

MRI Together

A global workshop on Open Science and Reproducibility
December 2021

A White Hat's Guide to P-Hacking

Dr. Xenii Deligianni, University of Basel, Switzerland



University
of Basel



Department of
Biomedical
Engineering



University Hospital
Basel



@DXeniMRI



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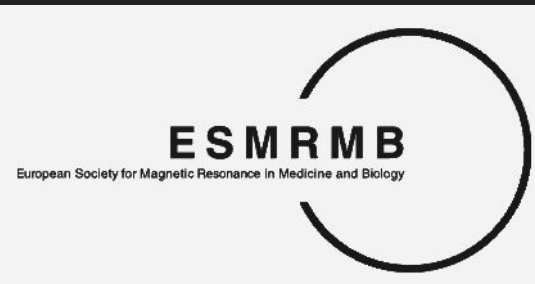
Speaker name:

Dr. Xenia Deligianni, University of Basel, Switzerland

Conflicts of interest regarding this presentation:

Nothing to disclose

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LOOK! A NEW CONTINENT!*



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- 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?

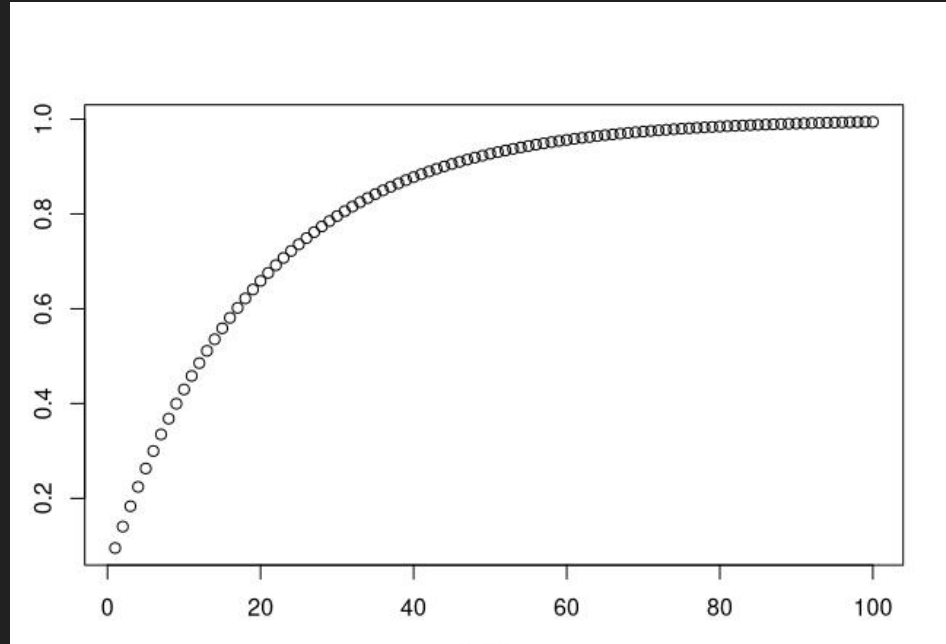


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<https://mybinder.org/v2/gh/XDeligianni/phacking/HEAD?labpath=pHacking.ipynb>

Depiction of the increasing error rate of multiple comparisons

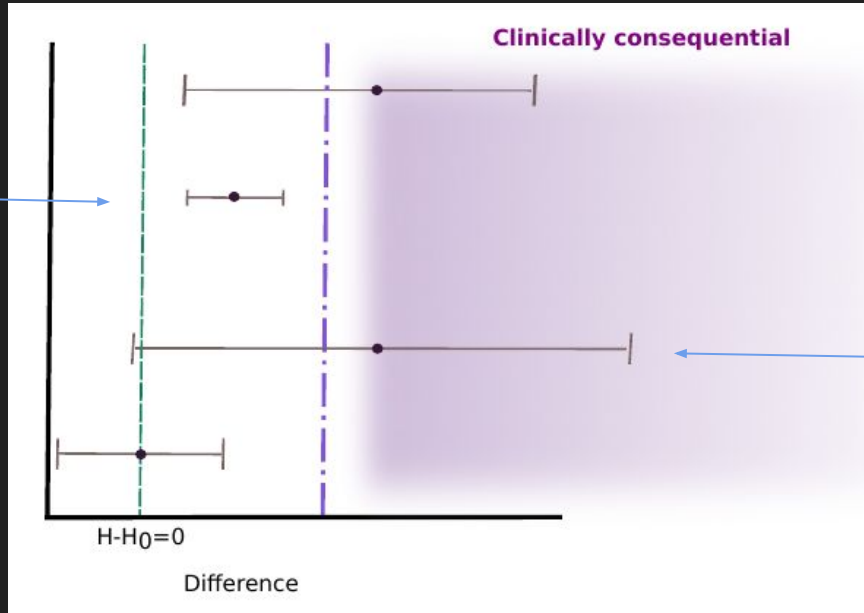
Probability of at least one
p-value less than 0.05



Number of hypothesis tests

Clinical vs Statistical Significance

Statistically
significant, but not
clinically
consequential



Not statistically
significant, but
potentially clinically
consequential

TAKE HOME MESSAGES



- Do not follow the crowd!
- Describe/ **Visualize your data** before testing! Be careful with boxplot drawing¹!
- Check your **assumptions**!
- Choose the appropriate test (beyond t-test/ p-value)
- Don't be invent on the way!

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THANK YOU!



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