What are Hypotheses?

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A hypothesis is a logical supposition, a reasonable guess, or an educated conjecture. We often hypothesize in everyday life. When we choose to see a movie or go to a new place for dinner, we hypothesize that these will be enjoyable and worthwhile experiences. When we claim that an educational program or a treatment for a disease is more efficacious than an existing program or treatment, this, too, involves making a hypothesis. Humans reason on a relational basis, and have a natural tendency to try to account for the cause of an event by constructing a series of reasonable guesses or hypotheses.

In quantitative research, hypothesizing starts with the identification of a problem (and its attendant subproblems), and then constructing research questions, regarding the relationship between variables, to help solve the problem. A hypothesis provides a tentative explanation for a phenomenon under investigation. We *never* prove or disprove a hypothesis. Instead we determine if the hypothesis is supported, or not supported, by the data. If the data run contrary to a particular hypothesis, we reject that hypothesis and turn to other possibilities as being a more likely explanations of the phenomenon in question (Leedy & Ormrod, 2010).

Although a research question may contain more than one independent variable and more than one dependent variable, each hypothesis should contain only one of each type of variable [an exception would be if multivariate methods will be used to test the hypothesis]. You must

have a way to *measure* each type of variable in your study. The hypothesis needs to express the probable relationship between the variables. A correctly formulated hypothesis should answer the following questions:

- Which variables am I, the researcher, manipulating, or what variables are responsible for a situation? How can I measure these variables? (Independent variable)
- What results do I expect? How can these results be measured? (Dependent variable)
- Why do I expect these results? The rationale for these expectations should be made explicit in the light of your review of the research, your personal experience and/or your theoretical framework. Even if you don't have a specific theory, there should be some sort of logic underlying your expectation. This rationale should be explicated in your study.

The null hypothesis (H0) is a statistical hypothesis asserting that any change from what has been thought to be true will be due entirely to random error. Some people refer to the null hypothesis as the ***no*** hypothesis; no relationship, no change; no difference. If H0 is not rejected, this does not lead to the conclusion that no association or differences exist, but rather that the analysis did not detect any association or difference between the variables or groups. Failing to reject the null hypothesis is comparable to a finding of not guilty in a trial. The defendant is not declared innocent. Instead, we conclude there is not enough evidence to be convincing beyond a reasonable doubt. In the judicial system, a decision is made and the defendant is set free (see: http://www.ruf.rice.edu/~lane/hyperstat/B51569.html) regardless of the true guilt or innocence of the defendant.

A null hypothesis is **not** accepted just because it is not rejected. Even if the data are not sufficient to show convincingly that a difference between means is not zero, this does **not** prove

that the difference **is** zero. Such data may even *suggest* that H0 is false but not be strong enough to make a convincing case that the null hypothesis *is* false. A p-value (or probability value) is a measure of how much evidence we have against the null hypothesis. The smaller the p-value, the more evidence we have against H0. The standard for rejecting the null is $p < 0.05$. For example, if the probability, or p-value value was 0.15 ($p = 0.15$) then one would not be ready to present one's case that the null hypothesis is false to the (properly) skeptical scientific community. More convincing data would be needed to do that. However, there would be no basis to conclude that the null hypothesis is true. It may or may not be true; there just is not strong enough evidence to reject it.

If the null hypothesis is not rejected, where does this leave the researcher who wishes to argue that a variable does **not** have an effect? If the null hypothesis *cannot be accepted,* even in principle, then what type of statistical evidence can be used to support the hypothesis that a variable does not have an effect? The answer lies in relaxing the claim a little and arguing not that a variable has **no** effect whatsoever, but that it has, at most, a *negligible* effect. This can be done by constructing a confidence interval around the parameter value.

Hypothesis formation

Broad area/Research Question	Hypothesis
Employee Motivation What is the relationship between the implementation of an attendance bonus system and employee attendance?	The implementation of an attendance bonus is related to employee attendance. H0: The implementation of an attendance bonus is not related to employee attendance.
Health Field What is the difference in longevity of cancer patients who receive chemotherapy and those who receive both chemotherapy and radiation?	There is a difference in longevity between cancer patients receiving chemotherapy only and those receiving both chemotherapy and radiation. H0: There is no difference in longevity between cancer patients receiving chemotherapy only and those receiving both chemotherapy and radiation.
Education What is the relationship between the type of pre-service training received and teacher performance?	There is a relationship between the type pre-service training and teacher performance. H0: There is no relationship between the type pre-service training and teacher performance.

References

Creswell, J. W. (2009). *Research Design* (3rd Ed.). Los Angeles, CA: Sage.

Leedy, P. D., & Ormrod, J. (2010). *Practical Research* (9th Ed.). Upper Saddle River, NJ: Pearson.

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