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Develop your design and methods

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The International School on Research Impact Assessment

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Presentation of myself

Agència de Qualitat i Avaluació Sanitàries de Catalunya

AQuAS – Agency for Health Quality and Assessment of Catalonia

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My own experience in RIA

- Assessment of health research calls –ex-ante, ongoing and ex-post (public funds, philantropic funds)
- Elaboration of accountability tools for public spending in research (dashboard, registry data)
- Elaboration of accreditation / assessment system of traslational health research institutes (ongoing work)
- Co-founder of ISRIA –which means I attended all ISRIA editions

Challenges I faced

- ‘Turbulent’ political cycles
- Frequent changes in the direction of the agency where I work
- Austerity measures and budget cuts in R+D
- Culture of evaluation

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Achievements

- Policy makers use the ‘headline message’ of our sectoral analysis and case studies
- Accountability tool to become also an allocation tool (in discussions)
- Change the strategy of the National Institute of Health Sciences (ISCIII) vis-a-vis translational research organisations, from accreditation approach to assessment approach
- Set up a new ‘regional’ strategy for translational health research and a comprehensive research programme
  - Incorporated (pilot) the social contract of researchers
  - Incorporated (pilot) stakeholders in the design of the strategy, programme and assessment

My talk on design and methods is inspired by....










...and more....

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Learning outcomes

- Recall design options
- Understand how to select the appropriate design / data to answer your questions (and address your needs)
- Identify common methods / data
- Understand the value of mixed methods
- Learn the basics of bibliometrics, case studies and questionnaires

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Observational design

- No intervention is was naturally occurring
- Limited control over the conditions
- Not necessarily comparative
- May have hypothesis testing
- Prospective or retrospective

- **Descriptive, single group**
  - Cohort, cross-sectional, case studies
- **Analytical, comparison group**
  - Cohort (selection on exposure), Case control (selection on outcome), Cross-sectional (selection on other attributes)

Experimental design

- Intervention purposely introduced
- Controlled conditions
- Comparative data
- Hypothesis testing
- Prospective & planned
- Allocation approach needs to be determined

- **Experimental**
  - randomised controlled trial
- **Quasi-experimental**
  - controlled trial, interrupted time series, before/after study

Things to consider when choosing approach

Observational design

Strengths	Weaknesses
•Easily applied •Generalisable (external validity) •Rigour through analysis	•Time span •Risk of confounding factors •Correlation rather than cause & effect

Experimental design

Strengths	Weaknesses
•Attribution •Cause & effect •Robust & reliable (internal validity) •Rigour in design	•Cannot always be applied •Costly •Reduced generalisability

Design options: preliminary considerations

- What is driving the need for assessment?
- What resources can I commit?
- What data might be available?
- Who is my audience?

Design options

- Identify which questions need which types of data
  - Link the appropriate method for providing that data
- Consider the cost and practicality of the method
  - Do you do it in-house, contract out, collect the data now, use other's data?
- Think about your stakeholders
  - What methods and data might they need / understand?

Type of data / sets of information

Qualitative	Quantitative	Mixed
Methods that provide rich detail on impacts but are not numerical and do not produce easily comparable or summable data	*Methods producing numerical data that is comparable but may not contain details on complex impacts*	*Combination of qualitative and quantitative methods*
For example: • Interviews • Narratives or stories • Focus groups • Social media or text • Ethnographic • Observation (field notes)	For example: • Bibliometrics and altmetrics • Questionnaires / surveys • Financial, numerical or trend data sets • Economic data (costs, monetarised benefits, willingness to pay, created jobs,...) • Q-Methodology • Biophysical methods	For example: Case study

How many methods?

- In short, more than one …
  - Need for triangulation
  - Need to answer different questions with different methods
  - Need to provide data and evidence that is relevant and credible to stakeholders
  - Need to fit methods with the RIA resources

Source: CAHS Panel

Now I will present...

- Bibliometrics
- Questionnaires
- Case studies

Tomorrow, Dr Jian Wang will present...

- Economic returns

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BIBLIOMETRICS

Learning objectives

- Introduce you to bibliometrics in a general manner
- Show you the basic requirements for conducting bibliometric analyses
- You will learn about invalid bibliometric measures around

- ***Build up expertise in bibliometrics before using it !***
- ***Use bibliometrics wisely, and in context !***

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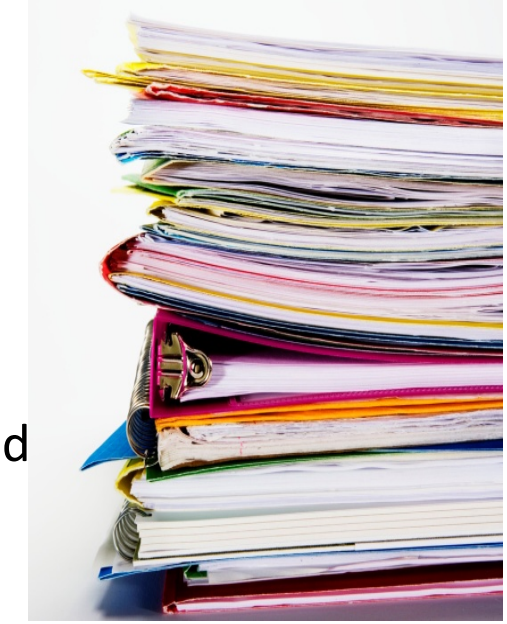
BIBLIOMETRICS

What is bibliometrics?

- The use of published scientific literature (articles, books, conference proceedings, etc.) for measuring research activity
  - eg output volume, science 'quality', interdisciplinarity, networking



- New knowledge created by scientists is embedded in the scientific literature
  - By measuring scientific literature, we measure (somehow) knowledge and the ways it is produced
  - Need to be complemented with other methods

BIBLIOMETRICS

Bibliometrics relies on information in a paper

Journal →

Title →

Authors →

Addresses →

Abstract →

References /citations →

Brain (2002), **125**, 1839–1849

Autism, Asperger syndrome and brain mechanisms for the attribution of mental states to animated shapes

Fulvia Castelli,[1] Chris Frith,[2] Francesca Happé[3] and Uta Frith[1]

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Summary

Ten able adults with autism or Asperger syndrome and 10 normal volunteers were PET scanned while watching animated sequences. The animations depicted two triangles moving about on a screen in three different conditions: moving randomly, moving in a goal-directed fashion (chasing, fighting), and moving interactively with implied intentions (coaxing, tricking). The last condition frequently elicited descriptions in terms of mental states that viewers attributed to the triangles (mentalizing). The autism group gave fewer and less accurate descriptions of these latter animations, but equally accurate descriptions of the other animations compared with controls. While viewing animations that elicited mentalizing, in contrast to randomly moving shapes, the normal group showed increased activation in a previously identified mentalizing network (medial prefrontal cortex, superior temporal sulcus at the temporo-parietal junction and temporal poles). The autism group showed less activation than the normal group in all these regions. However, one additional region, extrastriate cortex, which was highly active when watching animations that elicited mentalizing, showed the same amount of increased activation in both groups. In the autism group this extrastriate region showed reduced functional connectivity with the superior temporal sulcus at the temporo-parietal junction, an area associated with the processing of biological motion as well as with mentalizing. This finding suggests a physiological cause for the mentalizing dysfunction in autism: a bottleneck in the interaction between higher order and lower order perceptual processes.

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BIBLIOMETRICS

Bibliographic data systems

- In health sciences:
  - Web of Science by Thomson Reuters;
  - Scopus by Elsevier Science;
  - Google Scholar by Google.
- Understanding strengths and weakness of different databases is key (i.e. “Coverage”)

Levels of bibliometric analysis

Macro, e.g. country and region comparisons

Meso, e.g. research organisation, universities, institutes

Micro, e.g. analysis of programmes, groups or individual researchers

Methods of data collection

Based on list of names of researchers

Based on a list of publications of a unit

Based on the address of a country or an institute

BIBLIOMETRICS

Additional analyses can focus on ..

- **Research profiles**:
  - E.g by fields of science.
- **Scientific cooperation analysis:**
  - E.g by types of scientific collaboration
- **Highly cited paper analysis:**
  - which publications are among the most highly cited output (top 10%, 5%, 1%) of the global literature in that same field(s).
- **Network analysis:**
  - how is the network of partners composed, based on scientific cooperation?

BIBLIOMETRICS

Basic principles

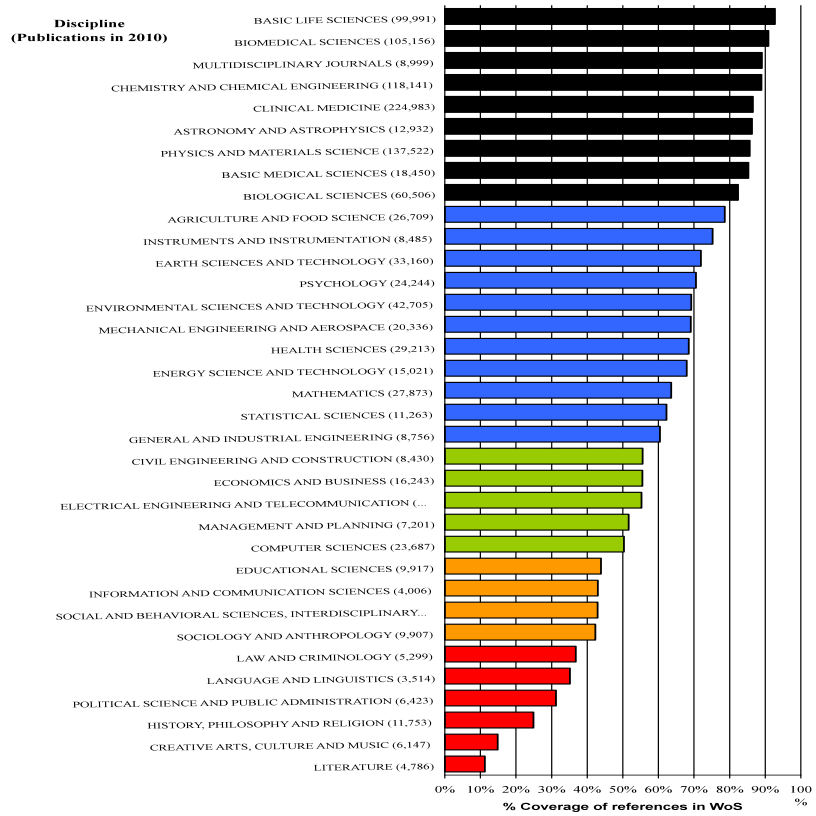
- Need for contextualization
  - Do not apply bibliometrics as a stand-alone tool, without any context.
  - Bibliometrics and peer review can reinforce one another.
- Understand the coverage of your data set. Two types of coverage:
  - *Internal* (from inside the perspective of the WoS)
  - *External* (from the perspective of a total output set)
- Need to normalize the data
  - otherwise can give the misimpression that certain fields or institutions are underperforming

BIBLIOMETRICS

Coverage

WoS Coverage in 2010 across disciplines:

- **Black=Excellent coverage** (>80%)
- **Blue= Good coverage** (between 60-80%)
- **Green= Moderate coverage** (but above 50%)
- **Orange= Moderate coverage** (below 50%, but above 40%)
- **Red= Poor coverage** (highly problematic, below 40%)



BIBLIOMETRICS

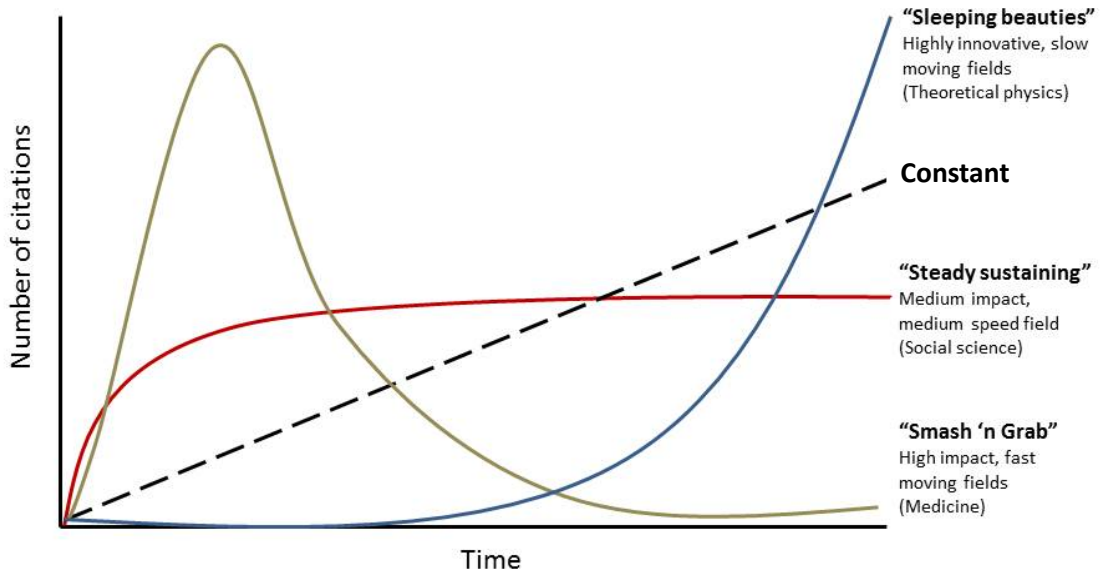
Normalisation of citations

Non-normalised analysis can give the misimpression that certain fields or institutions are underperforming.

Different fields have different citation patterns, expressed differently over time

This means it is important to normalise citation patterns by both field of research and year of publication

This is done by comparing observed citations to expected citations for a field/ year combination



BIBLIOMETRICS

Normalisation example: two papers

Year	Title	Journal	Raw Citations	Cites/yr	NCS	WoS category
2010	Instructive role of the vascular niche in promoting tumour growth and tissue repair by angiocrine factors	NATURE REVIEWS CANCER (JIF=37.54)	51	17.00	4.32	ONCOLOGY
2010	Inverse spectral problems for differential operators on arbitrary compact graphs	JOURNAL OF INVERSE AND ILL-POSED PROBLEMS (JIF=0.43)	5	1.67	4.81	MATHEMATICS

The (mean) normalised citation score compares **actual** citations against **expected** citations by taking into account the field, age and document type of a paper. Also know as the: Relative citation score, average relative citation score, etc.

BIBLIOMETRICS

Indicators (non preferred)

- **Journal Impact factor**
  - *Definition:* The mean citation score of a journal, determined by dividing all citations in year T by all citable documents in years T-1 and T-
- **Hirsch Index**
  - *Definition:* The 'impact' of a researcher, determined by the number of received citations of an oeuvre, sorted by descending order, where the number of citations equals the rank position.

PROBLEMATIC! Not-nromalised

BIBLIOMETRICS

Problems with H-Index

- Some bibliometric-mathematical problems of H-index:
  - Is mathematically inconsistent in its' behavior.
  - Tends to rise only, no decrease possible, and thus conservative by nature.
  - Not field normalized.
- Some bibliometric-methodological problems of H-index:
  - How to define an author?
  - In which bibliographic/metric environment?
- Some conceptual problems of H-index:
  - Is biased against youth, and favors age and experience.
  - Is biased against selective researchers, and favors highly productive scientists.
  - No relationship between H-index and research quality.
  - Ignores other elements of scholarly activity.
  - Promotes one-indicator thinking.

BIBLIOMETRICS

San Francisco Declaration on Research Assessment (DORA)

"Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions"

BIBLIOMETRICS

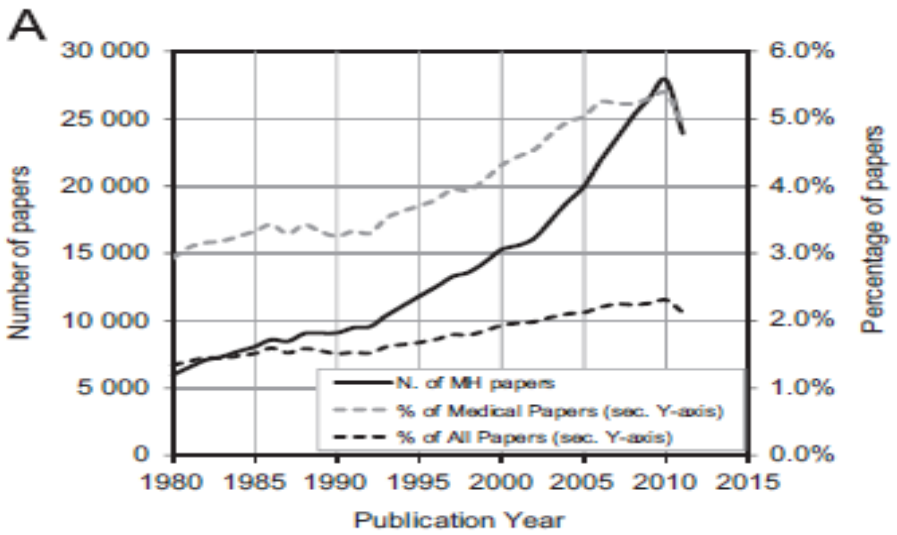
Preferred indicators

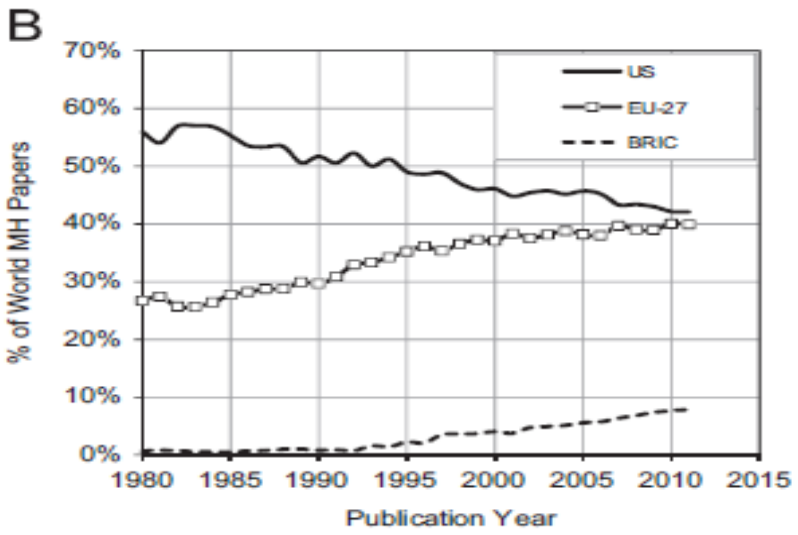
- Bibliometric indicators could best compare ***actual*** versus ***expected*** impact.
- Take into account the field, age , and types of document you are dealing with.
- Stay away from “One-Indicator” thinking: preferably use a variety of indicators.

Preferred indicators should be normalised

Some examples of bibliometric analysis: Mental Health Research

Volume of research publication in ‘mental health’ research





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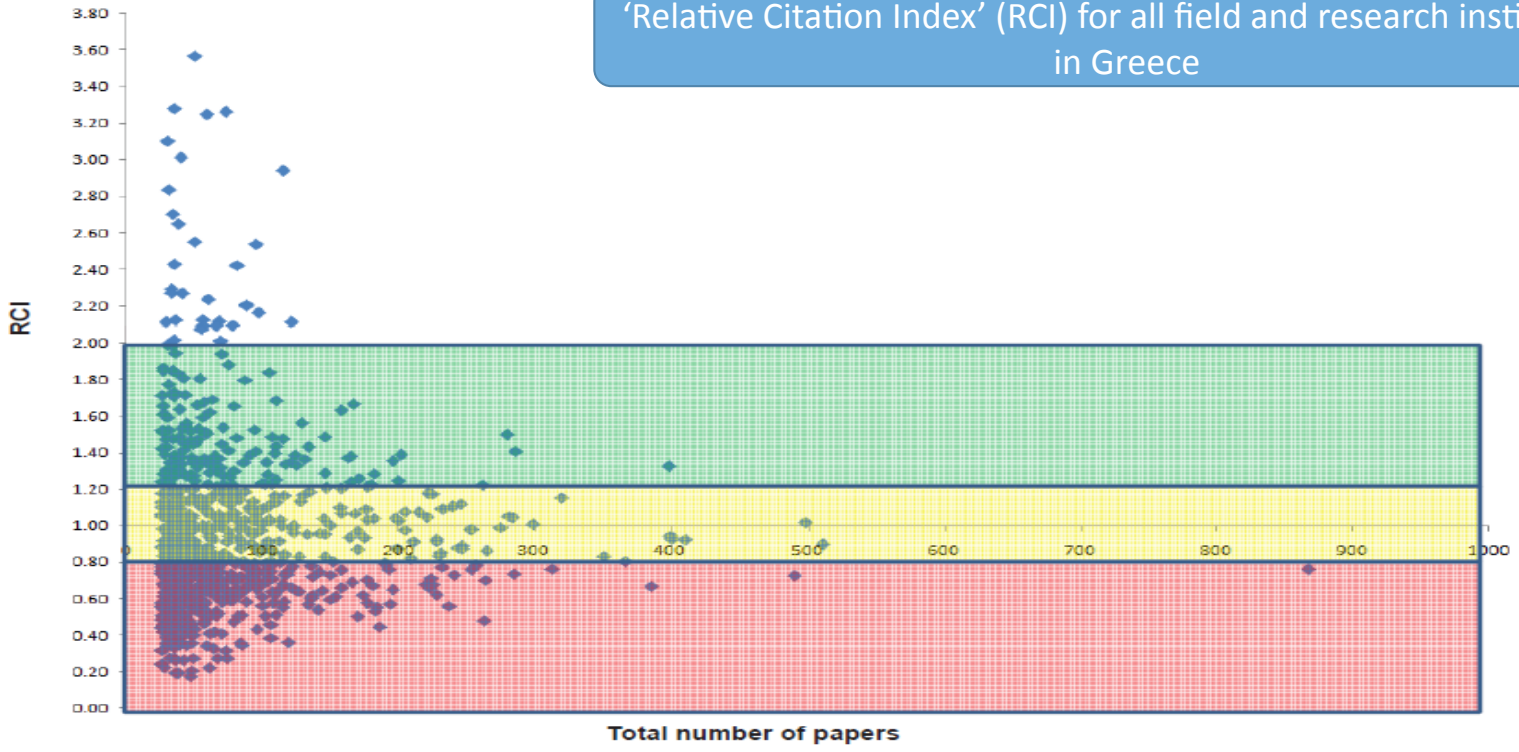
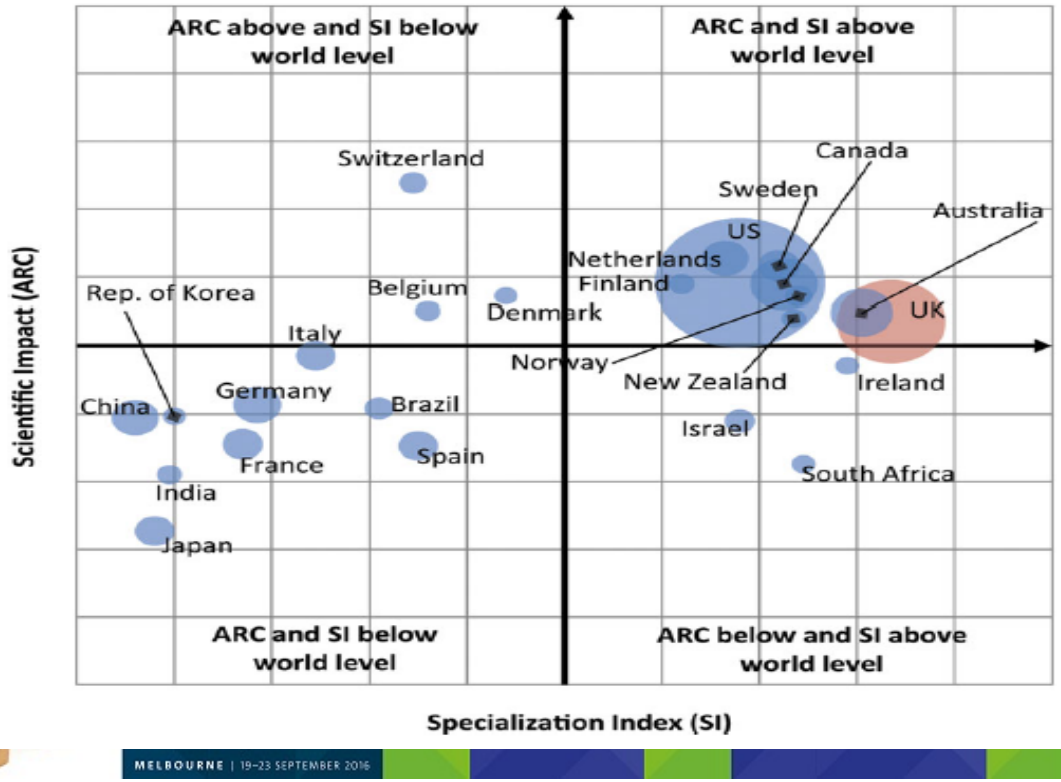
Some examples of bibliometric analysis Greece R&D System

'Relative Citation Index' (RCI) for all field and research institutions in Greece



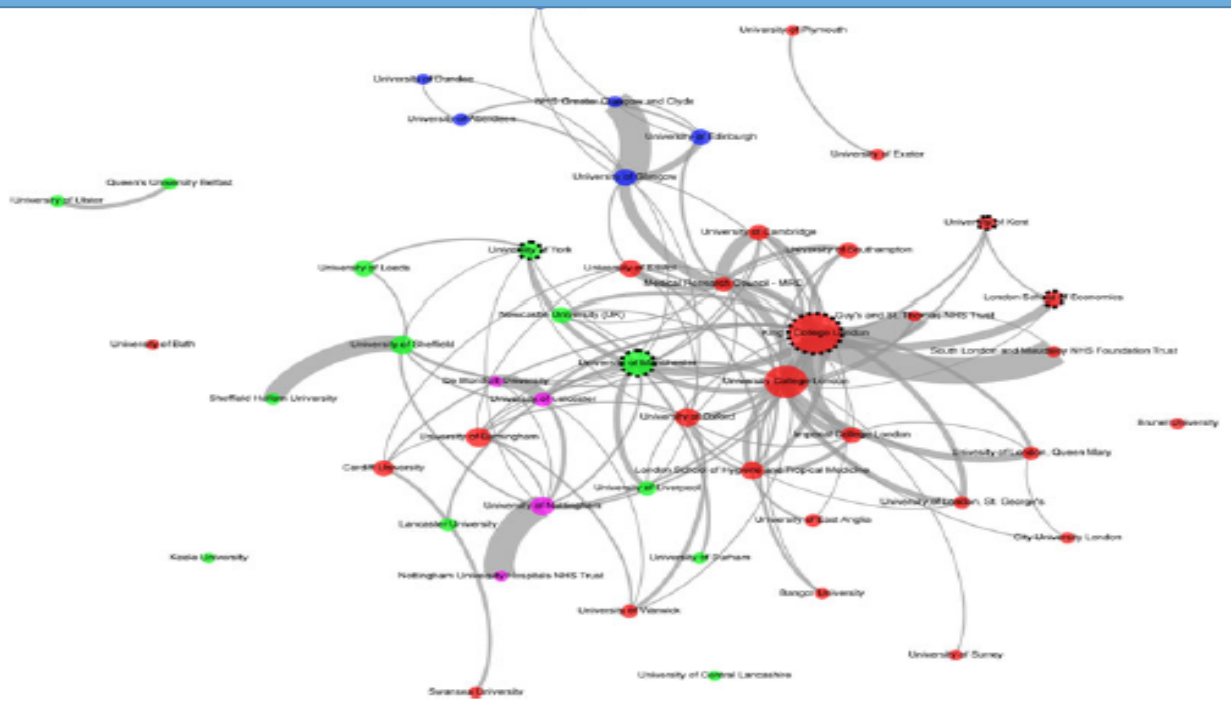
Some examples of bibliometric analysis: Social Care Research (1)

Relationship between 'Average Relative Citations' and 'Specialisation Index' by country



Some examples of bibliometric analysis: Social Care Research (2)

Network analysis of relationships between UK universities



CASE STUDIES

Learning objectives

- Identify why / how to use case studies
- Understand what is case studies
- Understand the key methodological issues
- Recognise the advantages and challenges

CASE STUDIES

Why use a case study approach?

- Holistic approach
- In-deph understanding
- Theory generation

How to use a case study approach?

- Mixed-methods
- Triangulate data
- Cross-case analysis

Case study method can range from a single case to multiple cases, can use quantitative and qualitative data and can use multiple methods

CASE STUDIES

Methods typically used

- Case studies are not a single method, but an approach using a variety of methods

- Depends on purpose and framework used – e.g.
  - Interviews
  - Literature reviews
  - Bibliometrics
  - Economic analysis
  - Focus groups

CASE STUDIES

Key methodological issues

CASE STUDIES

Sampling

- Not a statistical sample
- Random sampling drawbacks:
  - Could miss examples of high impact
  - May not gain co-operation of low impact research teams
- Purposive sampling advantanges:
  - Select high impact cases by types of impact and cover all funding mechanisms (purposive, stratified)

CASE STUDIES

Data collection

- Must be governed by high scientific standards
- Must be as rigorous as quantitative methods
- Use an analytical or conceptual framework to guide data collection and analysis
  - e.g. Payback Framework, CAHS Framework, SIAMPI

CASE STUDIES

Data analysis

- Use an analytical or conceptual framework
- Triangulating data sources = more rigour
- Do not conduct data analysis in isolation
  - Data verification
  - double coding, member checking, solicit feedback from case study participants
- Do not generalise results – case studies are not statistical samples
  - Can support theory generation (as with a single experiment), but not for populations or universes
- Data reporting
  - display data and interpretation separately

CASE STUDIES

Quality control

Construct validity

- Identify valid measures of impact (e.g. bibliometric data, economic data)

Internal validity

- Only for explanatory/causal case studies
  - Establish causal relationship where condition A leads to Condition B

External validity

- Define the domain to which a study's finding can be generalised

Reliability

- Same data collection procedures = same results

CASE STUDIES

Advantages

- Flexible, can tailor to study design
- Understanding the 'How?' and 'Why?'
- In-depth understanding, provide context and nuance
  - can help with some RIA challenges (e.g. attribution, time lags, knowledge flows)
- Views phenomena through multiple lenses
- Rich variety of data sources
  - Triangulation adding extra rigour
- High internal validity

CASE STUDIES

Challenges

Challenges

- Subjective bias
  - Interview respondents
  - Researcher interpretations
- Time consuming / resource intensive
  - A ‘craft industry’ compared to metrics as ‘mass production’ (Martin, 2011)
- Possible low external validity
  - Difficult to draw conclusions beyond sample
- Need to consider the counterfactual

QUESTIONNAIRES

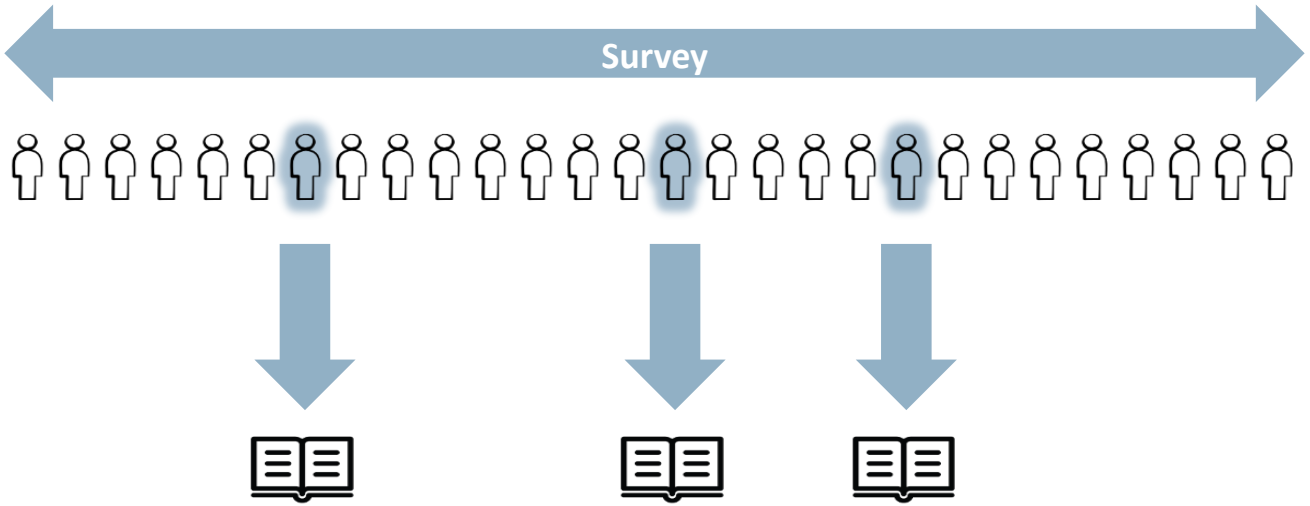
Learning outcomes

- Understand when to use a questionnaire
- Understand the basic principles for designing a questionnaire

QUESTIONNAIRES

When to use questionnaires

High level overview vs explore detail



QUESTIONNAIRES

When to use questionnaires

- To obtain high level overview
  - To select cases of the ‘case study’
- As an exploratory first stage in setting questions or scope
- To obtain representative results, can use large samples
- To use a robust mechanism in routine monitoring
- To obtain accurate relevant information

QUESTIONNAIRES

Types of Questionnaires

Delivery methods

- Large sample
- Non-respondents
- Expensive
- At own convenience
- Easy to administrate
- Low response rate

- High response rate
- Appropiate person
- Non-respondents
- Expensive
- Cheaper
- Convenient
- Low response rate

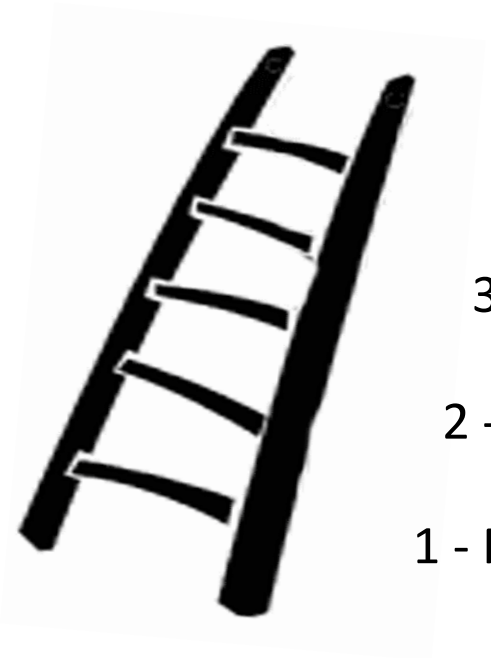
QUESTIONNAIRES

Conducting Questionnaires Research

1. Clarify focus of the questionnaire
2. Understand available resources
3. Decide on the delivery method
4. Design the questionnaire (adapt, translate)
5. Pilot test and revise
6. Prepare the sample
7. Train interviewers (if necessary)
8. Collect data
9. Process data (if necessary)
10. Analyse the results

QUESTIONNAIRES

Principles of Questionnaire Design



5 - Finalise the form & layout of the questionnaire

4 - Put the questions into an appropriate sequence

3 - Develop the response format

2 - Refine the question phrasing

1 - Make a draft listing of the questions (contents)

QUESTIONNAIRES

1. Question Content

- Make a draft listing of the questions
- Check if the questions address your research objectives
- Does one topic warrant more than one question?
- Ensure each question has an explicit rationale
- Don’t ask what you already know (or might)

QUESTIONNAIRES

2. Question Phrasing

- Write strightforward direct language
- Use short and simple sentences
- Explain and illustrate difficult questions
- Determine whether respondents will be able to answer accurately
- Avoid: double barrelled questions, questions containing double negatives, words like ‘regularly’, ‘often’, ‘locally’, avoid biased terms (e.g. ‘fantastic’)

QUESTIONNAIRES

3. Response format

Open questions

- Encourage respondents to explain their answers and reactions
- Needs coding and risk of misinterpretation
- Allows to explore a topic in depth

Closed questions

- More difficult to construct
- Quicker to answer
- Limit respondents' answers to the survey

QUESTIONNAIRES

4. Questions Order

- Give the questionnaire a narrative (if possible)
- Move logically from one to the next
- Group questions logically (e.g., use a framework)
- Start with easy, non-threatening questions

QUESTIONNAIRES

5. Form & Layout

- Clear instructions (or cover letter)
- Length
- Appearance
  - Don't want to look too cluttered
  - Neat, attractive and convenient
- Headings and numbering

QUESTIONNAIRES

Some tips

- In order to know which type of survey you need, think about:
  - What type or questions are you going to ask?
  - How much time & money do you have?
- The best questionnaires are constantly edited and refined until finally they have clear questions and instructions, laid out in a logical order
- Appropriate questionnaire design is essential to obtain valid responses to questions

Key Messages

- There are many designs and methods – may need to look at multiple options
- Selection will depend on your assessment questions and access to data sources
- Use multi-methods to triangulate your findings
- Know how to balance your methods to achieve your goals on budget and on time

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ACTIVITY

TIME

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Why and when?

- Bibliometrics
- Questionnaires
- Case studies

Activity time

- Choose one method
- Discuss for what A's this method is a good choice
- Choose one of these A's and think of an example where triangulation improves your RIA

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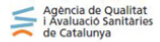

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