Tidy Data

Data Tidying

There are 7 different **variables** in this spreadsheet.

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

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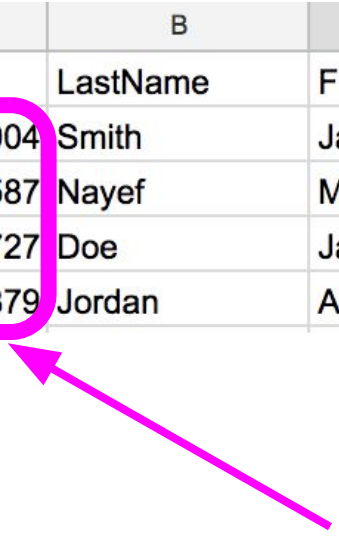

For each variable, we see there are 4 different **observations**.

Demographic Survey Data

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

Two different **types** of data

Doctor's Office Measurements Data

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Height_inches	Weight_lbs	Insulin	Glucose
2	1004	Smith	Jane	65	180	0.60	163
3	4587	Nayef	Mohammed	75	215	1.46	150
4	1727	Doe	Janice	62	124	0.72	177
5	6879	Jordan	Alex	77	160	1.23	205

1. Each variable you measure should be in a **single column**

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

2. Every observation of a variable should be in a **different row**

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

3. There should be one spreadsheet for each type of data

Demographic Survey Data

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1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

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4. If you have multiple spreadsheets, they should include a column in each spreadsheet with the same column label that **allows them to be joined or merged**

Demographic Survey Data

	A	B	C	D	E	F	G
1	ID	LastName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
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Rules for Tidy Spreadsheets

1. Be consistent
2. Choose good names for things
3. Write dates as YYYY-MM-DD
4. No empty cells
5. Put just one thing in a cell
6. Don't use font color or highlighting as data
7. Save the data as plain text files

1. Be Consistent!

	A	B	C	D	E	F	G
1	ID	astName	FirstName	Sex	City	State	Occupation
2	1004	Smith	Jane	female	Frederick	MD	Welder
3	4587	Nayef	Mohammed	male	Upper Darby	PA	Nurse
4	1727	Doe	Janice	female	San Diego	CA	Doctor
5	6879	Jordan	Alex	male	Birmingham	AL	Teacher

Keep exactly the same variable names across spreadsheets.

In these data, sex is always specified as “female” or “male.” Pick a way to code your variables and stick to it.

Broman KW, Woo KH. (2017) Data organization in spreadsheets. *PeerJ Preprints*5:e3183v1 https://doi.org/10.7287/peerj.preprints.3183v1

2. Choose good names for things

	Do this...	**Not This!**
Avoid Extra Spaces	'male'	'male '
Use underscores not spaces	doctor_visit_v1	Doctor Visit 1
Choose meaningful names	doctor_visit_v1	“F1”

3. Write dates as YYYY-MM-DD

	Do this...	**Not This!**
Use 'ISO 8601' standard	2018-02-27	2/27 *or* 2_27_2018 *or* Feb 27

4. No empty cells

A

	A	B	C
1	id	date	glucose
2	101	2015-06-14	149.3
3	102		95.3
4	103	2015-06-18	97.5
5	104		117.0
6	105		108.0
7	106	2015-06-20	149.0
8	107		169.4

B

	A	B	C	D	E	F	G	H	I
1		1 min				5 min			
2	strain	normal		mutant		normal		mutant	
3	A	147	139	166	179	334	354	451	474
4	B	246	240	178	172	514	611	412	447

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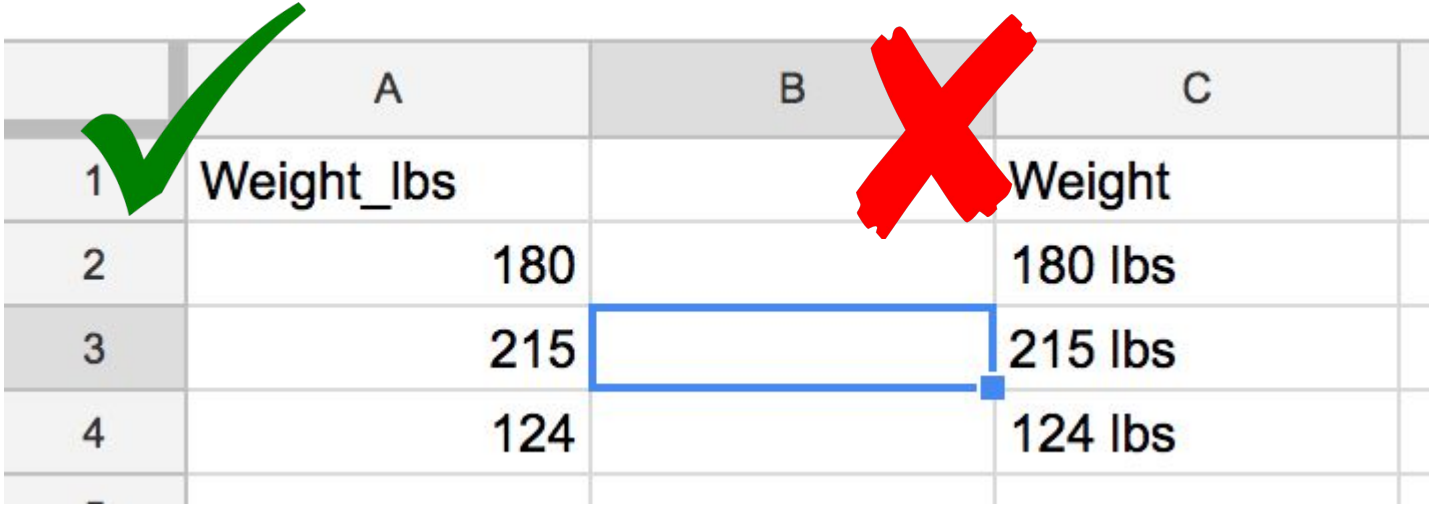
5. Put just one thing in a cell



	A	B	C
1	Weight_lbs		Weight
2	180		180 lbs
3	215		215 lbs
4	124		124 lbs

6. Don’t use font color or highlighting as data

A

	A	B	C
1	id	date	glucose
2	101	2015-06-14	149.3
3	102	2015-06-14	95.3
4	103	2015-06-18	97.5
5	104	2015-06-18	1.1
6	105	2015-06-18	108.0
7	106	2015-06-20	149.0
8	107	2015-06-20	169.4

B

	A	B	C	D
1	id	date	glucose	outlier
2	101	2015-06-14	149.3	FALSE
3	102	2015-06-14	95.3	FALSE
4	103	2015-06-18	97.5	FALSE
5	104	2015-06-18	1.1	TRUE
6	105	2015-06-18	108.0	FALSE
7	106	2015-06-20	149.0	FALSE
8	107	2015-06-20	169.4	FALSE

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When..	Be sure to...	So Do this...	Avoid this...	Why?
Naming variables (aka assigning column headers)	Use meaningful variable names	`AgeAtDiagnosis`	`ADx`	`ADx` is an unclear and uninformative abbreviation
Naming variables	Avoid spacing in column headers	`AgeAtDiagnosis`	`Age At Diagnosis`	Spacing in variable names makes the analyst's life more difficult
Naming variables	Use consistent capitalization	`AgeAtDiagnosis`	Using both `AgeAtDiagnosis` and `ageatdiagnosis`	Using consistent column names across tables/spreadsheets simplifies any merging the statistician may have to do.
Naming variables	Avoid using separators, but if it's necessary, use an underscore (`_`)	`IGF1` (or `IGF_1`)	`IGF.1`, `IGF-1`, `IGF/1`, `IGF,1`	Separators (commas, periods, hyphens, slashes, spaces etc.) often have different meanings in coding languages than they do in text. Avoiding them avoids error.
Coding variables	Avoid unnecessary spaces	'male'	'male '	That extra space after 'male ' makes it different from 'male' without a space.
Coding variables	Be consistent!	'male'	'Male',`male', and 'M',	In the eyes of the statistician, 'Male',`male', and 'M' could be incorrectly perceived as three different values.
Coding variables	Be careful of spelling errors	'male'	'maale'	That extra 'a' makes these two different categories.
Coding date and time	Use ISO 8601 coding	'YYYY-MM-DD'	'MM/DD/YY` and `Month Day, Year`	Consistency simplifies the analyst's life, and YYYY-MM-DD will not be misconstrued if opened in Excel.
Coding missing data	Not leave any cells blank and use a consistent value	'NA'	'0', '-9', red-highlighted blank cells, '.', ' ', '-', ...	Each cell should be filled with a consistent value. Pick a way to denote missingness (ideally 'NA') and stick with it. Avoid using numbers or punctuation to denote missing data.
Entering data	Stick to text and numbers	Convey all information with direct text/numerical entry	Using cell highlighting or font color to convey information	Your analyst may not use the same platform for analysis as you used for data entry, so avoiding font color and cell highlighting will minimize issues.
Generating an Excel file	Save the data in an appropriate format	Use one worksheet per table and save as CSV or text files	Multiple worksheets	Statisticians require this format to import your data onto other platforms.
Entering Data	Avoid entering unnecessary lines of text at the start	Start your first row with variable names	Adding lines of text	This violates the rules of tidy data and makes processing more difficult. Include this information in the "Code book" instead.
Opening files in Excel	Know and avoid its pitfalls	Consistently include one value per cell and be careful of date and time data.	Using macros, splitting cells, and merging cells	These formats are not amenable to data analysis on other platforms.

Ellis SE, Leek JT. (2017) How to share data for collaboration. *PeerJ Preprints* 5:e3139v5https://doi.org/10.7287/peerj.preprints.3139v5

Tidy data = rectangular data

A

	A	B	C	D	E
1	id	sex	glucose	insulin	triglyc
2	101	Male	134.1	0.60	273.4
3	102	Female	120.0	1.18	243.6
4	103	Male	124.8	1.23	297.6
5	104	Male	83.1	1.16	142.4
6	105	Male	105.2	0.73	215.7

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