Question 1, Homework 1

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## Toward Evidence-Based Medical Statistics. 1: The P Value Fallacy

# Steven N. Goodman, MD, PhD

Goodman (1999) has provided us with some insight into the different approaches to statistics, and how we might go about reaching conclusions based upod the current schools of thought. More broadly this is referring to the subtle but important difference between inductive and deductive reasoning in statistics. Goodman also hints out how this may shape our thinking about one of the two common schools of thought in statistics, frequentist statistics. For all intents and purposes, deductive reasoning implies that we assume something to be true in nature and then make a prediction about what should happen if that were true. Alternatively, inductive reasoning in statistics allows us to first evaluate things happening around us in nature, and then based upon that information we can make hypotheses about the real world.

The basis of statistics is its use to draw conclusions about larger populations, by doing research about a small sample that represents that population. This implies associating from a smaller object to a much larger object. Another important association in statistics is the ability to take observations in the short term, and associate them to long term situations. The author argues however, that the current mindset towards solving this problem of association is to use a P-value. Goodman makes an intriguing argument that using a P-value to associate from the short term perspective to the long term perspective is in fact a fallacy. The short term reasoning implies evidence based inductive conclusions, whereas the long term reasoning implies error-based and deductive conclusions. This paradox Goodman has coined as the P-value fallacy.

As could be expected, the author does provide a (better, although admittedly imperfect) solution to the inductive vs. deductive paradox within the scheme of the P-value fallacy. Goodman proposes that the commonly reported frequentist statistical approach of confidence intervals allows for a range of solution effects that suit the data. Confidence intervals allow us to acknowldge the size of the effect at hand. As was mentioned, this is an imperfect solution, while certainly better that P-values, confidence intervals do not solve all of our frequentist problems (enter bayesian methods, and likelihood ratios).