Statistics 101 on GBV for practitioners: Understanding & Interpreting the Numbers

Making friends with quantitative findings

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What are the key questions we need to answer set policies and plan programmes?

PREVALENCE: WHO HAS THE PROBLEM AND HOW BAD IS IT?

RISK AND PROTECTIVE FACTORS: WHAT CAUSES THE PROBLEM?

INTERVENTION STUDIES: HOW CAN WE FIX THE PROBLEM?

Part 1: Prevalence and Incidence

How much GBV is Happening

Lifetime prevalence of GBV

- Lifetime prevalence: cumulative lifetime experience or perpetration to date
  - Most useful for:
    - Assessing need for services that are sensitive to survivors of violence
    - Studying medium to long term physical and mental health consequences of violence
    - Use in advocacy communications (tends to be highest number available)
    - Comparing geographic settings over the long term and/or historically
  - Generally ***terrible*** for looking at impact of programmes or policies
  - Subject to recall bias & therefore underestimates

Past year prevalence of GBV

- Past year prevalence: experience or perpetration of GBV over the past 12 months
  - Most useful for:
    - Getting a current snapshot of on-going problems with GBV
    - Comparing with most large-scale & standardized data sets
    - Assessing need for services that can serve newly-traumatized survivors of violence
    - Comparing with lifetime prevalence to see how violence persists or doesn't
    - Looking at risk and protective factors for GBV
    - **Looking at impact of prevention programmes or policies**
  - Can be useful for advocacy communications (depends)

What about "incidence"?

- Classic disease-focused epidemiology:
  - Incidence rate, typically expressed in Number new cases per 100 or 1000 person years:

$$\frac{\text{Number of new cases of disease during}}{\text{Total person-years of observation}}$$

ex. Incidence of HIV among women aged 15-24 is 2.3 per 100 py

  - Incidence proportion (or attack rate), typically expressed as a percent (%):

$$\frac{\text{Number of new cases of disease}}{\text{Population at start of time interval}}$$

ex. 10% of HIV patients become infected with TB each year

  - **Incidence proportion = period prevalence but going forward in time**
  - **Most commonly use metric in longitudinal GBV research & IE**

i.e. What % of women experienced IPV on the 12 months since baseline?

ex. At follow-up, 25% of women in the study reported experiencing of physical IPV in the past 12 months

Typical assessments in a GBV Impact Evaluation

- Baseline:
  - Lifetime experience or perpetration to date (lifetime prevalence)
  - Past year experience or perpetration (past year prevalence)
- 1 year post-baseline
  - Past year experience or perpetration (now serves as measure of incidence)
- 2 years post-baseline
  - Past year experience or perpetration (now serves as measure of incidence)
- Must always specify the time component in the follow-up measures

Confidence Intervals around Prevalence

- Quantitative studies are usually based on "samples," not the full population.
- If the study were repeated using a different sub-sample of the population, the result might differ
- Therefore, "Confidence Intervals" are reported with % (e.g. 95% CI):
  - If you did the exact same project 100 times, 95 times of those times would give a result inside stated interval
  - Ex. Prevalence of lifetime IPV among women in Zambia is 32.5 (95% CI: 31.9 – 33.1)
- A larger sample size *usually* gives a narrower confidence interval.

What do these look like?

- Point estimate: expressed as a %
- 95% confidence interval around the point estimate
- Is there a significant difference? Confidence intervals should not overlap

	Setting 1: South African Clinics % (95% CI)	Setting 2: USA National % (95% CI)
Lifetime prevalence of IPV	55.4% (52.3 – 58.7)	40.6% (37.7 – 43.2)
Past year prevalence of IPV	44.6% (38.4 – 53.6)	15.8% (10.6 – 20.2)

Assessing the quality of GBV data

Assessing a GBV estimate

Ask yourself 3 key questions about the research methods:

1. What was asked?
2. Who was asked?
3. How was it asked?

Assessing a GBV estimate: What was asked?

What was the GBV outcome of interest? How was it defined and operationalized?

Was a standard measure used?

If a non-standard measure, assess everything carefully

"Ask a stupid question, get a stupid answer"

Constructs	Some Recommended Measures
IPV	WHO Violence Against Women Instrument (adapted for perpetration through extensive work in South Africa & other settings), IMAGES, and the UN MCS of Men in Asia and the Pacific, *recent* DHS surveys
Sexual violence	IMAGES, UN MCS, What Works Sexual Experience Survey (SES) – N. America

Advantages of Benchmarking

- Questions on IPV drawn from WHO Violence Against Women Instrument (for women) and International Men and Gender Equality Survey (for men)
  - Used in over 16 countries by WHO
  - Used in 11 countries by IMAGES
  - Used in 6 countries UN Multi-country Study of Men in Asia and the Pacific
  - Model for current DHS module on domestic violence, used worldwide
- Allow international benchmarking of magnitude of program effectiveness
  - Used in Stepping Stones and IMAGE trials in South Africa
  - Used in SASA! in Uganda
  - All What Works trials

Assessing a GBV estimate: Who was asked? Sampling!

- **Two key enquiries to make about sampling:**
  - ***How was this sample drawn?***
  - ***How does this sample compare to the population I want to talk about?***
- Be cautious about over-generalisation!
- (Authors do it, but readers and users of data do it more)

Generalizability: How do the people you are *reading* about compare to the people you want to *talk* about?

- Geographic area
- Age
- Socio economic status: Education, employment, housing, food security etc
- Relationship status (partnered, married, etc)
- Sexual orientation / gender identity
- Whatever else is relevant to your purpose

Sampling Strategies and Generalizability

Sampling strategy	Can be generalized to
Population-based household surveys	Valid for an entire geographic area Examples: WHO Multi-Country Study, UN MCS, DHS, IMAGES
Other probability samples, using sampling frames	The population represented by the sampling frame Examples: patients seeking care in a hospital system, students at a university, members of professional register
Respondent driven sampling	If done well, to members of a hidden population in the area covered Examples: injection drug users, sex workers, men who have sex with men
Convenience	Not generalizable

Assessing a GBV estimate: How was it asked?

Fieldwork practices can have a huge impact on disclosure

What is the single biggest problem in gathering any data on GBV?

Getting people to tell you that it is happening

Detection Biases

- Underreporting bias
- Social desirability bias

Statistical measures for reading tables

- N : a count
- % : proportion of people to whom a count applies
- 95% confidence interval (95% CI):
- p or p-value: (roughly) how likely is it that difference/association seen in the data occurred by random chance and is not "real".
  - Range 0 < p < 1; smaller p values mean more confidence
  - Usual thresholds: $p < .05$; $p < .01$; $p<.001$ (etc)
  - Careful when doing many simultaneous comparisons
- Mean: average value
- Median: Most common value

Questions ?

Part 2:
Understanding and Using Data on Risk Factors & Protective Factors for GBV

Where do we get information on risk & protective factors for GBV?
Observational Studies

Cross sectional surveys

- Can estimate prevalence (may or may not be representative)
- Can suggest risk and protective factors
- *Cannot* establish causation
- Very commonly used for GBV – now have multi-national datasets to look across settings

Longitudinal/Prospective surveys

- Follow the same group of people over time
- Can establish incidence
- Can help establish causation (know time sequence of events)
- UNCOMMON in GBV research – it's unethical to refrain from helping!

However! You CAN use data from intervention studies to answer observational questions

Where do we get information on risk & protective factors for GBV?

- Primary or secondary analysis of data from impact evaluations
  - Follow the same group of people over time
  - Can establish incidence
  - Can help establish causation (know time sequence of events)
  - Becoming MORE common in GBV research – lots of prevention trials!

Some Common Terminology

Outcome variable (Y)

- **The thing you hope to change** or most want to explain(for most of us, GBV)
- aka **dependent** variable
- aka **criterion** variable

Independent variables (X_1, X_2, X_3, … X_{etc})

- The **intervention** in experimental research
- aka **predictor** or **exposure** variables in epidemiological studies
- aka **correlates** in cross-sectional studies
- aka **risk factors, protective factors, drivers**

3rd Variables (usually in models only)

- **Mediators** (mediating variables, effect modifiers)
  - a variable that explains (or mediates) the observed relationship between two other variables
  - changes the of the relationship between X and Y (usually by getting in the middle)
  - Example: The association between experience of sexual violence and increased alcohol use is mediated through and increase in depression & PTSD
- **Moderators** (moderating variable, buffer, confounder)
  - Identifies conditions under which the relationship between two variables might be stronger or weaker
  - Also: covariates, extraneous variable, lurking variable
  - Example: Alcohol increases risk of non-partner sexual violence for

    young women at university more than older married women

Example: Comparing age and education

	Women (N=1400)		Men (N=1400)		
	Mean	95% CI	Mean	95% CI	p
Age	33.0	(32.4-33.6)	34.8	(34.2 - 35.5)	<.0001
Education	**N**	**%**	**N**	**%**	
No school	240	17.2	241	17.2	0.74
Primary	911	65.2	913	65.2	
Secondary	158	11.3	163	11.6	
> Secondary	60	4.3	62	4.4	

More on p-values and confidence intervals

- P-values and Confidence intervals are based on measures of the "standard error"
- The standard error tells use how precise our measurements are
  - Note that it tells us nothing about accuracy!
- There are different ways to calculate standard error if you have
  - Simple random sample
  - Stratified sample
  - **Cluster sample**
- There is no single best approach

Measure of association

Suppose we want to know how STRONGLY a factor is associated with IPV

Most common measures are Odds Ratios and Risk Ratios or Relative Risk

If you want to understand them, take an intro epi class

If you just want to USE them ….

Dr. Dunkle's quick and dirty guide to odds ratios risk ratios, part 1

Odds Ratios	Risk Ratios / Relative Risk
Come from cross sectional data	(Usually) come from longitudinal data
Speak to correlations	Aspire to be about causality
Often OVERESTIMATE associations	Are usually pretty accurate
Odds of 1:1 gives a ratio of 1.00 = no effect	If risk in exposed = risk in unexposed, then Risk (exposed)/Risk (unexposed) = 1.00 = no effect
OR > 1 = positive associations = risk factor	RR > 1 = positive associations = risk factor
OR < 1 = neg association = protective factor	RR < 1 = neg association = protective factor
Can be crude (2 variable) or adjusted (in a model with lots of variables)	Can be crude (2 variable) or adjusted (in a model with lots of variables)
Use the words "increased odds / decreased odds" to discuss. Do NOT say "risk." Be smug.	Go ahead and talk about "risk". It's right there in the name.

Build Models

What is a model?

- A set of calculations that account for relationships among many variables simultaneously
- A set of statistical relationships that (hopefully!) represent some aspect of reality

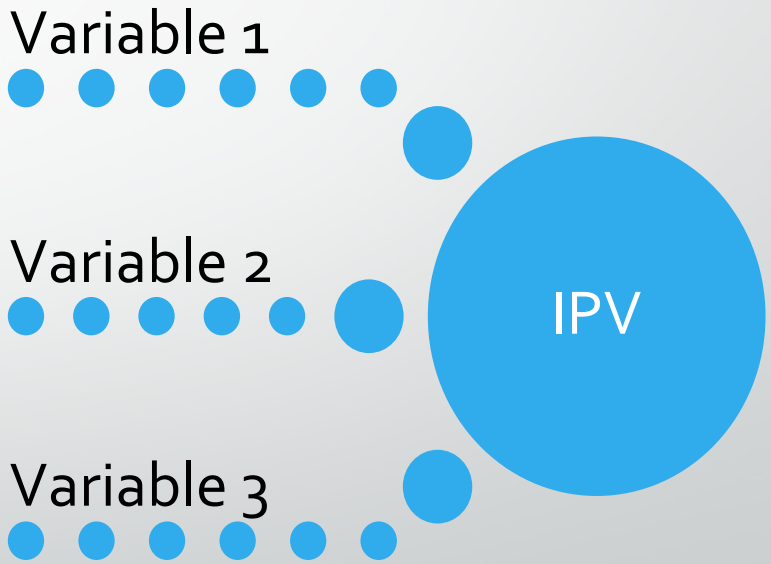
Why model?

- Everything in your data is interdependent; models help handle this complexity
- Eliminate "confounding"
  - *Example: Coffee drinkers get more lung cancer. Does coffee cause lung cancer? NO. But coffee drinkers are more likely to smoke cigarettes.*
- Learn which risk & protective factors have biggest impact on outcome
  - *Does education or availability or services matter MORE?*

Commons Models in IPV Research

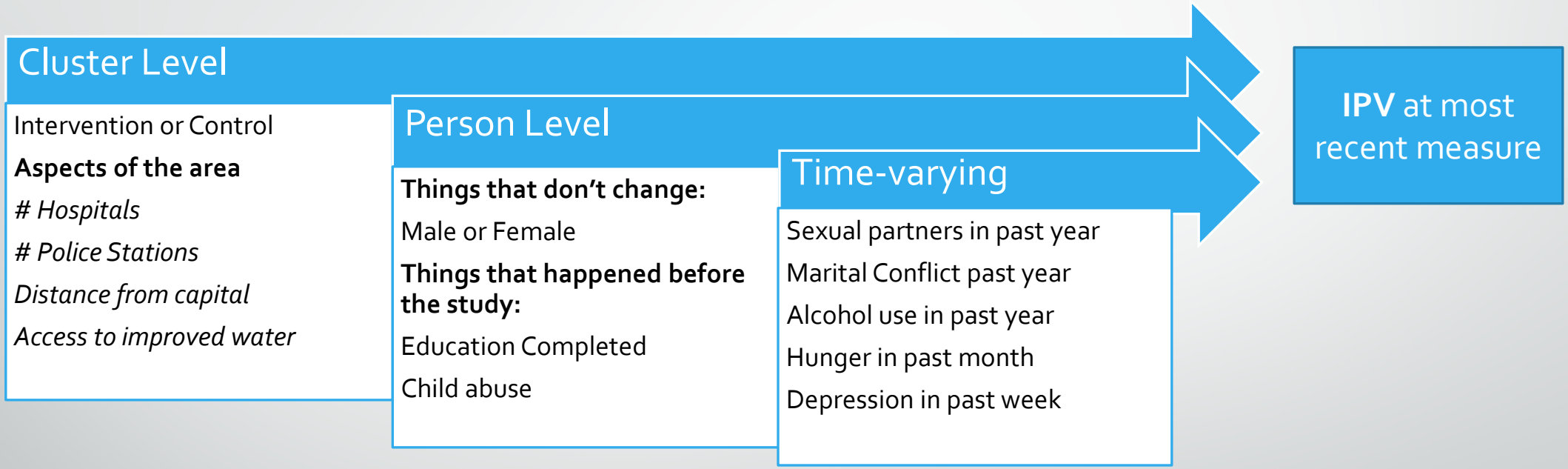
Multiple or Multivariable Regression: Multiple variables pointing together at a single outcome variable

Logistic regression: dichotomous outcome	**Multinomial** regression: categories	**Poisson** (or log-linear) for counts
• IPV No or Yes • Expressed as Odds Ratios (sometimes Risk Ratios)	• IPV: None, Physical Only, Sexual Only, Both • Each other category compared to "none" in turn • Often expressed as Risk Ratios	• IPV: How many times did it happen? • Often expressed as coefficients



Commons Models in IPV Research

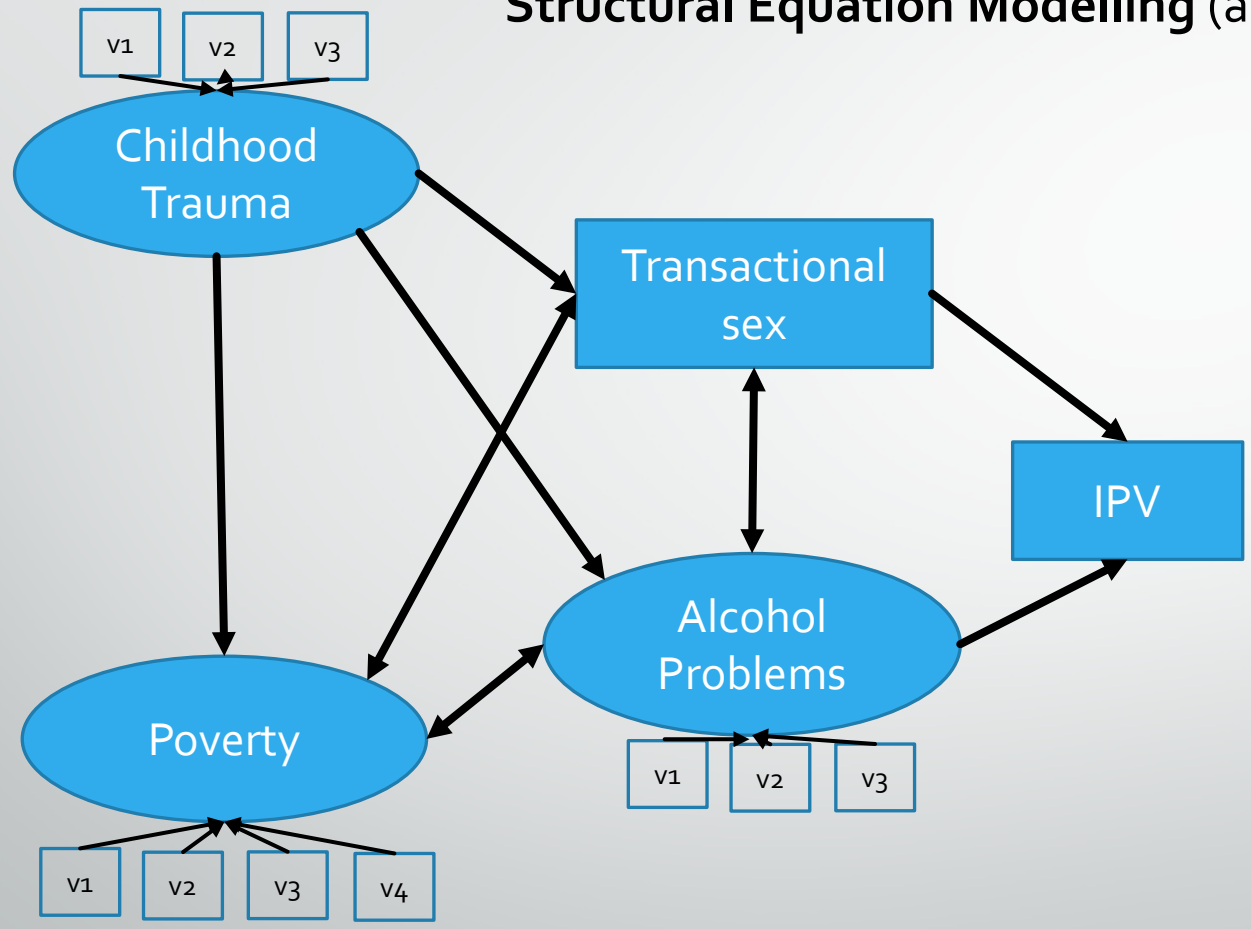
Hierarchical Linear Models (see also Generalized Estimating Equations)



- **<u>Super Great</u>** for cluster sampled data
- Equally good for longitudinal or cross-sectional
- "Hierarchical" means looking at the data at multiple different levels at the same time

Commons Models in IPV Research

Structural Equation Modelling (also path analysis)



- **Looks at multiple pathways between a collection of variables**
- **Can include "latent" variables – multiple scale items pointing at a single construct**
- Output is a coefficient for each line and a test for significance; non-sig lines are usually dropped
- Good for cross sectional or longitudinal data
- **MUST be solidly grounded in a theory**
- Requires specialized methods to do this on cluster sampled data, but can be done

Useful points and tips about models

- Building from a THEORY almost always helps
- In general, more "parsimonious" (smaller and simpler) models are preferred, even if you can get the same answer in a more fancy way.
- If you get the same answer by doing the model more than one way, your answer is more likely to be real (consistency, coherence).

Top Tip: Always, always, always check the N (number of observations) included. If more than a handful are missing, these is a problem

Most often attributed to McCullagh and Nelder (1983, 1989)

1. **All models are wrong, but some are more useful than others**.
2. Do not fall in love with one model to the exclusion of others.
3. Thoroughly check the fit of a model.

Part 3:
Understanding and Using data from RCTs and other Impact Evaluations

What is impact evaluation?

- There are many types of "evaluation"
  - Needs assessment: What do our stakeholders needs or want? What is missing?
  - Formative or developmental: How might we fill the gaps?
  - Process or operational: Are we doing what we said we would? How well is it going?
  - **Impact evaluation:**
    - **Did things change?**
    - **Are they better? Are they worse?**
    - ***Would they be the same even if we did nothing?***
  - *Academic & research types often talk about "trials"*

Outcome measures in GBV IEs

- Impact Evaluations are a special case for risk factor analysis
  - Key protective factor of interest is *assigned*
  - Generally looking for Risk Ratios because longitudinal
    - You are trying to DISPROVE RR = 1.00
    - Protective effect is RR < 1.00 for the intervention
    - Confidence interval must NOT include 1.00
    - P-value if presented should be significant
    - RR should be adjusted for any factors that differed at baseline
    - Can interpret 1-RR as % reduction in outcome
      - i.e. RR= 0.55 (95% CI 0.45 – 0. 65) = 45% reduction in GBV

Key elements of impact evaluation I

What do change we want?

- Define a set of key outcome variables / indictors based on objectives

Where we are we starting?

- Assess or measure key variables / indicators BEFORE starting (Baseline / Pretest)

Did things change? Are they better? Are they worse?

- Must look at **multiple time points**

Key elements of impact evaluation II

Where did we get to? What's different?

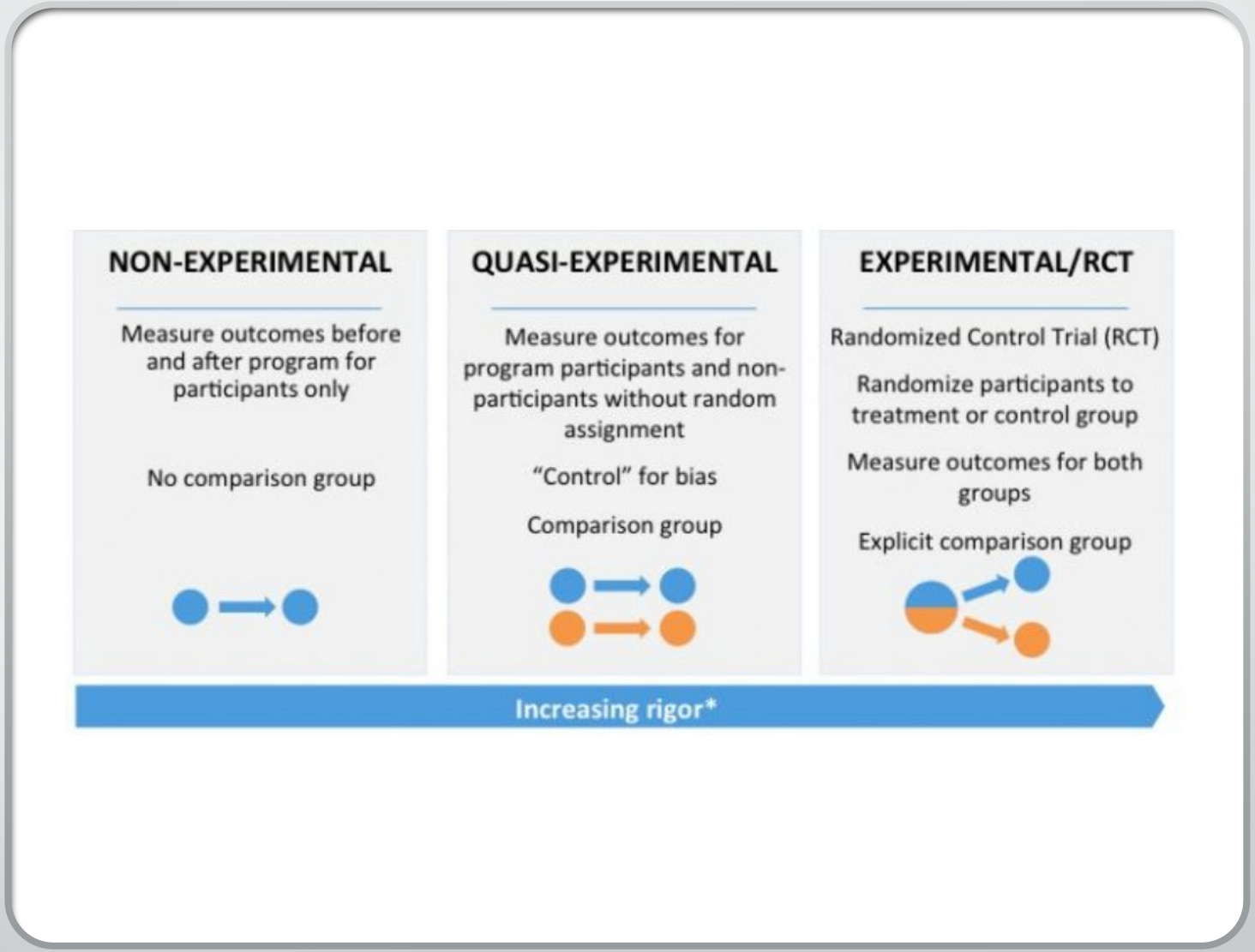
- Assess or measure key indicators AFTER program (Endline / Post-test)
- If interested in the process / progress of change, can measure 1or more times DURING program (Midline)
- If interested in sustained impact, can measure again 1 or more ties AFTER the end of the program

Key elements of impact evaluation III

Would things be the same even if we did nothing?

- If we want to say **our program** *caused* change, we need to compare our outcomes to people who have *all the same experiences* EXCEPT our program
- Requires a counterfactual or "control" population
  - The world changes all the time
  - People we are targeting do things for themselves
  - People who are not us offer services
  - Big events happen that impact everyone

Type of study designs



Randomized Controlled Trials (RCTs)

- **Randomized Controlled Trials**
  - "Gold standard" of evidence
  - Individuals or groups of people who are equally eligible and split ***by chance*** into intervention and control groups
- Allocating by ***chance eliminates*** volunteer and selection bias
- ***Eliminates*** history bias (i.e. everyone experiences the same current events)
- ***Allows*** change to be attributed to the programme

- ***Most persuasive to policy makers and donors***
- ***Best (potential!) tool to advocate for program effectiveness***

RCTs, Individual Randomization

- Participant enrols and then is randomly allocated to intervention or control
- Statistically simplest, requires smallest sample sizes
  - Often less expensive
- Must be able to logistically handle individual allocation, e.x.
  - Randomly allocate clinic patients to new counselling strategy or standard care
  - Randomly allocate students to different versions of a programme
- Works best with interventions that are delivered to individual people & interventions where little spillover/contamination to controls is expected

RCTs, Cluster Randomization

- Most common in GBV research
- Used when intervention is delivered at group level or expected to have group effects
  - By geography: village, province
  - By institution: clinic, school
  - Other logistical reasons
- Groups randomly assigned to intervention or control
- Statistically more complex, must adjust sample sizes and analysis to account for the clustering

Key Variations in Impact Evaluation

- Non-Experimental
  - No control groups or counterfactual
  - Can select people by any strategy
  - Measures (hopefully) at multiple points in time
  - Is easiest and cheapest
  - Cannot say that change was due to program

- Quasi-experimental
  - Uses a control or counterfactual group, but not fully random
  - Usually easier and cheaper
  - Eliminates history bias; vulnerable to selection & volunteer bias

Evaluation without impact

- Endline or post program assessment only
  - Good for assessing participant impressions of and reactions to a programme
  - Good for demonstrating feasibility or acceptability of an intervention strategy
  - Can be very useful in looking at process and operational variables

  - **Cannot assess impact**

Qualitative Evaluation

- Looks in depth at smaller numbers or people or groups
- Able to gather deep and detailed information about process and motivations for change
- Useful what quantitative methods are infeasible (too expensive, too complicate)
- Useful when process of change is not yet understood
- Best for answering questions about “how” and “why”

How to learn more…

Suggested resources (NOT official endorsements):

- David Kleinbaum (legendary prof!) free, low-bandwidth, online class in epidemiology: http://activepi.herokuapp.com/
- Intro Epidemiology online by UNC faculty; free if you do not need a certificate https://www.coursera.org/learn/epidemiology:
  - Coursera & other MOOCs also have social science stats courses
  - Adding courses regularly in languages other than English

- **Mess around with data and make as many mistakes as you can!**
- **Prof. Google is your best friend**
  - Put is the name of your software and what you want to do: someone has written code!
  - Lot of useful tutorials can be discovered this way