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IOANNIDIS AND THE REPRODUCIBILITY CRISIS

“Why Most Published Research Findings are False,” John Ioannidis

Explain the following terms from Ioannidis.

- Q1. Type I error. Type I error occurs when a true null hypothesis is incorrectly rejected. It's often denoted as α (alpha) and commonly set at 0.05 in research, indicating a 5% risk of concluding that a difference exists when there is none.
- Q2. Type II error. Type II error occurs when a false null hypothesis fails to be rejected. It's denoted as β (beta) and is related to the power of the study, where power = $1 - \beta$. It represents the risk of not detecting a true effect when one actually exists.
- Q3. Power. Power, denoted as $1 - \beta$, is the probability that a test will reject a false null hypothesis (i.e., correctly identify an effect when there is one). A study with high power is more likely to detect an effect if it exists.
- Q4. R. R represents the ratio of true relationships to non-relationships in a field of study. Ioannidis discusses how a lower pre-study probability (which can be related to R) leads to a higher likelihood that a research finding is false.
- Q5. PPV. PPV is the probability that a research finding reflects a true effect. Ioannidis highlights how PPV is affected by the study's power, the ratio of true to non-true relationships (R), and the level of bias.
- Q6. The relation between R and PPV.
The relationship between R and PPV is crucial; as R decreases (meaning fewer true relationships compared to non-relationships), the PPV decreases, indicating a higher likelihood that a finding is false.

The Reproducibility Crisis

Q7. Why might the survey described in the first paragraph be better than the survey described in the section “what can be done?”

The survey in the first paragraph likely offers more direct, empirical evidence about the reproducibility crisis compared to the later survey, which might be based on more general perceptions or less direct measures.

Q8. What is pre-registration and why is it a good practice?

Pre-registration involves documenting the research methods and proposed analyses before the study begins. It enhances transparency and reduces the risk of data dredging, thus increasing the credibility of the research findings.

Q9. What is the meaning of the word “wrong” in “failure to reproduce means that the result is probably wrong”

In the context of failure to reproduce, “wrong” typically means that the original findings are not reliable or generalizable. It implies that the original results might have been due to chance, bias, or other factors that do not reflect a true effect.