Maximizing Data Transparency

Measures to minimize the risk of bias rank highly among experimental design elements that should be conveyed for all studies regardless of reporting venue, especially for confirmatory or hypothesis-testing research. For example[1]:

1) Randomization
- Randomly assigning samples or subjects to treatment groups to minimize unknown sources of variation and unconscious selection biases that could otherwise lead to unintentional or hidden differences between groups at baseline.

2) Blinding/Masking
- Preventing knowledge of group allocation in order to minimize unconscious biases, such as confirmation bias or expectation bias, that arise from knowing which experimental group is which.

3) Sample Size Estimation
- Ensuring experiments will be adequately powered or will have enough samples to make proper inferences.
- Ensuring appropriate use of resources so that samples or subjects are not wasted.

4) Data Handling
- Setting pre-defined inclusion and exclusion criteria to reduce unconscious biases when considering outlier or other data removal and making decisions in advance about what to do about missing data.

These practices do not necessarily apply to **exploratory or hypothesis-generating work**; however, exploratory studies should be appropriately described as preliminary, and potential discoveries should be followed-up with rigorously conducted confirmatory studies.

With the advent of NIH's recent Data Management and Sharing Policies[2], some researchers may also find it useful to know whether **data/code/analysis pipelines are available in a public repository**. Additional elements of rigorous experimental design may be important to convey for specific fields or disciplines.

Scientific meetings are an important venue for dissemination of findings, but space and time for experimental design details are often limited. Thus, to facilitate increased transparency in scientific presentations, we propose the use of rigor icons to effortlessly convey experimental design elements of importance to the scientific community. To improve conveyance of important experimental design elements, a proposed set of **core rigor icons to use in oral and poster presentations** include:

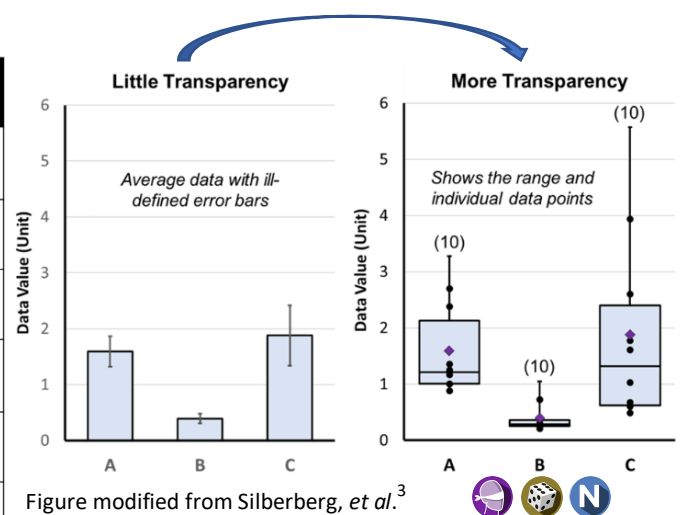| Rigor-related item	Proposed Icon
Experimenters were blinded/masked to treatment during experimentation and analysis	
Samples were randomly assigned to experimental groups	
Sample size/power was calculated in advance	
Outliers or other data were excluded according to pre-defined criteria	
This experiment is exploratory (hypothesis-generating)	
Data/code/analysis pipelines are available in a public repository	

Figure modified from Silberberg, *et al.*[3]

Figure Legend: The same data are represented as (L) bar graphs with vague error bars and (R) a quantile boxplot showing the mean (purple diamond), sample size, individual data points, and the range for data spread. The rigor icons represent (left to right) blinding/masking, randomization, and sample size estimation. *The graph on the right, with the same amount of space, conveys more detailed information about the methods and analysis.*

References:
1. Landis, *et al.* 2012 *Nature* PMID: 23060188
2. https://sharing.nih.gov/data-management-and-sharing-policy
3. Silberberg, *et al.* 2017 *Nature* PMID: 28796229

Learn more:
- NINDS Office of Research Quality: https://go.nih.gov/kxZASSG
- NINDS Rigor Icons Website: https://go.nih.gov/f95mlhJ