Which Chapter Should You Read?¹

This note is devoted to helping you sort out which tools to use when your question looks like one of the following:

1. Has there been an increase (or decrease or change, simply) in the average of $Y$?²
2. Does the average of $Y$ meet some chosen target?
3. Has there been an increase (or decrease or change, simply) in the proportion of individuals in category $A$?³
4. Does the proportion of $A$ meet some chosen target?

If your question is one of relationships (e.g. how does the average of $Y$ change⁴ with some predictor $X$ (or some number of predictors), then you would likely be better served heading off to the regression material.

Choices for a Measured Variable

Let’s tackle questions (1) and (2) first: seeking evidence regarding some quantitative variable $Y$.

If you are looking for a change⁵, you need something against which to compare the mean of $Y$.

That value could arise from a previous sample of data. If so, and

1. You measure $Y$ on the same samples as previously, you have paired data.
   a. If your interest is in incremental change⁶, the Methods for Paired Data is what you need.
   b. If your interest is in relative change, the Relative Change in Paired Data is what you need. Note that there you will have to decide between the mean of ratios approach or the ratio of means approach.

¹ If you are a student in a statistics class, this is a no-brainer: read whatever the heck the instructor tells you to ☺. This little note is for later. Once you get into the real world, it may well be up to you to decide which statistical tools to use.
² Here, $Y$ is a generic symbol for some quantitative variable you are measuring.
³ Again, “$A$” is a placeholder. We used the word “individuals” here; they may indeed by individual people, but could also be individual plots on a landscape, or any of a large number of other entities. Here, each datum will be recorded as “Yes” or “No” with regard to membership in $A$.
⁴ If your question reads more like “How does the proportion of individuals in category $A$ change…”, then it is a logistic regression question...
⁵ And for purposes here, “change” will be shorthand for, “increase, decrease, or change simply”.
⁶ Incremental change meaning a change measured by subtraction...
(2) If you measure $Y$ on a completely different sample of subjects, you have two independent samples.

In either of these two cases, if your interest is in incremental change, you would test against a null value of 0 (indicative of no change), or look to see if 0 falls into a confidence interval based on the observed change. If you are intent on relative change, then “1” becomes the point of testing and comparison.

The value in question could also be simply a choice (perhaps from the historical record or some other source)\(^7\). In this case, it has no uncertainty (unlike the mean from some other sample). In that case, you have in mind a fixed number $C$, say, and a mean from a single sample. You would test whether the mean of the population whence came your data was equal to $C$, or whether a confidence interval constructed with your sample mean includes $C$.

It is important to note that claiming an objective has been met (or not) usually requires at least a properly constructed confidence interval or a properly done test\(^8\). Simply reporting a value without reference to its precision is usually not enough. In the relevant chapters are notes on how to proceed if, for instance, your sample sizes are on the small side\(^9\). A further cautionary point: if you are interested in relative change, confidence intervals usually need to be done by bootstrapping; we cover how to do that in our chapters.

### Choices for a Binomial Proportion.

The choices here parallel those in the foregoing section on choices for measured variables. There is but a single chapter to turn to here, **One- and Two-sample methods for Binomial Proportions**, but we will here discuss the design choices.

If you are looking for a change\(^{10}\), you need something against which to compare the observed proportion.

That value could arise from a previous sample of data. If so, and

(3) You estimate the proportion using the same samples, in which case you have paired data. Paired data wherein each datum is a recorded “yes” or “no” with regard to membership in some category is quite rare\(^{11}\). That said, we show you in the chapter how to test and estimate the change.

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\(^7\) An example we could imagine would be to ask a sample of people which way they would vote on a given issue, and then ask the same people that same question sometime later.
(4) If you estimate the proportion on two different samples of subjects, you have two independent samples; methods for this are covered in the chapter.

The value in question could also be simply a choice (perhaps from the historical record or some other source). In this case, it has no uncertainty (unlike the mean from some other sample). In that case, you have in mind a fixed proportion $P$, say, and a proportion from a single sample. You would test whether the proportion in the population whence came your data was equal to $P$, or whether a confidence interval constructed with your sample mean includes $P$. 