UCL Energy Institute

Are we heading towards a replicability crisis in energy efficiency research? A toolkit for improving the quality, transparency and replicability of energy efficiency impact evaluations

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People, Adaptability, Comfort and smart Energy ***(PACE)***

Panel 8 - Transparency needs the (right!) measurement
Paper No. 8-299-17

https://digest.bps.org.uk/2016/09/16/ten-famous-psychology-findings-that-its-been-difficult-to-replicate/

Replication crisis

- Replication crisis in medicine, psychology, neuroscience, economics, genetics *(Camerer et al. 2016)*

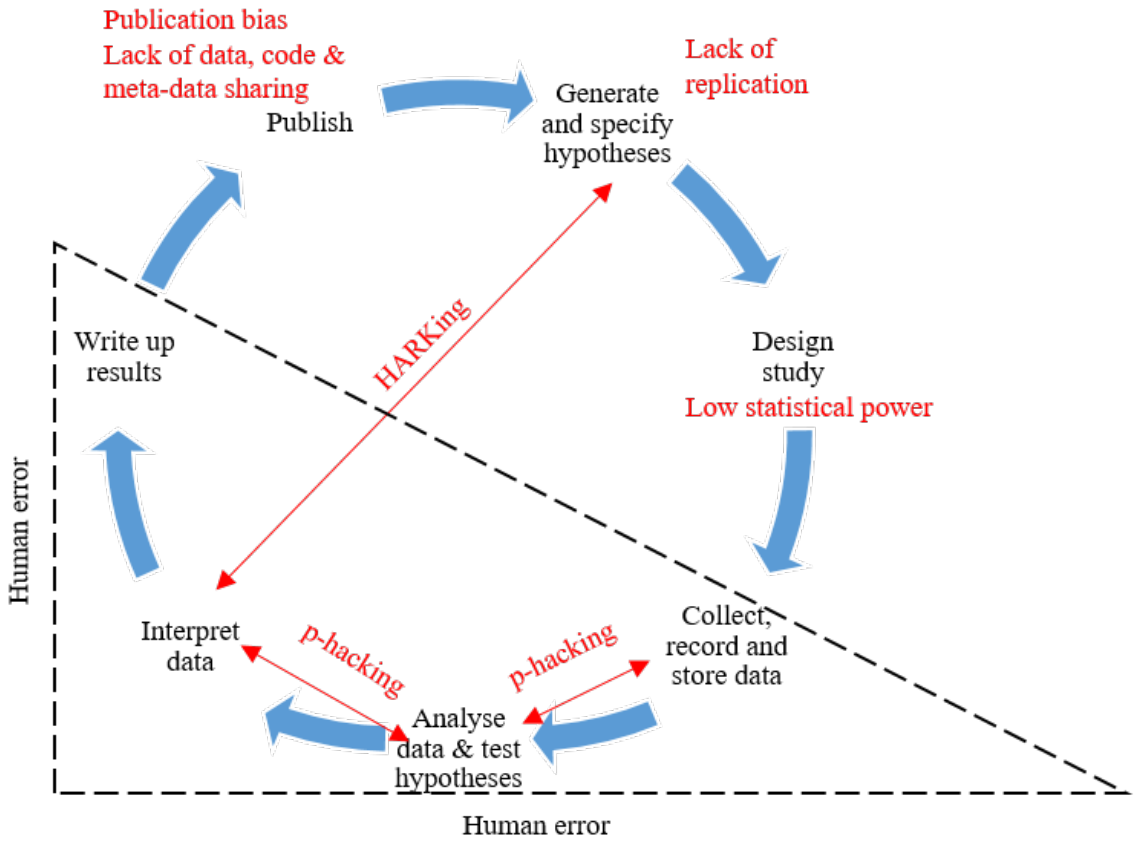
- Psychology: failure to replicate two thirds of seminal studies *(Open Science Collaboration et al. 2015)*
  - Effect size often much smaller if effect found

(Why) Is this relevant to energy efficiency research?

- Potential waste of money
- Public's welfare is directly at stake

We need robust, valid research!

What contributes to the replication crisis?



HARKing (Hypothesising after results known)

Adapted from Chambers et al. (2014)

State of the art in energy efficiency research

- So far, hardly any attempt to replicate findings
- Of the 700+ subscribers to the Center for Open Science's Transparency and Openness Guidelines less than 0.1% are energy or environment journals
- One paper with "energy efficiency" and "replication" in the title *(Scott, 1997, Energy Economics)*

State of the art in energy efficiency research

- "How can researchers minimize bias—their own, and that of their subjects – when doing research?"*(Sovacool 2014, p. 11)*
- 'Energy Economics'
  - Issued a call for contributions to a Special Issue on replication (December 2016)
  - Replication paper as new submission stream
- Papers and presentations on the topic *(Vine et al., 2014; Frederiks et al., 2015; Nicolson et al., 2016)*
- Meta-analyses or review articles synthesising the findings *(e.g. Staddon et al. 2016; Abrahamse et al. 2005; Davis et al. 2013)*
  - But: a meta-analysis of biased studies doesn't help *(Davis et al. 2013)*

What can be done?

Randomised Control Trials

Evidence reviews

Pre-analysis plans

Reporting guidelines

Data Sharing

(1) Randomized control trials

- Allow establishing a *causal* effect
  - Randomisation ensures that the units allocated to the treatment group and control group are the same on average

    -> the only difference is that one received an intervention and the other did not
  - Overcomes selection bias and omitted variable bias

2) Evidence reviews

- Synthesize existing evidence from multiple studies, enhancing robustness, generalizability (or importance of context), objectivity and replicability.
- Pre-prepared protocol sets out search strategy and inclusion criteria, validity assessment and approach extraction/synthesis.
- Range of timescales/resources:
  - Systematic review – most comprehensive; years.
  - Rapid evidence assessment – comprehensive within constraints; months.
  - Systematized review – draws on above systematic review approach but not necessarily comprehensive; weeks.

3) Pre-analysis Plan

- A document which specifies details of the analysis before researchers see the outcome data
  - statistical methods, sample exclusions, outcome measures, covariates, outlier correction etc.
- Uploaded online
  - also serves as trial registry

- Could help to overcome the ‘file drawer problem’ and ‘cherry-picking’ and ‘p-hacking’

4) Reporting guidelines

- Full reporting of study characteristics necessary to judge quality and allow replication and synthesis.
- Reporting checklists make this easy by specifying which details should be reported.
- Key guidelines/checklists include:
  - CONSORT for RCTs
  - PRISMA for systematic reviews
  - COREQ for qualitative studies

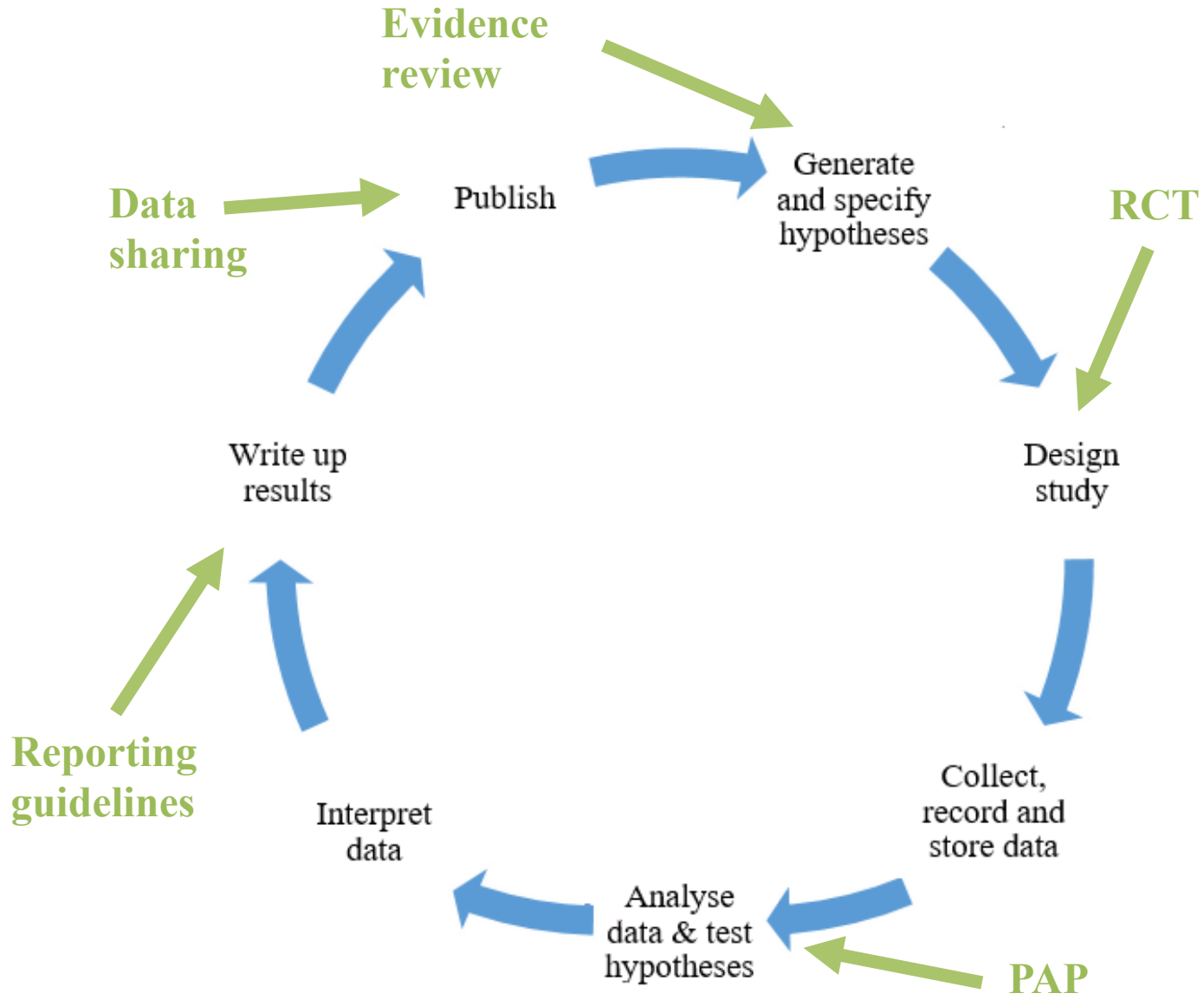
5) Data sharing

- Key aspect in *preventing data fraud*
- http://www.re3data.org/
  - a list of more than 1,500 research data repositories
- Nature Scientific Data
  - mandates uploading data on submission
- Data need to be de-identified
- For energy research, e.g.:

Dataverse

Harvard Dataverse

OpenEI



Best Practice

Limitations

- Suggested tools might not (all) be suitable / appropriate for qualitative research.
- Sometimes the most interesting finding is the one that was not pre-specified.
  - an 'exploration' stream in journal for studies less suited to pre-specification
- Institutional issues, not just individuals.

Thoughts?

Come to our informal session
"Confronting the replicability crisis –
What should we do?"

TODAY at 14.00 h in Room *Tour Fondue* (Panel 4)

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