

7 WAYS TO HANDLE MISSING DATA

by Jeff Sauro | June 2, 2015

3	4	Strongly Agree 5
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
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Data goes missing.

It's a fact of life for the researcher.

You put time and money into a research study. You do what you can to prevent missing data and dropout. (<http://www.measuringu.com/blog/horrible-responserate.php>) but missing values happen and you have to deal with it.

How do you address that lost data?

First, determine the pattern of your missing data. There are three types of missing data (<http://www.measuringu.com/blog/missing-data.php>):

- **Missing Completely at Random:** There is no pattern in the missing data on any variables. This is the best you can hope for.
- **Missing at Random:** There is a pattern in the missing data but not on your primary dependent variables such as likelihood to recommend (<http://www.measuringu.com/blog/nps-ux.php>) or SUS Scores (<http://www.measuringu.com/blog/10-things-SUS.php>).
- **Missing Not at Random:** There is a pattern in the missing data that affect your primary dependent variables. For example, lower-income participants are less likely to respond and thus affect your conclusions about income and likelihood to recommend. Missing not at random is your worst-case scenario. Proceed with caution.

And here are seven things you can do about that missing data:

1. **Listwise Deletion:** Delete all data from any participant with missing values. If your sample is large enough, then you likely can drop data without substantial loss of statistical power. Be sure that the values are missing at random and that you are not inadvertently removing a class of participants.
2. **Recover the Values:** You can sometimes contact the participants and ask them to fill out the missing values. For in-person studies, we've found having an additional check for missing values before the participant leaves helps.

Imputation

Imputation is replacing missing values with substitute values. The following methods use some form of imputation.

3. **Educated Guessing:** It sounds arbitrary and isn't your preferred course of action, but you can often infer a missing value. For related questions, for example, like those often presented in a matrix, if the participant responds with all "4s", assume that the missing value is a 4.

Please rate your level of agreement to the following statements about the Chipotle website.

	Strongly Disagree 1	2	3	4	Strongly Agree 5
The Chipotle website has a clean and simple presentation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
The Chipotle website is easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I find the Chipotle website to be attractive.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
The Chipotle website is trustworthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
It is easy to navigate within the Chipotle website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Chipotle website's capabilities meet my requirements.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
The information on the Chipotle website is credible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I will likely return to the Chipotle website in the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

4. **Average Imputation:** Use the average value of the responses from the other participants to fill in the missing value. If the average of the 30 responses on the question is a 4.1, use a 4.1 as the imputed value. This choice is not always recommended

because it can artificially reduce the variability of your data but in some cases makes sense. [\(https://measuringu.com/\)](https://measuringu.com/) [\(https://measuringu.com/my-account/\)](https://measuringu.com/my-account/)

5. **Common-Point Imputation:** For a rating scale, using the middle point or most commonly chosen value. For example, on a five-point scale, substitute a 3, the midpoint, or a 4, the most common value (in many cases). This is a bit more structured than guessing, but it's still among the more risky options. Use caution unless you have good reason and data to support using the substitute value.

6. **Regression Substitution:** You can use multiple-regression analysis to estimate a missing value. We use this technique to deal with missing SUS scores. Regression substitution predicts the missing value from the other values. In the case of missing SUS data, we had enough data to create stable regression equations and predict the missing values automatically in the calculator [\(https://www.measuringu.com/products/SUSpack/\)](https://www.measuringu.com/products/SUSpack/).

7. **Multiple Imputation:** The most sophisticated and, currently, most popular approach is to take the regression idea further and take advantage of correlations between responses. In [multiple imputation](http://www.csos.jhu.edu/contact/staff/jwayman_pub/wayman_multimp_aera2003.pdf) [\[pdf\]](http://www.csos.jhu.edu/contact/staff/jwayman_pub/wayman_multimp_aera2003.pdf), software creates plausible values based on the correlations for the missing data and then averages the simulated datasets by incorporating random errors in your predictions. It is one of a number of examples where computers continue to change the statistical landscape. Most statistical packages like SPSS come with a multiple-imputation feature. More on [multiple imputation](http://sites.stat.psu.edu/~jls/mifaq.html#ref) [\[http://sites.stat.psu.edu/~jls/mifaq.html#ref\]](http://sites.stat.psu.edu/~jls/mifaq.html#ref).

Missing data is like a medical concern: ignoring it doesn't make it go away. Ideally your data is missing at random and one of these seven approaches will help you make the most of the data you have.

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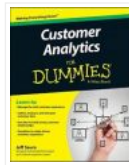
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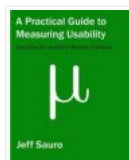
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201 Steele St, #200
Denver, Colorado 80206
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