

CPT898: Foundations of Social Science Research

Nov 2016

Cross-sectional, Longitudinal and
Experimental Research Designs

Lecture Overview

- What is research design?
- Cross-Sectional
- Repeat-Cross-sectional
- Longitudinal
- Experimental Designs

What is Research Design?

- The research design provides a framework for the collection and analysis of data. A choice of research design reflects decisions about the priority being given to a range of dimensions of the research process. These include the importance attached to:
 - Expressing causal connections between the variables
 - Generalising to a larger group of individuals
 - Having a temporal appreciation of social phenomena and their interconnections
 - Understanding behaviour and the meaning of that behaviour in its specific social context

(Bryman, 2012:46)

Research Design & Research Questions

- Research questions / hypotheses inform the choice of research design. The ability to answer most research questions is dependent on using the correct research design
- The function of research design is to ensure that the evidence obtained enables us to answer the initial questions as unambiguously as possible. De Vaus (2001:9)
- For example, how can you measure changes over time with a one-off survey?

Good practice in developing a Design

- Anticipate alternative explanations before collecting data
- For example, an observed increase in divorce rates following introduction of no fault divorce legislation may be explained as:
 - No fault divorce directly causes increase in divorce
- Plausible rival explanations
 - NFD leads to devaluing of marriage
 - NFD is a response to increasing marriage breakdown
 - Any increase in divorce – simply a catch up in formalising ended marriages
 - Any increase – simply long term trend – would've happened anyway
- Design the collection to obtain context and comparisons. This will reduce ambiguity of data

Principal Types of Research Design

- Cross Sectional
- Longitudinal
- Case studies
- Experiments, Randomised Controlled Trials (RCTs)

Research Design and Methods

- Research design is distinct from methods
- “A study that followed infants from birth to adolescence weighing them on 1st January every year would be longitudinal in design. A study that followed infants from birth to adolescence, interviewing their parents about their happiness every year, would also be longitudinal. A study that did both of these would still be longitudinal, even though some commentators would, distractingly and pointlessly, categorise the first study as ‘quantitative’, the second as ‘qualitative’, and the third as ‘mixed methods’.”

Gorard, S. (2013) Research Design. (p6-7)

Cross-Sectional Research Designs

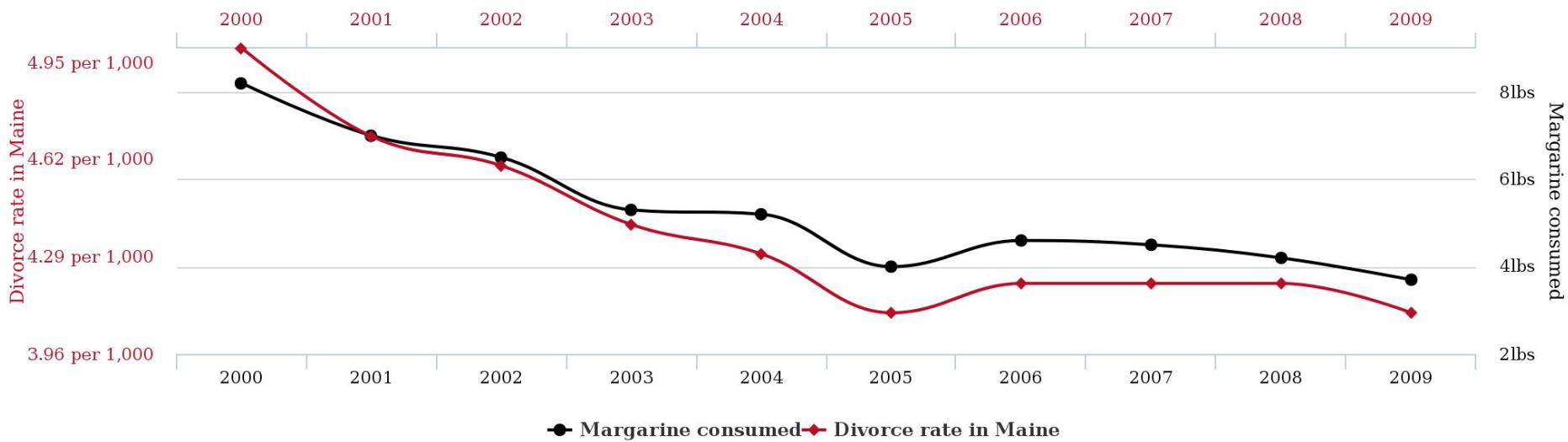
Cross-Sectional Designs

- Provide a snapshot at a point in time
- Allow you to assess prevalence or average
 - For example:
 - What is the average income?
 - Are there differences between groups?
- Identify existing differences, relationships between groups
 - Need to think about groups beforehand and be aware of sample size



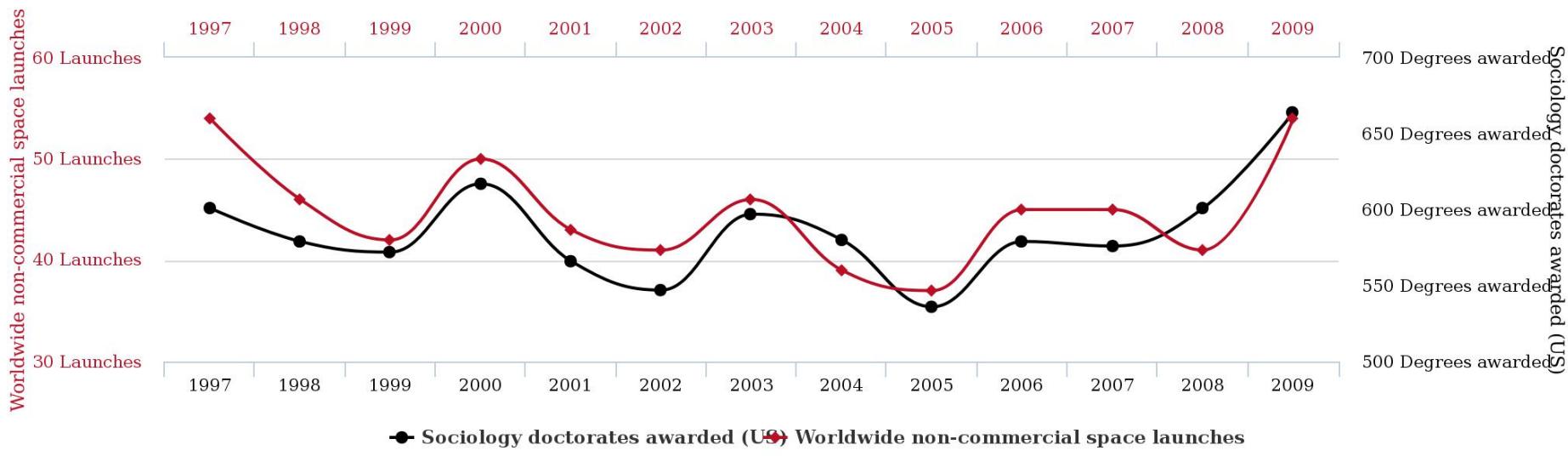
Spurious Correlation 1

Divorce rate in Maine
correlates with
Per capita consumption of margarine



Spurious Correlation 2

Worldwide non-commercial space launches
correlates with
Sociology doctorates awarded (US)

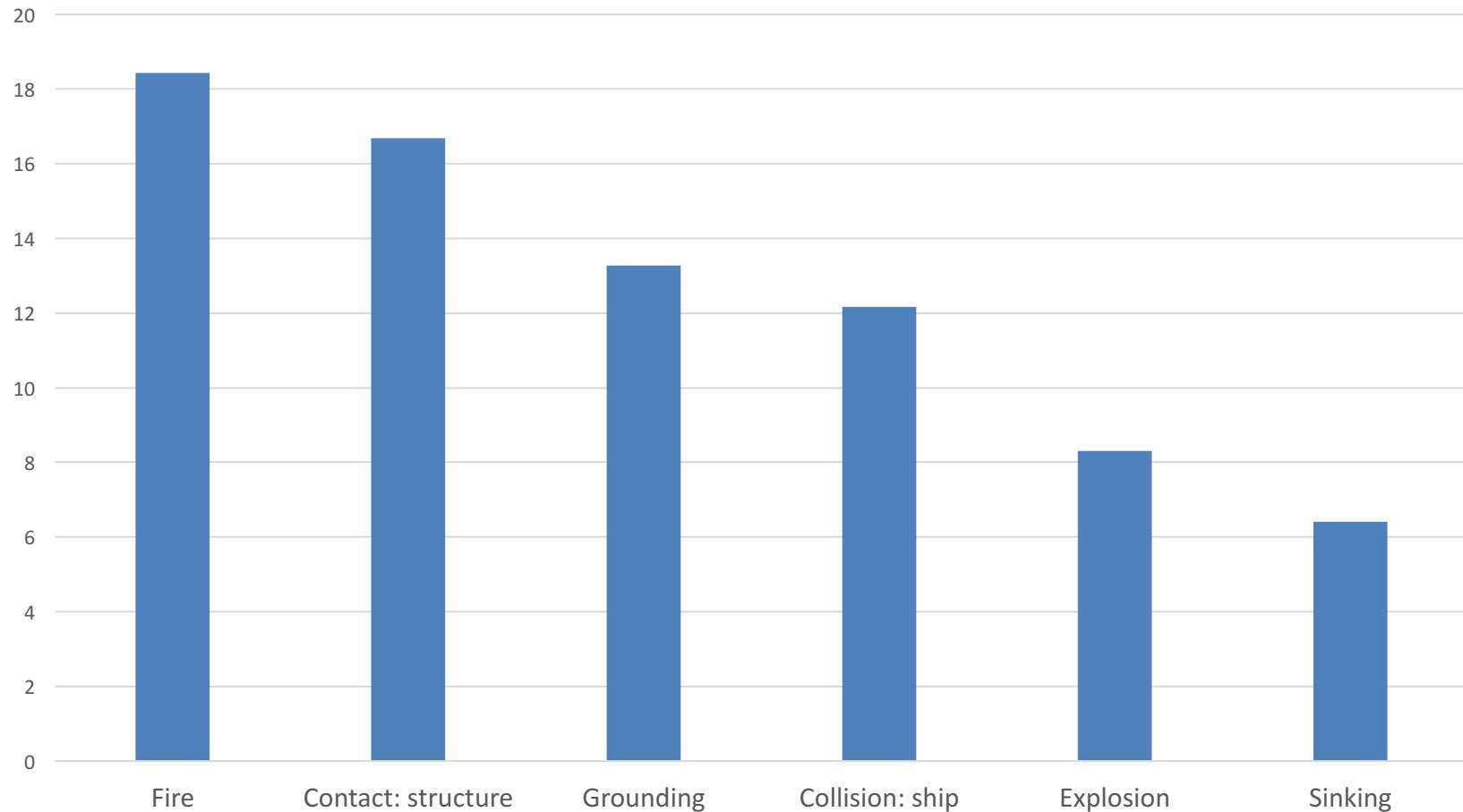


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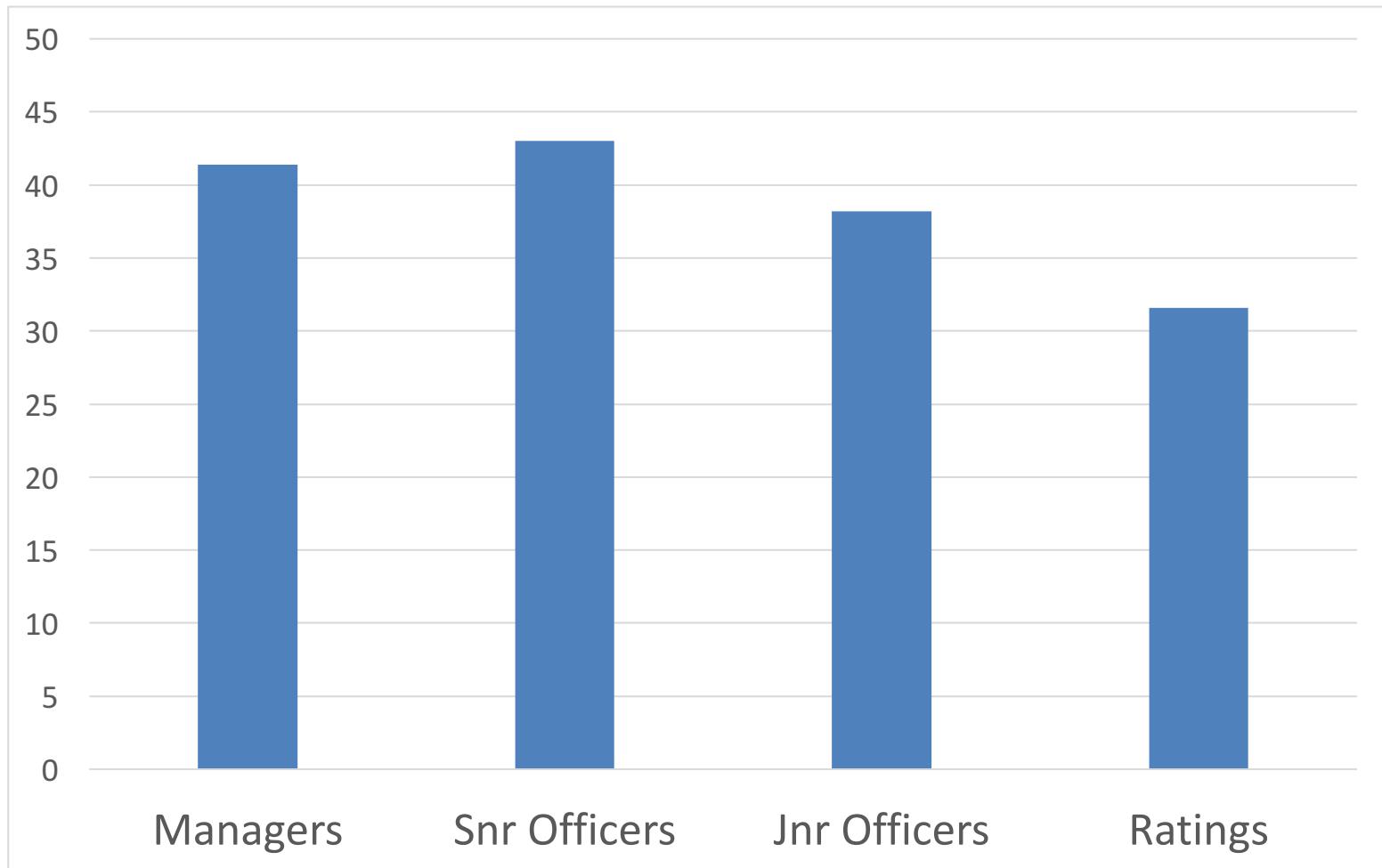
<http://tylervigen.com/spurious-correlations>

Frequencies

Perceived likelihood of incident



Comparisons: Likelihood of Fire



Why is risk of fire perceived to be a major risk by seafarers aboard ship?

- I mean if it's a major fire, then we've got the equipment but we don't have the manpower for a major fire. That's why we've got a lifeboat so we can all just get off. (Captain)
- Well we're such a small crew. If there was a fire in the engine room... You probably have no chance ... Not enough people. (chief officer)
- a ship this size, if we had a big fire, how many fire fighters would you have down on the quay to fight it, there would just be hundreds of people round, there'd be all kinds, specialists, but we're expected to fight it with what, 24 people on board, of which you're going to have 2 people on the bridge, you've got to have 2 people in the engine room, the electricians going to be running around, there goes 5, you've got 19 left - 4 of them are out of the game because they're cooks and stewards and they're just not interested, they've got no experience of what's going on. ... so you're down to very few, realistically what equipment have we got as well to fight an incident, a dangerous cargo fire on deck (Navigator)
- if you had to go in and fight a fire I think you would struggle. The first wave would be fine, but once you got in there it's maybe the third attack when you're going in you'd start to get a bit thin on the ground (Chief Engineer)

Cross-Sectional Designs: Limitations

- Cannot measure temporal elements: asking someone what something was like before as compared to now is not capturing temporal change
- Cannot measure causal relations only associations
- Cannot be used to measure the effects of social policies or interventions although frequently (e.g. poor educational evaluation post-event)

Cross-Sectional Designs: Examples

- Despite the problems, cross-sectional designs are very common and used in many studies including:
 - Evaluation and customer service research
 - e.g. National Students Survey (NSS)
 - All undergraduate final year students in UK HEIs
 - Online, postal and telephone



Repeated Cross-Sectional Research Designs

Repeated Cross-Sectional Designs

- We can get a better understanding of change if we repeat cross-sectional studies over time
- However this would involve surveying different samples at each time point (multiple independent samples)
- Danger of confusing changes over historical periods with changes in the life of individuals.
 - That is, repeated cross-sectional surveys allow you to answer questions about social change (but not individual changes over time which requires a 'cohort' study)

Examples of repeated cross-sectional designs include:

- British Social Attitudes Survey
 - Conducted annually since 1983 (exc. 1988 and 1992)
 - Samples around 3,000 people every year
 - Over 80,000 participants so far
 - Topical issues (social, political and moral attitudes)

- General Lifestyle (Household) Survey
 - Conducted annually since 1971 (exc. 1997/8 and 1999/2000)
 - Consists of a continuous component (constant 2000-2004)
 - Also a ‘modular’ component which can change
 - Introduced a longitudinal component in 2005/06





Longitudinal Research Designs

Longitudinal Designs

- Longitudinal designs repeatedly collect data from the same sample of individuals (or families) at repeated (>2) time points
- Allow us to measure changes in this ‘cohort’ of individuals over time



Longitudinal Designs: Examples

- Studies that follow the same group ('cohort') over an extended period of time include:
 - 1958 National Child Development Study (17,500 people born in 1958)
 - Children surveyed at 7, 11, 16, 23, 33, 42, 46 and 50
 - Includes DNA data
 - Supplementary data from 1971 and 1981 Censuses
 - School leaving examination results collected in 1978
 - Millennium Cohort Study (18,000 people born in 2000/01)
 - Allowed for seasonal effects (whole year sample)
 - Covers whole of UK inc. N. Ireland
 - Fathers interviewed as well as mothers (more than 1 respondent)
 - Children surveyed at 9 months, 3, 5 and 7 years
 - Includes saliva samples
 - Linked to routinely collected data (e.g. National Pupil Database)

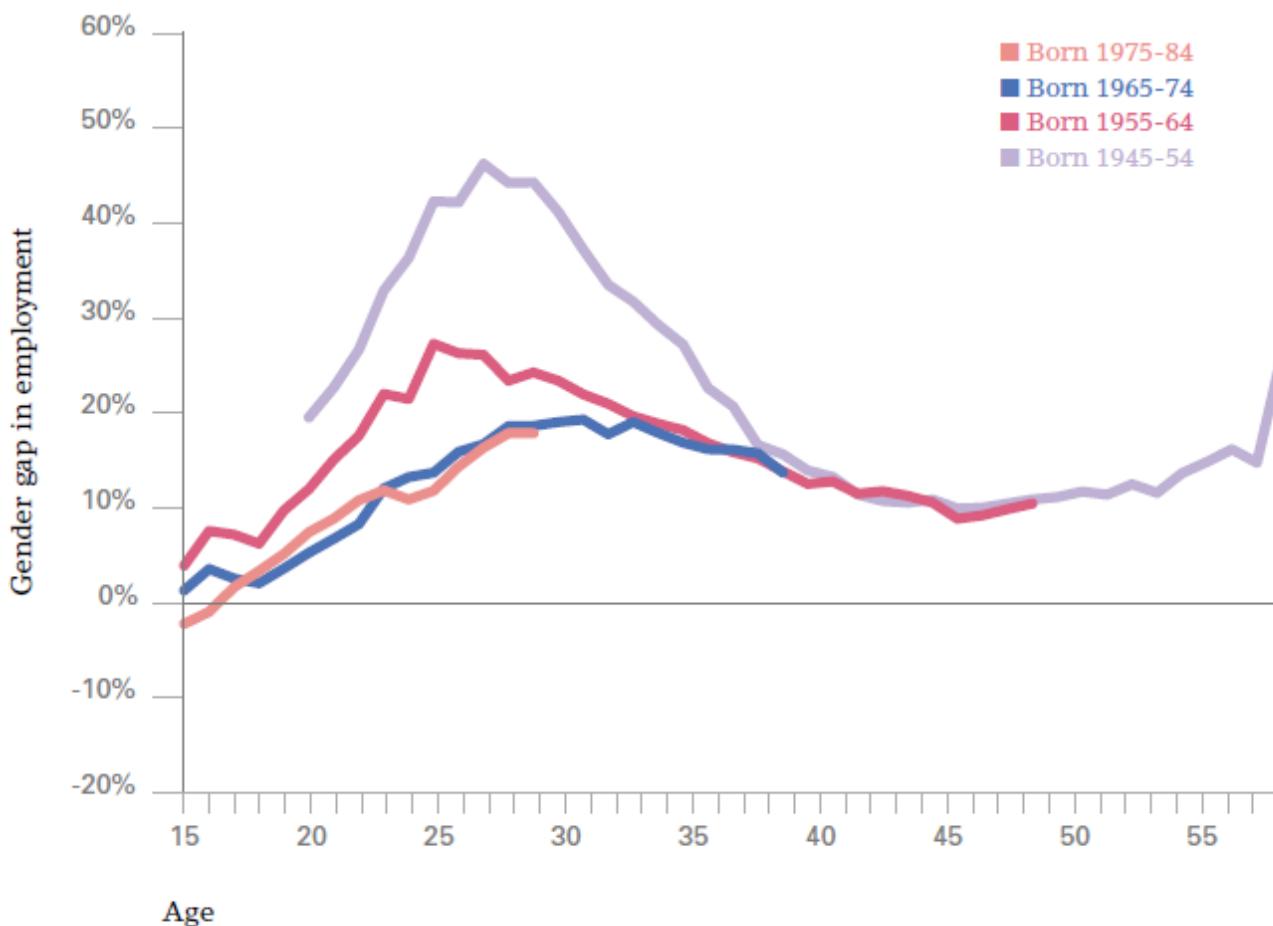
An example: Changes over time & between groups

- While the pay gap between men and women is reducing, the rate of reduction is slowing and varies over the lifecycle
- For those women born in the years 1965-74, the current pay gap is 8% less than it is for those born 10yrs earlier
- By contrast, those born 1977-84 are only 2% better off than women born in 1965-74
- If the pace of change continues at this rate = equal pay achieved in 150 years
- Manning, A. (2006) 'The gender pay gap', CentrePiece, Summer. London: CEP Discussion Paper, 700.
<http://cep.lse.ac.uk/pubs/download/dp0700.pdf>

Variations in inequality over the lifecycle

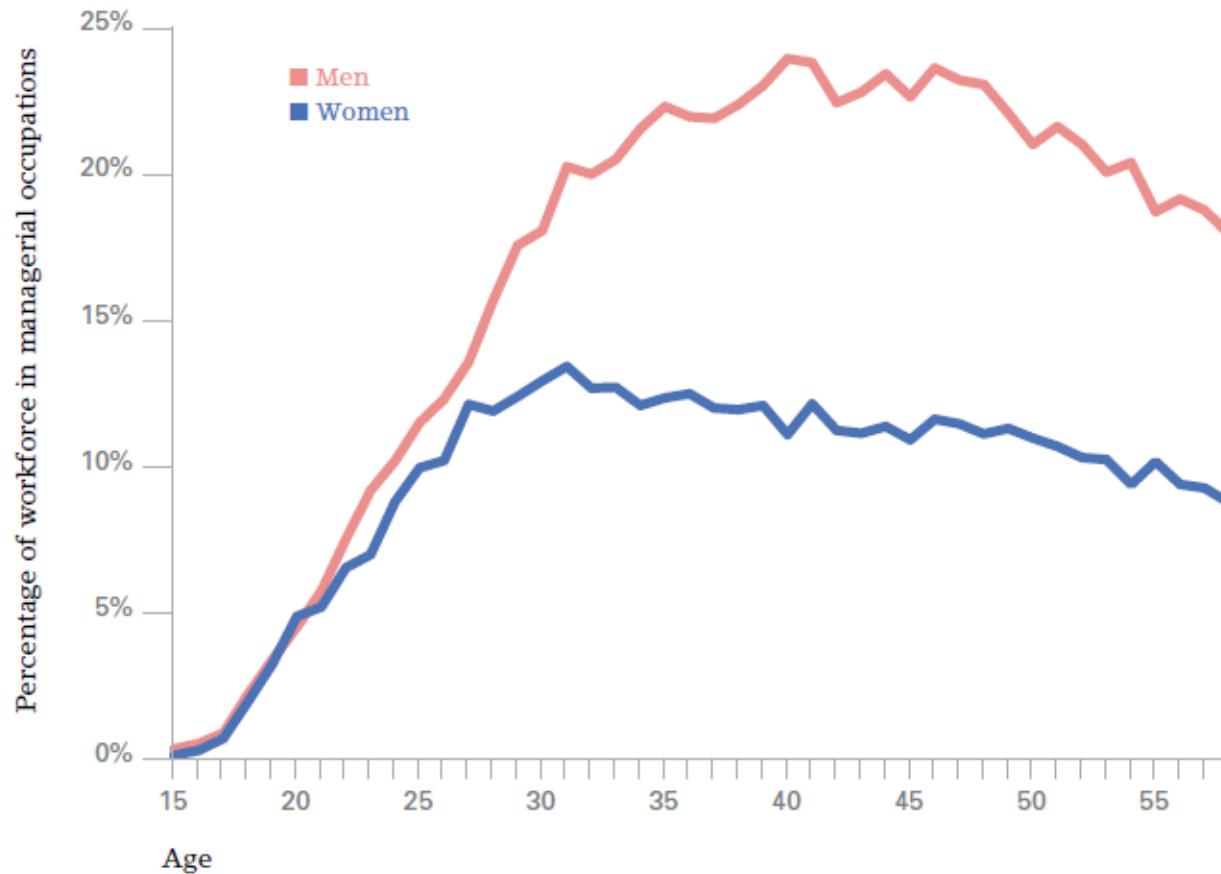
Figure 2:

The gender gap in employment and the lifecycle for different birth cohorts

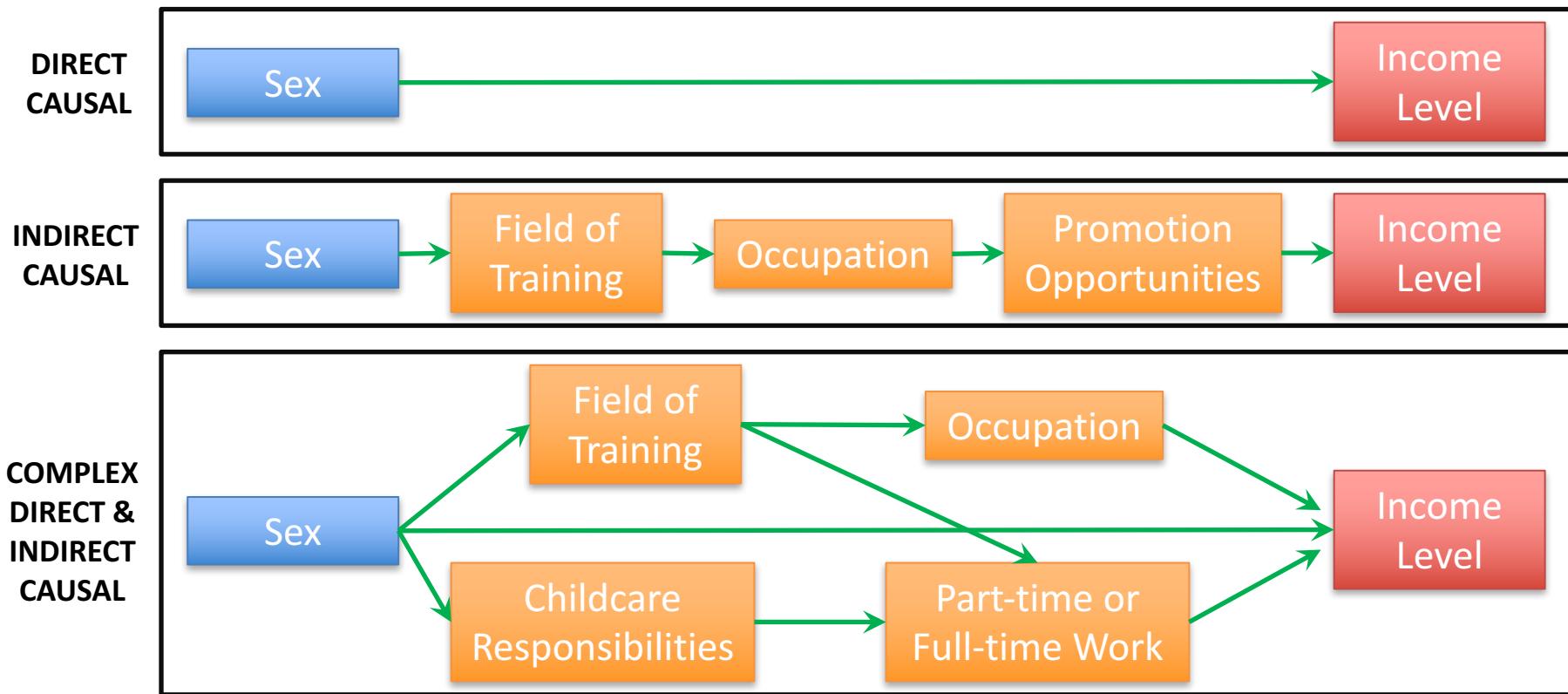


A glass ceiling in late 20s?

Figure 4:
Percentage of managers and the lifecycle



As social scientists we need to be very careful about claiming causal links...



Source: de Vaus, 2011



Experimental Research Designs

Experimental Designs

- Typically used in the natural sciences
- In a controlled environment (usually a laboratory) a single variable is changed and the outcome measured



Experiments in the social world can only emulate those in the physical world

Randomized Control Trials (RCTs)

Traditionally used in medicine and epidemiology, now commonly used in educational evaluations, gets closest to experiments in natural sciences by substituting randomisation for physical control

- RCT is a longitudinal study in which participants are randomly allocated into ‘study’ (or treatment) and ‘control’ groups
- The two groups must be the same in all relevant ways at the outset and participants, covered by random selection
- Measure before and after intervention ($t1$ and $t2$). You must measure the same thing before and after (i.e. use same questions)
- You only change a single variable – everything else is constant
- **Any measurable difference between the two groups is either due to intervention or chance – this can be quantified**
- Hence, good for measuring the **causal effect**



Stages of RCT

MRC guidelines recommend three pre-intervention stages in development of an intervention and RCT.

1. Initial design of intervention
 - Ensure grounded in theory and have explicit interpretation of causal mechanism
2. Using primarily qualitative methods conduct formative evaluation intervention to identify how it is working, potential barriers and facilitators
3. Intervention tested in a feasibility study where implemented and tested for acceptability to providers (e.g. teachers) and target audience

Moore, et al (2003)

Stages of RCT

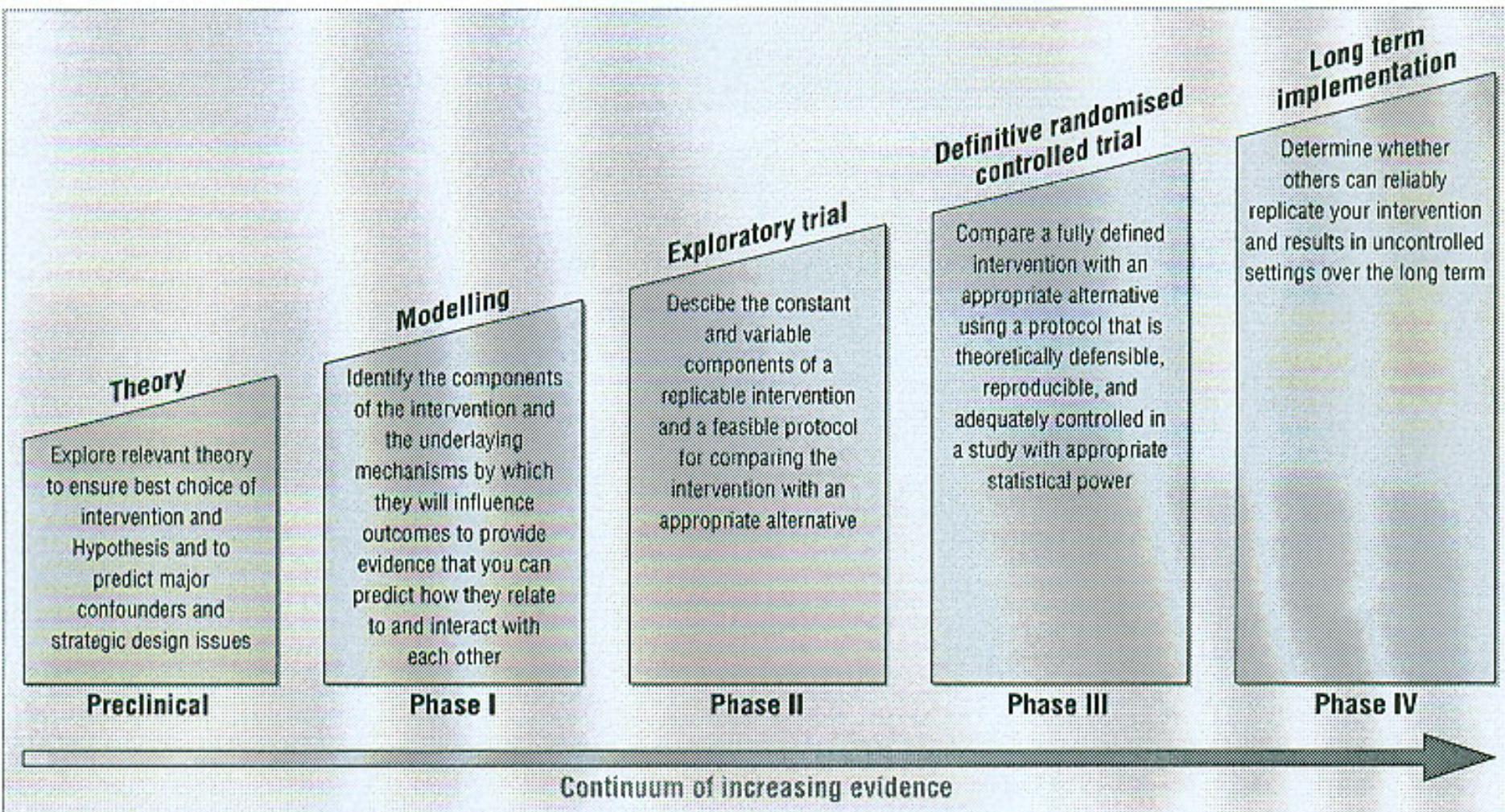


Fig 1 Sequential phases of developing randomised controlled trials of complex interventions

Methodological issues in RCTS

- Time consuming
- Expensive
- Maybe demanding of participants and researchers
- The sampling issue (selection effects)
- Drop out and non response
- What is the treatment / intervention, can it be standardised
- Violation of assumptions (interaction effects)
- Ethical issues

Quasi (natural) Experiments

- Similar principles but no random allocation and conducted in social settings
- Control may be non-existent or partial
- Interaction effects
- The Hawthorne effect
- The small n problem

Hence identification of causality more open to question

Example: Employee reactions to an open plan office
(Oldham and Brass, 1979)

An Example

Employee reactions to an open plan office

- Previous literature suggested that open plan offices facilitate employee interaction improving personal satisfaction, motivation and performance
- Oldham, G., and Brass, D. (1979) 'Employee Reactions to an Open-Plan Office: A Naturally Occurring Quasi-Experiment', *Administrative Science Quarterly*, 24(2):267-284

Example: Context

- Newspaper organisation move from conventional cellular offices connected by corridors to open plan office block
- New office block approx. same square footage as original office space
- No change in salaries, job classifications or duties
- Workers informed of planned change from outset

Example: Data collection

- 3 data collection points:
 - T1: 8 weeks prior to move
 - T2: 9 weeks after move
 - T3: 18 weeks after move
 - Data collected via questionnaire, informal conversations and interviews

Example: Measurement

- Questionnaires measured 15 variables, including: work satisfaction, interpersonal satisfaction, internal motivation, autonomy, friendship opportunities, task feedback, etc.
- Informal discussions: to gather reactions to move
- Interviews: to ascertain if any other major changes in working environment had occurred.

Example: Participants

- In organisation = (n=140)
- In study (n=128)
- In all 3 data collection waves (n=76)
- Drop out (n=21)

- Control group (press office) (n=5)
 - Already working in an open plan space

- Quasi control group (n=26)
 - Only completed T2 and T3

Example: Findings

- Exposure to instrument did not affect results
- Between T1 & T2 motivation and satisfaction with work & colleagues declined sharply
- Control group showed no significant difference between T1 & T2
- No changes between T2 & T3, so affects resulted from change T1-T2
- Interview data supplemented findings: with employees describing new office space as:
 - ‘Fishbowl’, ‘cage’ or ‘warehouse’
- Reported difficult to have private conversations, give feedback, and to concentrate due to noise

Summary

- Research design is different to methods. Different designs allow you to make different types of claim relative to temporality and causality.
- Cross-Sectional ‘survey’
 - Assess prevalence or average and/or how this varies by group
- Repeated cross-sectional surveys
 - Assess trends / social changes
- Longitudinal study (or ‘cohort’ study)
 - Examine individual changes over time & ‘predictive’ variables
- Experimental study / RCT
 - Measure effect of a policy or intervention