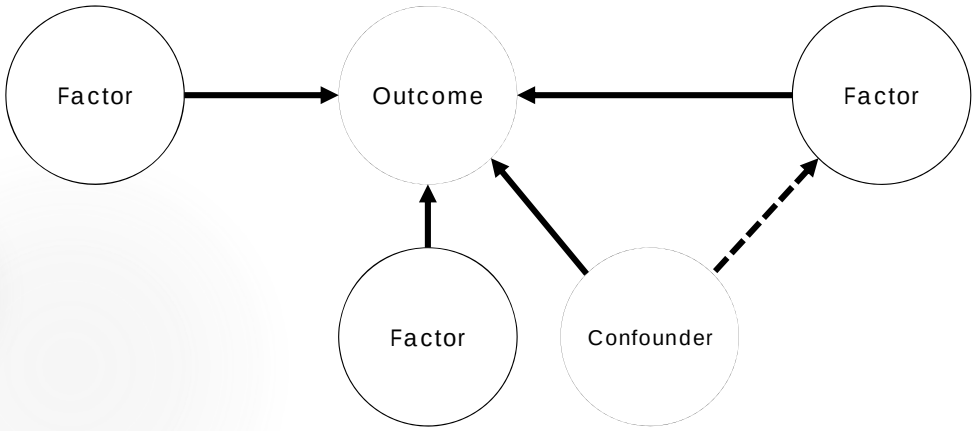
Part 2 – Conceptual Framework

Research Methodology Workshop
22-24 April 2014

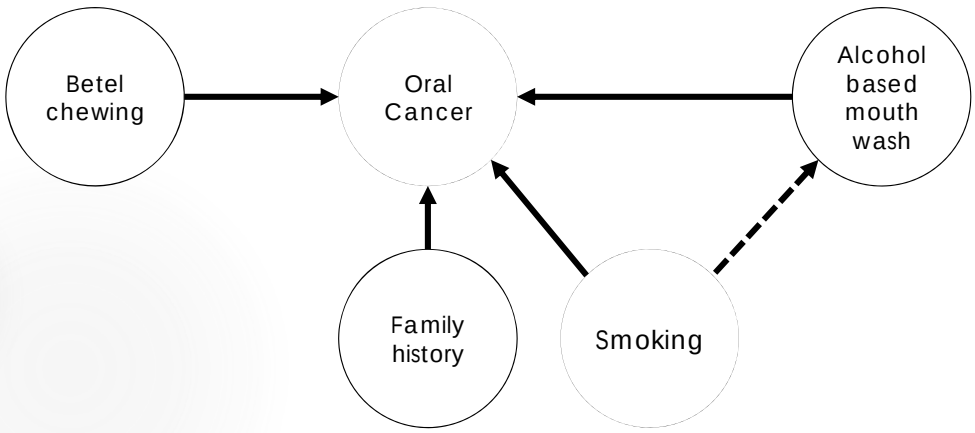
Build the concept

1. Main outcomes
2. Explanatory (exposures, factors) variables
3. Confounding variables

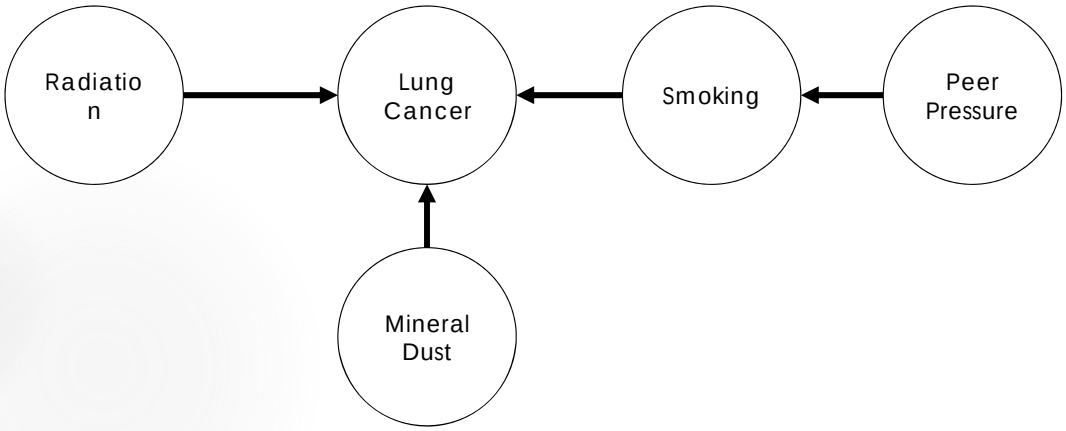
Conceptual idea

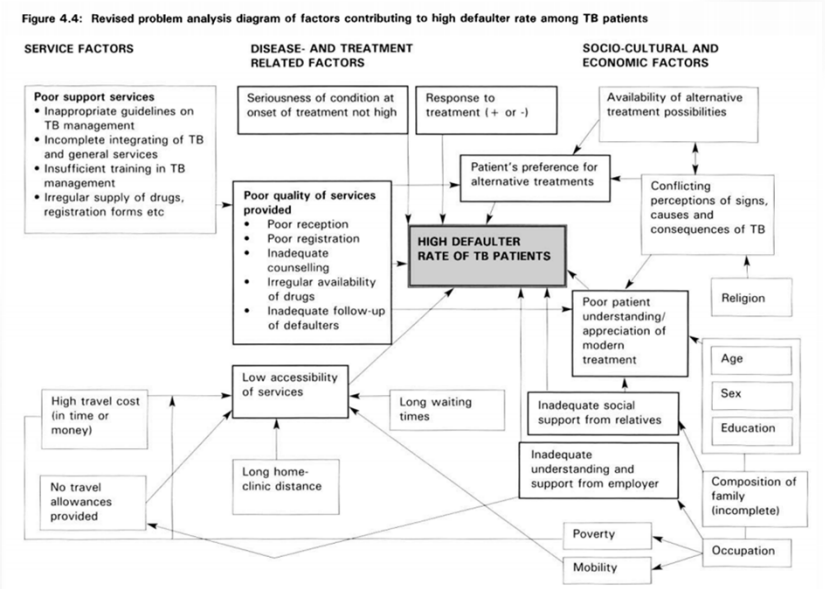


Example 1

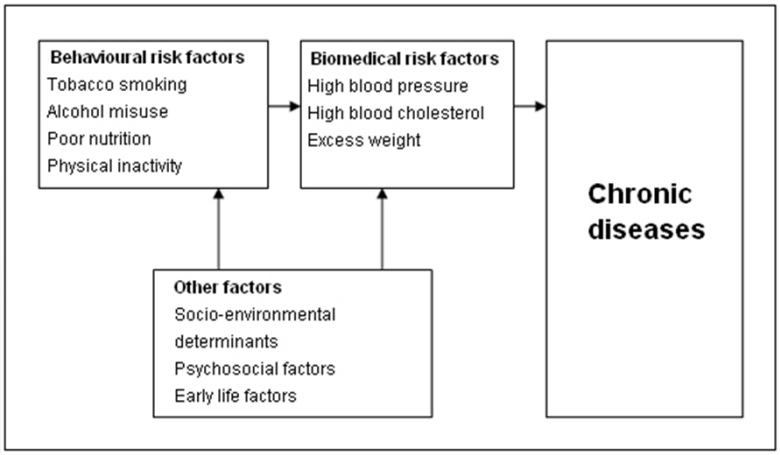


Example 2





Varkevisser, C. M., Pathmanathan, I., & Brownlee, A. T. (2003). Designing and conducting health systems research projects: Kit Publishers.



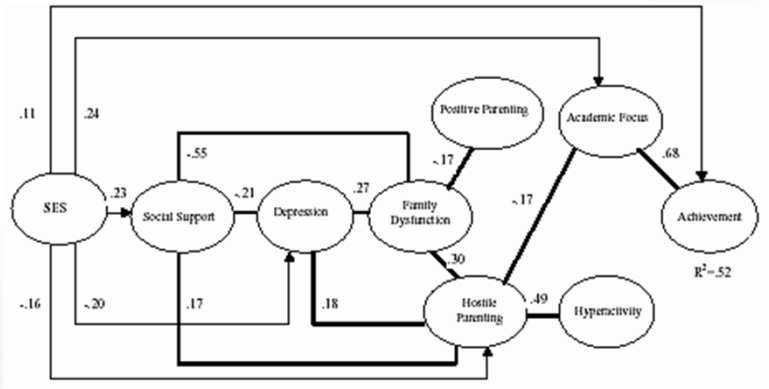


Figure 3 Structural Equation Model Showing the Relationship Between Family Processes, Child Characteristics, and Achievement for Girls Aged 6 to 11 years

Research Methodology Workshop
22-24 April 2014

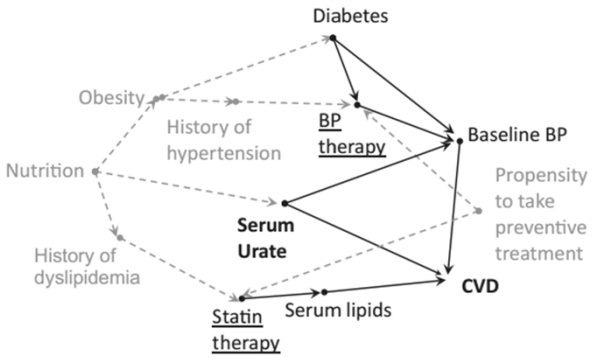


Figure 1: A directed acyclic graph (DAG), characterising the direction of selected influences* on risk of developing cardiovascular disease.
BP- Blood pressure; CVD-Cardiovascular disease.
*Dark font variables are those which are observed, whereas grey font represent unobserved. Drug treatment variables, which we consider colliders, which introduce the influence of unobserved variables not directly linked with the outcome, are underlined.

Thornley S (2012) Causation and Statistical Prediction: Perfect Strangers or Bedfellows? J Biom Biostat 3:e115. doi:10.4172/2155-6180.1000e115

Group Work #1 (2 hours)

1. Suggest the title of your research
2. State 3 reasons why your study is important
3. Identify the outcome, explanatory factors & the confounders (if applicable)
4. Build the conceptual framework
5. State the specific objectives of the study

Research Methodology Workshop
22-24 April 2014

Part 3 – Study design

Research Methodology Workshop
22-24 April 2014

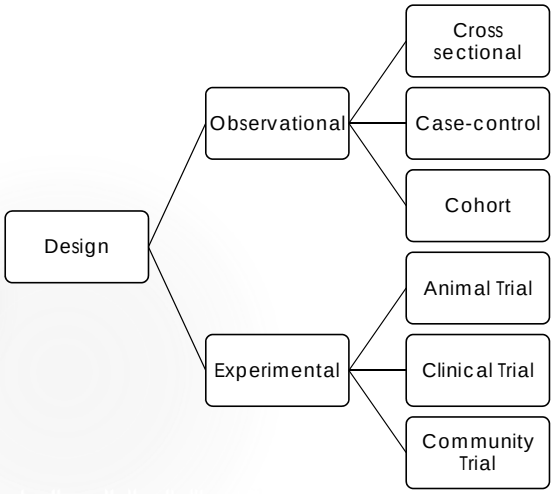
Exposure & Outcome

Smoking	Lung cancer
High carbo diet	Diabetes mellitus
Oral mouth wash	Oral cancer

Population → Exposure → Outcome

History — *To proof causation, exposure must precedes outcome* — Future

Research design

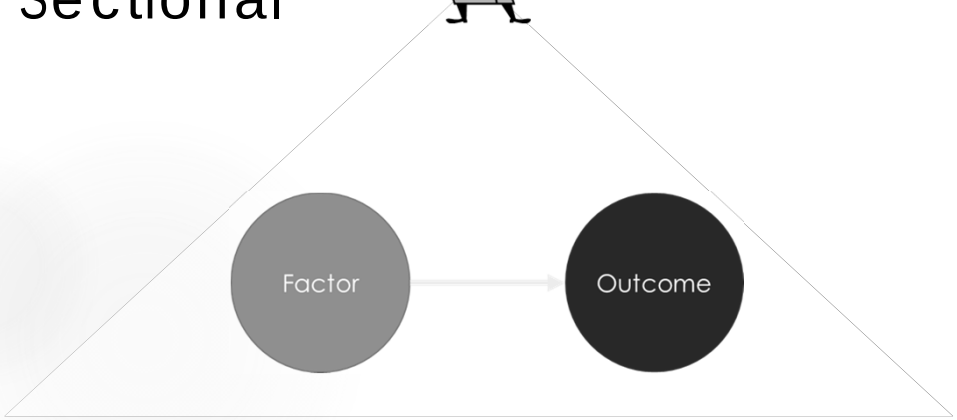


Measure exposure & outcome & the same time

Fix the outcome. Measure the exposure

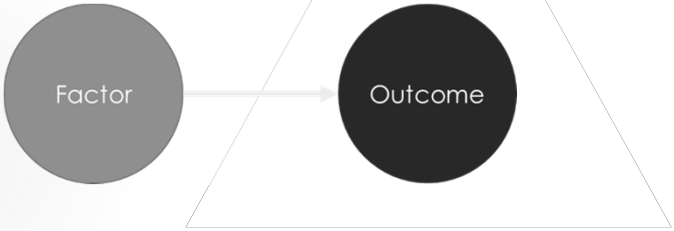
Fix the exposure. Measure the outcome

Cross Sectional

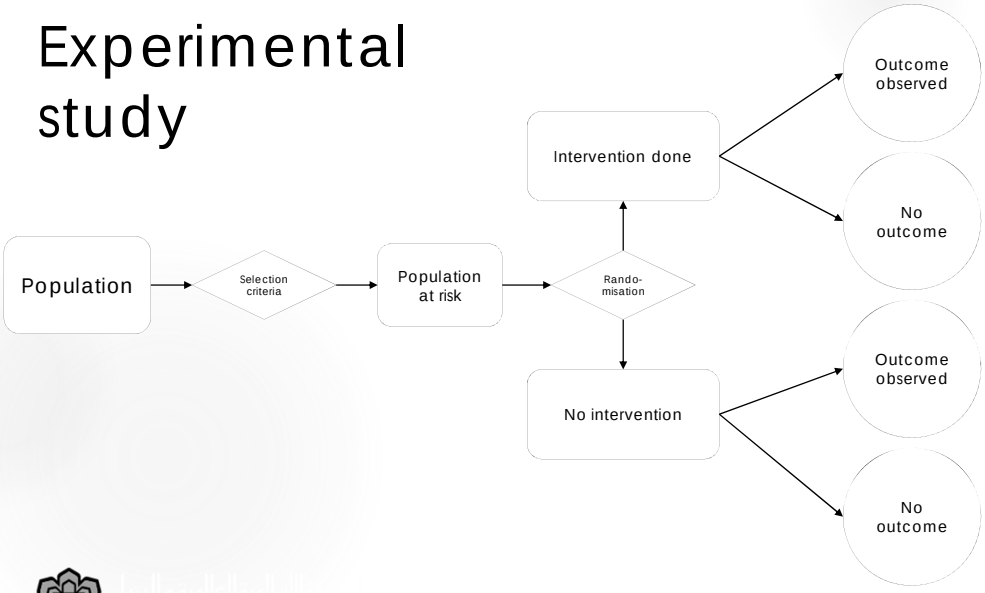


Case Control

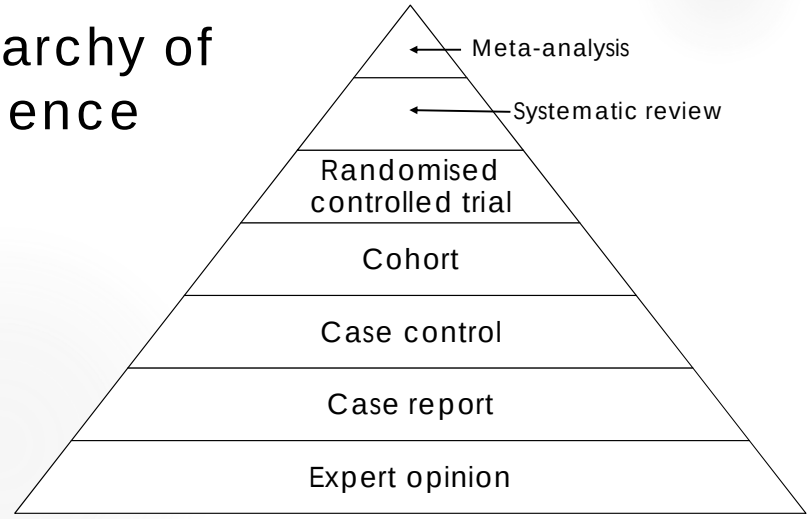
Cohort



Experimental study



Hierarchy of Evidence



Research Methodology Workshop
22-24 April 2014

Cross sectional study

- Population based – represent population
- Measure exposure & outcomes at the same point in time – No temporal association
- Impossible to infer causality
- Prevalence study – measure magnitude or burden of disease
- Descriptive
- Repeated cross-sectional study ~ pseudo-longitudinal e.g. British Association for the Study of Community Dentistry (BASCD) guidance on sampling for surveys of child dental health. A BASCD coordinated dental epidemiology programme quality standard (Pine et al. 1997)

Cross sectional study

Advantages

- Measure prevalence of a population
- Measure multiple exposures & outcomes
- Relatively inexpensive
- Relative shorter time

Disadvantages

- No temporal association – no inference to causality
- Prevalence-incidence bias (Nyman bias) e.g. if smokers die due to AMI faster, a cross-sectional study will reveal less smoker among AMI patients
- Health workers effect e.g. when survey done from house to house, only health respondent are available in their home/office

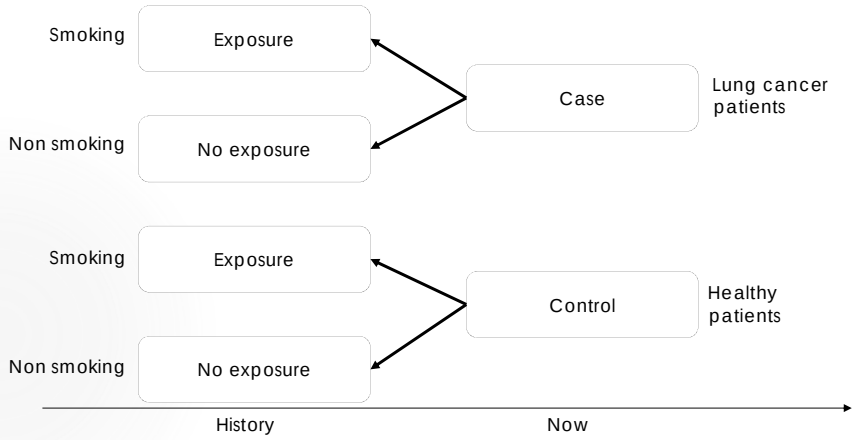
Cross sectional study - Example

- NHMS ~ Household study, all Malaysian (N=47,610 for 2006)
- NOHSA ~ Adult (>15) (N=14,444 for 2010)
- NMCS ~ GP vs. PHC (N~12,000)
- NHANES (US) - http://www.cdc.gov/nchs/nhanes.htm

Case control study

- Fix the outcomes, measure the exposures
- Longitudinal
- Retrospective
- Case = outcome of interest
- Control = comparing outcome

Case control study



22-24 April 2014

	Lung Cancer	No Lung Cancer
Smoking	20 (18.2%)	90 (81.8%)
Not Smoking	5 (4.5%)	105 (95.5%)

χ^2 *(df=1)= 10.150, p =0.001, OR = 4.7 (CI95% 1.7 – 13.0)*

Because $p < 0.05$, we reject H_0. Therefore there is a different between smoker & non smoker

Research Methodology Workshop
22-24 April 2014

Cases

- Well defined
- Source – institution vs. population

Control

- Matched vs. Unmatched
- Matching ~ controls resemble the cases *with regard to certain characteristics (age, gender, SES etc)*
- Individual vs. Group matching
- Source – institution vs. population
- Ratio to cases ~ up to 4:1

Case control study

Advantages

- Good for rare conditions or diseases
- Less time needed to conduct the study because the condition or disease has already occurred
- Measure multiple risk factors
- Can establish an association

Disadvantages

- Recall bias
- Not good for evaluating diagnostic tests because it's already clear that the cases have the condition and the controls do not
- It can be difficult to find a suitable control group

Example

- Tobacco use a
  of myocardial
  infarction in 52
  countries in the
  INTERHEART stu
  case-control st
  (Teo 2006)

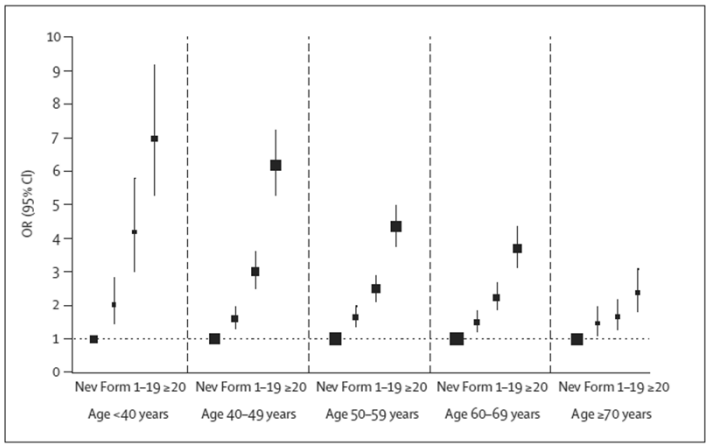


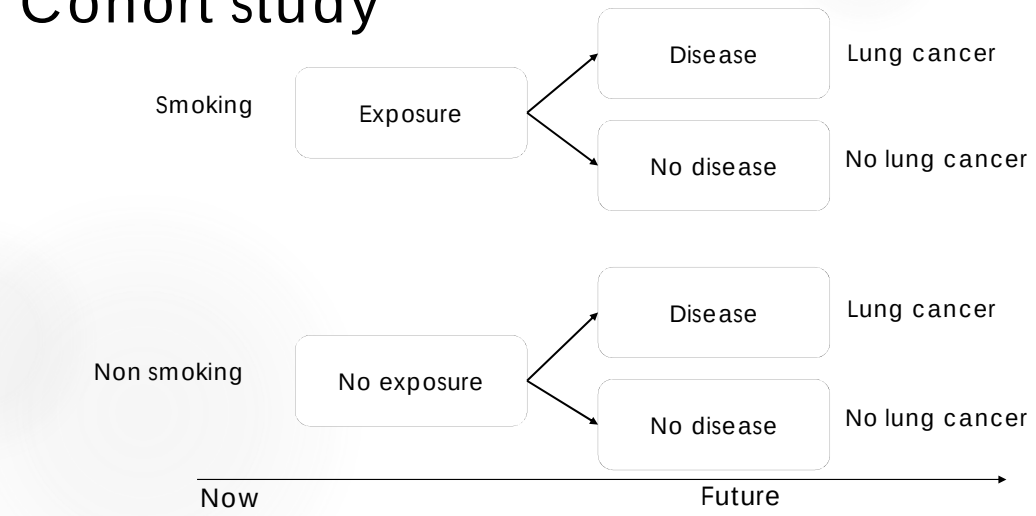
Figure 2: **Risk of AMI associated with numbers smoked, by age group**
p for interaction < 0·0001. Nev=never smokers. Form=former smokers. 1–19=currently smoking 1–19 cigarettes per day. ≥20=currently smoking 20 or more cigarettes per day.

Cohort study

- Measure outcomes
- Compare incidence of a disease (or condition) among exposed and unexposed individuals over time
- Disease free at the onset (or inception)
- Repeated measurements ~ follow up
- Prospective vs. retrospective cohort

Research Methodology Workshop
22-24 April 2014

Cohort study



Define cohort

- Both exposed & not exposed groups have equal chance to:
  - Develop disease
  - Be followed-up
- Types:
  - Representative – low exposed subjects
  - Enriched – high exposed subjects
  - Specific group – occupational, institution etc

Research Methodology Workshop
22-24 April 2014

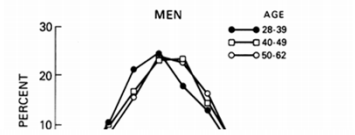
Measurements

- Exposure
  - Carefully defined in advance
  - Standard measurement for both E+ & E- groups
- Outcome
  - Primary vs. Secondary outcome

Follow-up

- Keep participation at > 90%
- Equal likelihood to detect disease in all subjects
- Active vs. Passive follow-up
- Blinding

Example



Obesity as an Independent Risk Factor for Cardiovascular Disease: A 26-year Follow-up of Participants in the Framingham Heart Study (Hubert 1983)

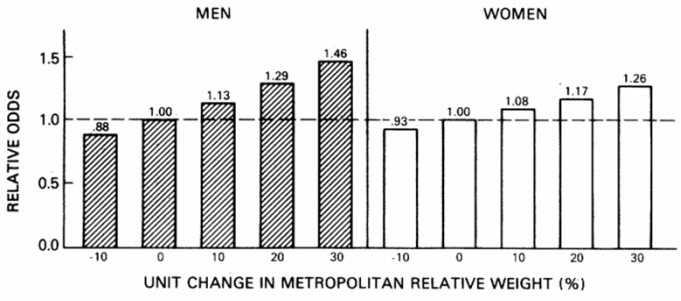


FIGURE 10. *The relative odds of developing cardiovascular disease corresponding to degrees of change in Metropolitan Relative Weight between age 25 years and entry into the Framingham Study. The odds ratios reflect adjustments for the effects of relative weight at age 25 years and age and risk factor levels at exam 1.*

Cohort study

Advantages

- Infer causality
- Measure multiple outcomes
- Study rare exposure
- Measure incidence

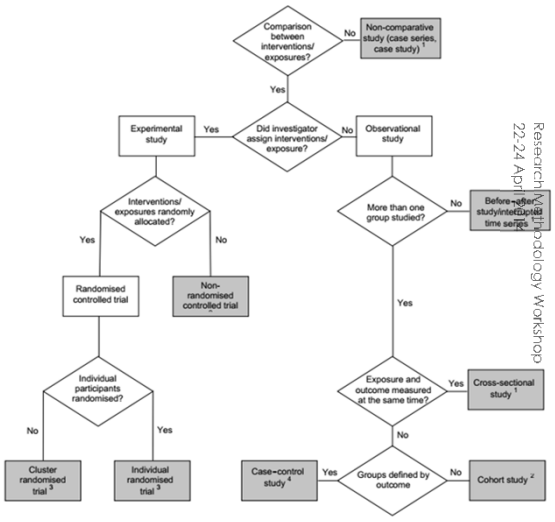
Disadvantages

- Costly
- Loss to follow up
- Large sample size for rare outcomes
- Selection bias

Research Methodology Workshop
22-24 April 2014

TABLE 2.3 CHOICE OF STRATEGY

Basis	Cohort	Case-control	Cross-sectional
Rare condition	Not practical	Bias	Not appropriate
To determine a precise risk	Best	Only estimate possible	Gives relative prevalence, not incidence
To determine whether exposure preceded disease	Best	Not appropriate	Not appropriate
For administrative purposes	Not appropriate	Not appropriate	Best
If attrition is a serious problem	Not appropriate	Attrition is usually minimal	Attrition may have occurred before the study
If selective survival is problem	Best	Not appropriate	Not appropriate
If all factors are not known	Best	Not appropriate	Less appropriate
Time and money	Most expensive	Least expensive	In between



Part 4 – Sample & sampling method

Research Methodology Workshop
22-24 April 2014

Sampling & sample size

- Type of sampling – *Random vs. Non random*
- Sample size – *Based on objective & research design*

Before we sample

Determine study place, duration & subjects

- Describe study place – especially if plan to represent a population
- State time & duration
- Who or what are the subjects – population, people, animal etc.

Research Methodology Workshop
22-24 April 2014

Subjects

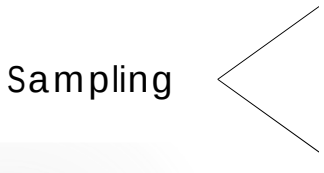
- Target population
- Study population
- Sampling frame
- Sampling unit
- Observation unit

Example – NHMS III 2006

- Target population *All Malaysian*
- Study population *Household up to strata 6*
- Sampling frame *List of Enumeration Block & Living Quarters*
- Sampling unit *Enumeration Block & Living Quarters*
- Observation unit *All household in the selected Living Quarters*

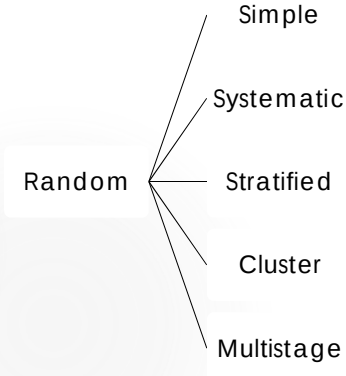
Research Methodology Workshop
22-24 April 2014

Sampling method



Random – equal chance to be selected

Random sampling



The ideal method. Randomly sample 10 students from a class of 50 students.

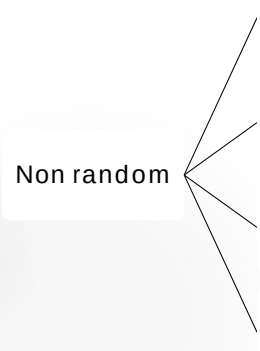
Follow certain pattern, order. Only first sample is random.

Study population divided intro strata. All strata selected. Portion of sample in each strata sampled.

Study population divided intro clusters. Assume all clusters are the same. Not all clusters selected. Only some will be sampled.

Several sampling techniques applied at different stage.

Non random sampling



Haphazard. Grab sampling. No rules. Just get the sample.

Non representative. Convenience but with certain purpose. E.g. diabetic patients on single insulin therapy.

When the sampling stop after achieving certain size.

Sample by reference or recommendation.

Example – NHMS III 2006

Two stage stratified random sampling

- Target population — *All Malaysian*
- Study population — *Household up to strata 6*
- Strata — *State & location (urban or rural)*
- Clusters — *Enumeration Block & Living Quarters*
- Sampling frame — *List of Enumeration Block & Living Quarters*
- Sampling unit — *Enumeration Block & Living Quarters*
- Observation unit — *All household in the selected Living Quarters*
- Sample distribution — *Proportionate to size*

Research Methodology Workshop
22-24 April 2014

Sample size

- How many sample required
- An estimate
- Adequate size to
  1. Represent population
  2. Test hypothesis
- Size affects duration & budget of the research
- Do not sample more than required

Sample size

- Sample size depends on
  1. Objective of the study
  2. Study design (design effect)
  3. Sampling method
  4. Expected (& precision) effect size
  5. Variability of sample
  6. Non-response rate
- Even the expected outcomes/effect size are estimates

Sample size – formula

- No single formula for all
- Depending on purpose – single proportion, compare two proportions, compare 3 proportions etc.
- Use of software or calculators e.g. PS Power and Sample Size, PASS etc.
- Anticipate non response, drop-out, loss to follow up, death (esp. animal study)

Example – Single proportion

- $N = \frac{z^2 p(1-p)}{d^2}$, where
- N is the sample size,
- z = z value for intended confidence interval,
- p is the estimated proportion (in decimal) &
- d is the precision of p (deviation from p) (in decimal)

Example – Single proportion

- Calculate sample size if you wish to do a study estimating the prevalence of DM as 20% with 5% variation at 95%CI (z for 95%CI is 1.96) anticipating 20% non response
- Answer: 246, ~ 250 then add 20% ~ 300 samples required

Group Work #2

1. What is the best study design? Give one reason
2. Describe the sample planned for your study – target, study, sampling frame, sampling unit & observation unit
3. Calculate the sample size required

Research Methodology Workshop
22-24 April 2014

Part 5 – Data collection

Plan for data collection

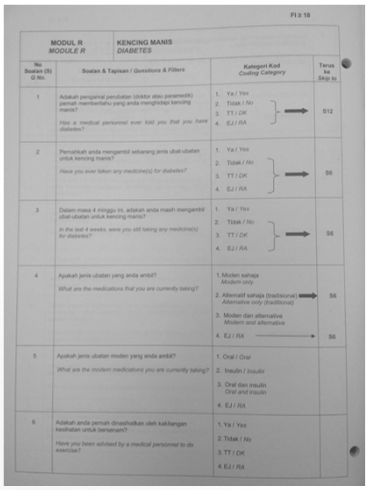
- Identify all variables of interest – *produce detail data dictionary – declare all definitions & the measure types*
- Must check **validity & reliability** of research tools – including questionnaires
- Training – ensure similar ways of collecting data
- Key word here - STANDARD

Research instruments

- Must be both valid and reliable
- Valid – content, face, criterion, construct etc
- Reliable - repeatability
- Must declare all tools used
- Including the questionnaire

Questionnaire or Record Form

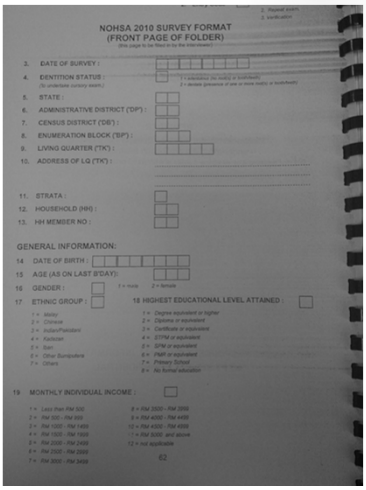
- Face-to-face vs. self-filled (online or paper-based) vs. postal vs. telephone
- Specific questions (fulfill the objectives)
- Open vs. closed ended
- Structured usually closed-ended – e.g. dichotomous, Likert scale, multiple choice.
- Response code – e.g. 1=Male, 2=Female



FI ≥ 18

MODUL R / *MODULE R* — **KENCING MANIS** / *DIABETES*

No Soalan (S) Q. No.	Soalan & Tapisan / *Questions & Filters*	Kategori Kod / *Coding Category*	Terus ke / *Skip to*
1	Adakah pengamal perubatan (doktor atau paramedik) pernah memberitahu yang anda menghidap kencing manis? / *Has a medical personnel ever told you that you have diabetes?*	1. Ya / *Yes* 2. Tidak / *No* 3. TT / *DK* 4. EJ / *RA*	S12
2	Pernahkah anda mengambil sebarang jenis ubat-ubatan untuk kencing manis? / *Have you ever taken any medicine(s) for diabetes?*	1. Ya / *Yes* 2. Tidak / *No* 3. TT / *DK* 4. EJ / *RA*	S6
3	Dalam masa 4 minggu ini, adakah anda masih mengambil ubat-ubatan untuk kencing manis? / *In the last 4 weeks, were you still taking any medicine(s) for diabetes?*	1. Ya / *Yes* 2. Tidak / *No* 3. TT / *DK* 4. EJ / *RA*	S6
4	Apakah jenis ubatan yang anda ambil? / *What are the medications that you are currently taking?*	1. Moden sahaja / *Modern only* 2. Alternatif sahaja (tradisional) / *Alternative only (traditional)* 3. Moden dan alternative / *Modern and alternative* 4. EJ / *RA*	S6 S6
5	Apakah jenis ubatan moden yang anda ambil? / *What are the modern medications you are currently taking?*	1. Oral / *Oral* 2. Insulin / *Insulin* 3. Oral dan insulin / *Oral and insulin* 4. EJ / *RA*	
6	Adakah anda pernah dinasihatkan oleh kakitangan kesihatan untuk bersenam? / *Have you been advised by a medical personnel to do exercise?*	1. Ya / *Yes* 2. Tidak / *No* 3. TT / *DK* 4. EJ / *RA*	



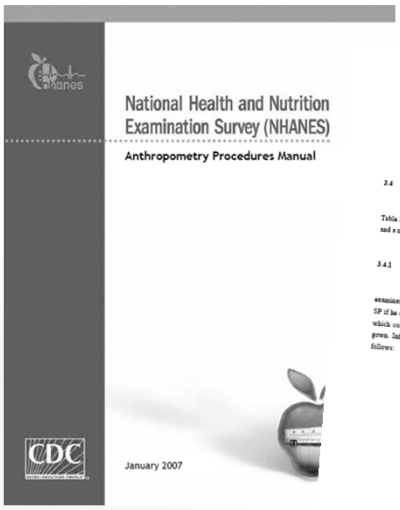
NOHSA 2010 SURVEY FORMAT
(FRONT PAGE OF FOLDER)

3. DATE OF SURVEY :
4. IDENTITION STATUS :
5. STATE :
6. ADMINISTRATIVE DISTRICT ('DP') :
7. CENSUS DISTRICT ('DB') :
8. ENUMERATION BLOCK ('BP') :
9. LIVING QUARTER ('TK') :
10. ADDRESS OF LQ ('TK') :
11. STRATA :
12. HOUSEHOLD (HH) :
13. HH MEMBER NO :

GENERAL INFORMATION:

14. DATE OF BIRTH :
15. AGE (AS ON LAST B'DAY):
16. GENDER :
17. ETHNIC GROUP :
18. HIGHEST EDUCATIONAL LEVEL ATTAINED :
19. MONTHLY INDIVIDUAL INCOME :

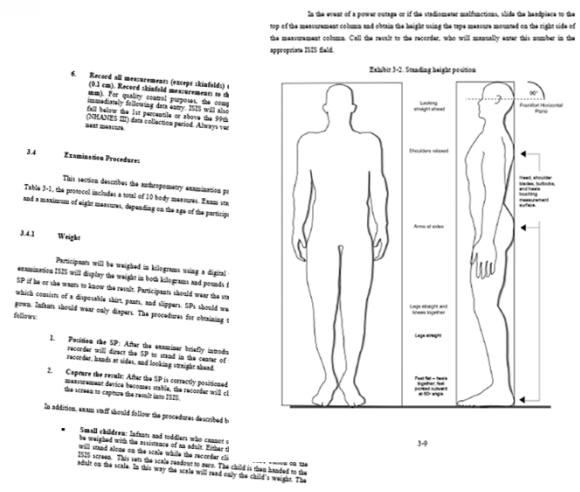
62



National Health and Nutrition Examination Survey (NHANES)

Anthropometry Procedures Manual

January 2007



In the event of a power outage or if the stadiometer malfunctions, slide the headpiece to the top of the measurement column and obtain the height using the tape measure mounted on the right side of the measurement column. Call the result to the recorder, who will manually enter this number in the appropriate HS2S field.

Exhibit 3-2. Standing height position

Looking straight ahead
Shoulders relaxed
Arms at sides
Legs straight and knees together
Legs straight
Feet flat — heels together, but pointed outward at 45° angle
90°
Frankfort Horizontal Plane
Head, shoulder blades, buttocks, and heels touching measurement surface.

3-9

6. **Record all measurement (except skinfolds)** (0.1 cm). **Record skinfold measurement to** mm). For quality control purposes, the examiner immediately following data entry. HS2S will also fall below the 1st percentile or above the 99th (NHANES III) data collection period. Always use best measure.

3.4 **Examination Procedures**

This section describes the anthropometry examination pr

Table 3-1, the protocol includes a total of 10 body measures. Exam sta and a maximum of eight measures, depending on the age of the participa

3.4.1 **Weight**

Participants will be weighed in kilograms using a digital examination HS2S will display the weight in both kilograms and pounds f SP if he or she wants to know the result. Participants should wear the sta which consists of a disposable shirt, pants, and slippers. SPs should wea gown. Infants should wear only diapers. The procedures for obtaining t follows:

1. **Position the SP.** After the examiner briefly introdu recorder will direct the SP to stand in the center of recorder, hands at sides, and looking straight ahead.
2. **Capture the result.** After the SP is correctly positioned measurement device becomes stable, the recorder will cl the screen to capture the result into HS2S.

In addition, exam staff should follow the procedures described b

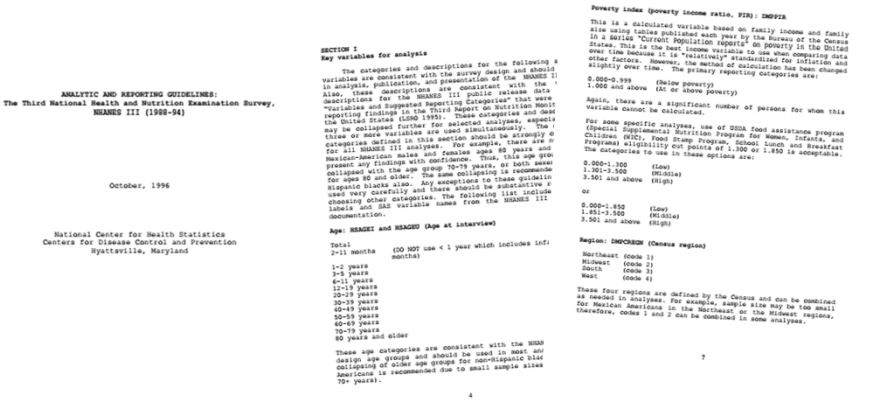
- **Small children:** Infants and toddlers who cannot s be weighed with the assistance of an adult. Either t will stand alone on the scale while the recorder cli HS2S screen. This sets the scale readout to zero. The child is then handed to the adult on the scale. In this way the scale will read only the child's weight. The

3-3

Data dictionary

- List of variables
- Definitions & working definitions
  e.g. When you say a subject is diabetes? Hypertensive?
- Cut-of-point e.g. How many age category
- Outcome vs. factors
- Type of measures – dependent or independent
- Coding e.g. 1=Male, 2=Female

Data dictionary - Example



ANALYTIC AND REPORTING GUIDELINES:
The Third National Health and Nutrition Examination Survey, NHANES III (1988-94)

October, 1996

National Center for Health Statistics
Centers for Disease Control and Prevention
Hyattsville, Maryland

SECTION I
Key variables for analysis

The categories and descriptions for the following s
variables are consistent with the survey design and should
in analysis, publication, and presentation of the NHANES I
Also, these descriptions are consistent with the
descriptions for the NHANES III public release data
"Variables and Suggested Reporting Categories" that were
reporting findings in the Third Report on Nutrition Monit
the United States (DHHS 1995). These categories and dec
may be collapsed further for selected analyses, especi
three or more variables are used simultaneously. The
categories defined in this section should be strongly c
for all NHANES III analyses. For example, there are n
Mexican-American males and females ages 85 years and
present any findings with confidence. Thus, this age gro
collapsed with the age group 70-79 years, or both sexes
for ages 80 and older. The same collapsing is recommende
Hispanic blacks also. Any exceptions to these guidelin
used very carefully and there should be substantive r
choosing other categories. The following list include
labels and SAS variable names from the NHANES III
documentation.

Age: HSAGEI and HSAGEU (Age at interview)

Total
2-11 months (DO NOT use < 1 year which includes inf
months)

1-2 years
3-5 years
6-11 years
12-19 years
20-29 years
30-39 years
40-49 years
50-59 years
60-69 years
70-79 years
80 years and older

These age categories are consistent with the NHAN
design age groups and should be used in most ana
design age groups for non-Hispanic blac
collapsing of older age groups for non-Hispanic blac
Americans is recommended due to small sample sizes
70+ years).

4

Poverty index (poverty income ratio, PIR): DMPPIR

This is a calculated variable based on family income and family
size using tables published each year by the Bureau of the Census
in a series "Current Population reports" on poverty in the United
States. This is the best income variable to use when comparing data
over time because it is "relatively" standardized for inflation and
other factors. However, the method of calculation has been changed
slightly over time. The primary reporting categories are:

0.000-0.999 (Below poverty)
1.000 and above (At or above poverty)

Again, there are a significant number of persons for whom this
variable cannot be calculated.

For some specific analyses, use of USDA food assistance program
(Special Supplemental Nutrition Program for Women, Infants, and
Children (WIC), Food Stamp Program, School Lunch and Breakfast
Programs) eligibility cut points of 1.300 or 1.850 is acceptable.
The categories to use in these options are:

0.000-1.300 (Low)
1.301-3.500 (Middle)
3.501 and above (High)

or

0.000-1.850 (Low)
1.851-3.500 (Middle)
3.501 and above (High)

Region: DMPCREGN (Census region)

Northeast (code 1)
Midwest (code 2)
South (code 3)
West (code 4)

These four regions are defined by the Census and can be combined
as needed in analyses. For example, sample size may be too small
for Mexican Americans in the Northeast or the Midwest regions,
therefore, codes 1 and 2 can be combined in some analyses.

7

Suggested details to include

1	Name	The name normally required in computer such as in database and statistical analysis. Name can be in one short word e.g. agecat for Age Category
2	Label	The name that can appear in table, graph or report
3	Definition	The definition used in the research. It is advisable to include references used
4	Instrument used	When relevant, we can describe the instrument used which include the brand and the method of calibration if relevant
5	Level of measurement	Should specify either it is nominal, ordinal or continuous
6	Category option and code	If the variable is categorical, the options should be specified e.g. Gender; Male=1, Female=2
7	Unit of measurement	If the variable is numerical, we should specify its unit e.g. mmol/L, mg/dL
8	Precision of measurement	How precise the variable is measured e.g. Age is measured to the nearest 1 year old. Income is measured to the nearest RM100
9	Data linkage	If this variable is related to other variable, we can specify here e.g. Missing value (Question on pregnancy) if respondent is Male (Question on Gender)

Data dictionary is very important!!

Research Methodology Workshop
22-24 April 2014

Part 6 – Statistical analysis plan

Statistical analysis plan

- Based on objective, especially the specific objectives – orderly manner
- Descriptive vs. analytical analysis
- The product is dummy table
- State all statistical tests planned to be used
- State significant level
- State software used
- Engage a statistician from the beginning!

Dummy table - example

Objective

To compare blood glucose level between gender

Variables involved

Variable label	*Working definition (linkage data)*	*Status*	*Variable name*	*Level of measurement*	*Category label (if relevant)*	*Variable Unit*	*Precision of measurement*	*Missing value*
Blood glucose	As measured	Dependent	glu	Interval		mmol/L	0.1	999
Gender	As reported	Independent	sex	Nominal	1 = Male, 2 = Female			None

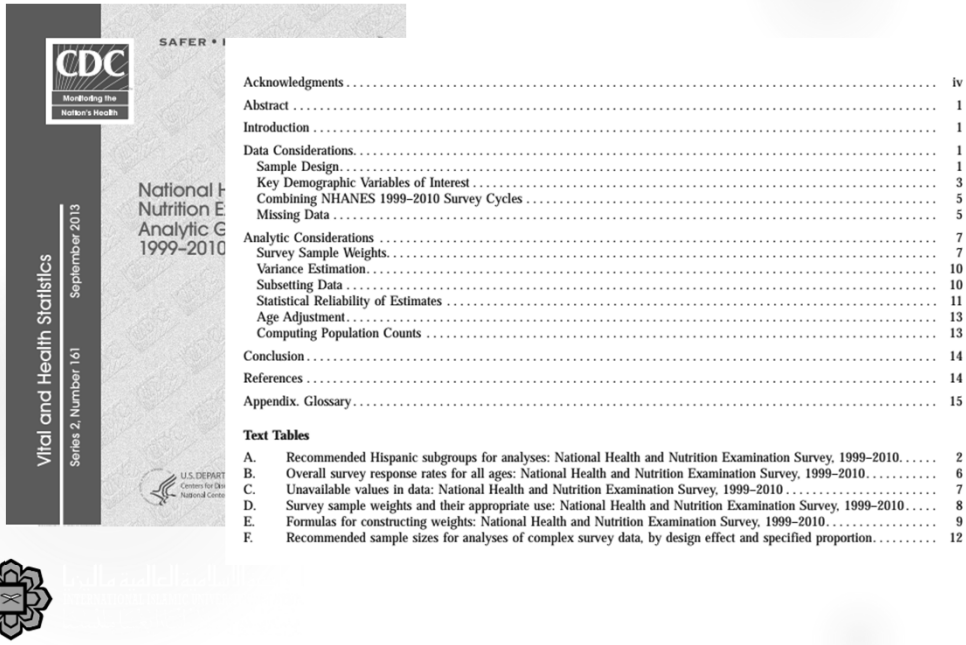
Statistical analysis

1. Check normality of *glu*
2. If *glu* Normal, run Independent sample t-test; if *glu* not Normal, run Mann-Whitney U-Test
3. Significance level = 0.05

Dummy table

	Mean (SD)	*Statistics*	*df*	*P*
Male	nn.n (n.n)	n.nnn	nn	0.nnn
Female	nn.n (n.n)			

SD = Standard deviation



SAFER • H

CDC Monitoring the Nation's Health

National H
Nutrition E
Analytic G
1999–2010

Vital and Health Statistics
Series 2, Number 161
September 2013

U.S. DEPART
Centers for Dis
National Cente

Research Methodology Workshop
22-24 April 2014

Data quality

- Valid value
  e.g. age > 200 years, weight > 500 kg, pregnant male etc
- No missing value
- Relevant skip response
  e.g. Not Applicable response for number of pregnancy for male respondent
- Declare method to ensure good data quality – e.g. double data entry

Group Work #3

- Prepare the data dictionary
- Describe what you will do with the data
- Prepare dummy table for each specific objective

Research Methodology Workshop
22-24 April 2014

Part 7 – Writing report

Before you write

- Decide the target audience
- Scientific publication or report
- Choose journal
- Study the format & requirement
- Separate text, table & graphics

The structure

Publication

- Title
- Abstract
- Keywords
- Introduction
- Method
- Results
- Discussion
- References

Report/thesis*

- Title
- Abstract
- Introduction
- Literature review
- Objective
- Methodology
- Results
- Discussion
- References

* Institution specific

The suggested sequence

1. Based on specific objective, analyse the data & produce planned tables
2. Interpret & describe the results in Result section
3. Discuss in Discussion section
4. Answer the research questions
5. Complete the method & introduction
6. Finally, write the abstract

Research Methodology Workshop
22-24 April 2014

Writing result

- Describe your result (no discussion)
- No reference (usually)
- Text vs. table vs. graphic (no redundancy)
- Text to summarise, Table for detail, Graphic to show trend
- May state relevant statistics done (if not mentioned in method)

Writing discussion

- Should answer the research questions mentioned in Introduction
- Discuss the result
- Do not repeat text as in Result
- May state limitation (but don't go overboard)
- Recommend
- Conclude

Research Methodology Workshop
22-24 April 2014

Part 8 – The administration

Other things to plan

1. Ethical consideration – consent form, advisory committee
2. Budget
3. Approval

In summary, what are the critical information

1. Specific objectives
2. Conceptual framework
3. Data dictionary
4. Dummy table & analytics guidelines