A White Hat's Guide to P-Hacking

Dr. Xeni Deligianni, University of Basel, Switzerland

University of Basel | Department of Biomedical Engineering | University Hospital Basel | BAMM Basel Muscle MRI | @DXeniMRI | ESMRMB European Society for Magnetic Resonance in Medicine and Biology

MRI Together

A global workshop on Open Science and Reproducibility
December 2021

Speaker name:
Dr. Xeni Deligianni, University of Basel, Switzerland

Conflicts of interest regarding this presentation:
Nothing to disclose

ESMRMB
European Society for Magnetic Resonance in Medicine and Biology

Look! a new continent!*

1) https://doi.org/10.1371/journal.pbio.1001863,Distinguishing between Exploratory and Confirmatory Preclinical Research Will Improve Translation, Jonathan Kimmelman, Jeffrey S. Mogil, Ulrich Dirnagl
2) https://doi.org/10.1111/1740-9713.01369, **Different worlds Confirmatory versus exploratory research** Simon Schwab, Leonhard Held
*)Senn, S. (2007) Statistical Issues in Drug Development. Chichester: John Wiley & Sons.

Exploratory vs Confirmatory

- "small and flexible experiments" [1]
- "No hypothesis is required"[2]
- **Hypothesis can be vague**"[2]
- "Neither the sequence of individual experiments, nor details of their design, is necessarily established at the outset of investigation."[1]
- To "generate new hypothesis from the data"[2]
- **"Finding the unexpected"[2]**

- "**Confirmatory research** starts with a **clear hypothesis** & then collects data that may or may not support that hypothesis."[2]
- "Clear hypothesis required"[2]
- "Suitable for establishing strong evidence."[2]
- Minimize the risk of **false positives**.[2]

1) https://doi.org/10.1371/journal.pbio.1001863,Distinguishing between Exploratory and Confirmatory Preclinical Research Will Improve Translation, Jonathan Kimmelman, Jeffrey S. Mogil, Ulrich Dirnagl
2) https://doi.org/10.1111/1740-9713.01369, Different worlds Confirmatory versus exploratory research Simon Schwab, Leonhard Held

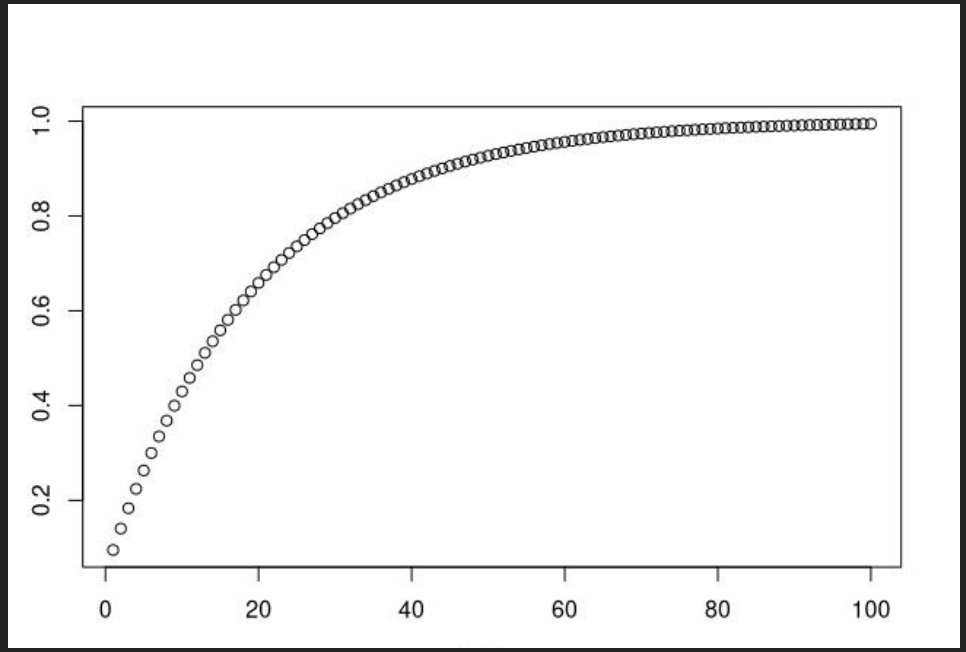
Would you like to know more?

Photo by unsplash: Lucy M

https://mybinder.org/v2/gh/XDeligianni/phacking/HEAD?labpath=pHacking.ipynb

Or https://github.com/XDeligianni/phacking/archive/refs/heads/main.zip

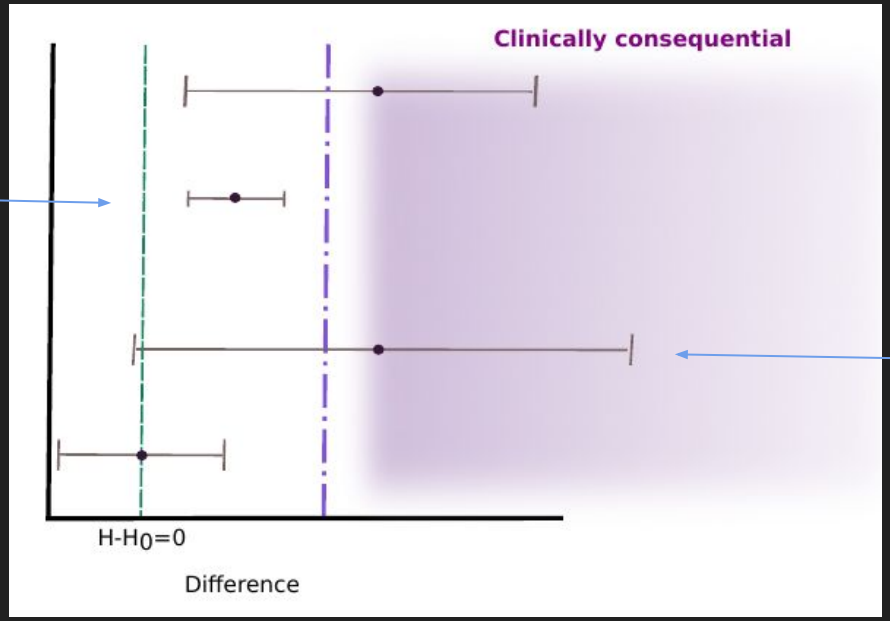
Depiction of the increasing error rate of multiple comparisons



https://doi.org/10.4097/kja.d.18.00242

Clinical vs Statistical Significance

Statistically significant,but not clinically consequential



Not statistically significant, but potentially clinically consequential

Medical Statistics, a textbook for health sciences Wiley, ISBN 978-0-470-02519-2, M J Campbell, D Manchin, S J Walters

Take HOME messages

- Do not follow the crowd!
- Describe/ **Visualize your data** before testing! Be careful with boxplot drawing[1]!
- Check your **assumptions**!
- Choose the appropriate test (beyond t-test/ p-value)
- Don’t invent on the way!

https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002128

MRI Together

A global workshop on Open Science and Reproducibility
December 2021

THANK YOU!

University of Basel

Department of Biomedical Engineering

University Hospital Basel

BAMM Basel Muscle MRI

ESMRMB