Lecture 1: Laying the Foundations + Terminology

Chapters 1.1-1.2

Goals for Today

- Go over the syllabus
- Show some examples of statistics
- Discuss how to evaluate the efficacy of a treatment
- Describe the different kinds of variables we'll consider

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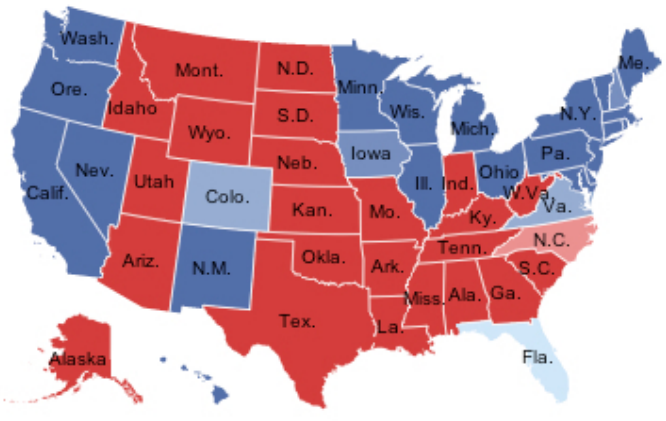
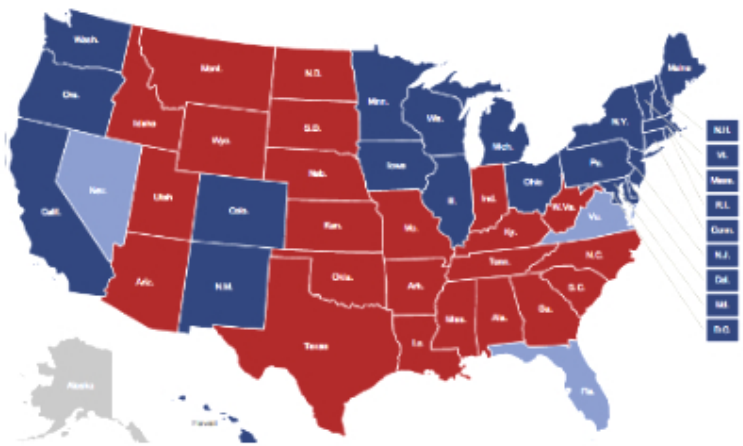
Statistics concerns itself with points 2 through 4.

Example: 2012 Election - Nate Silver's Predictions vs Actual Results



Nate Silver's Map



The Actual Map

Example: Brain & Breast Cancer in Western Washington

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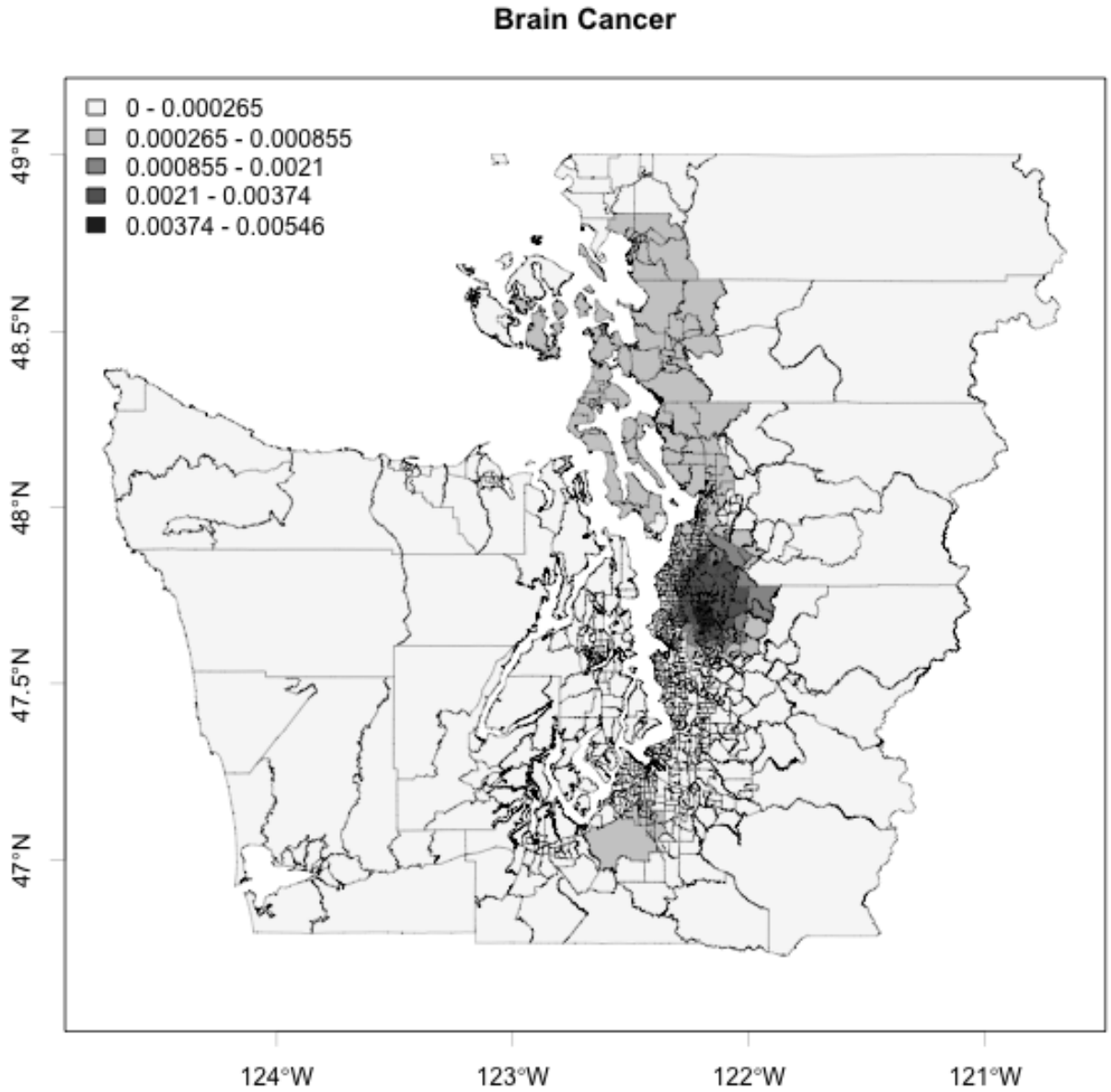
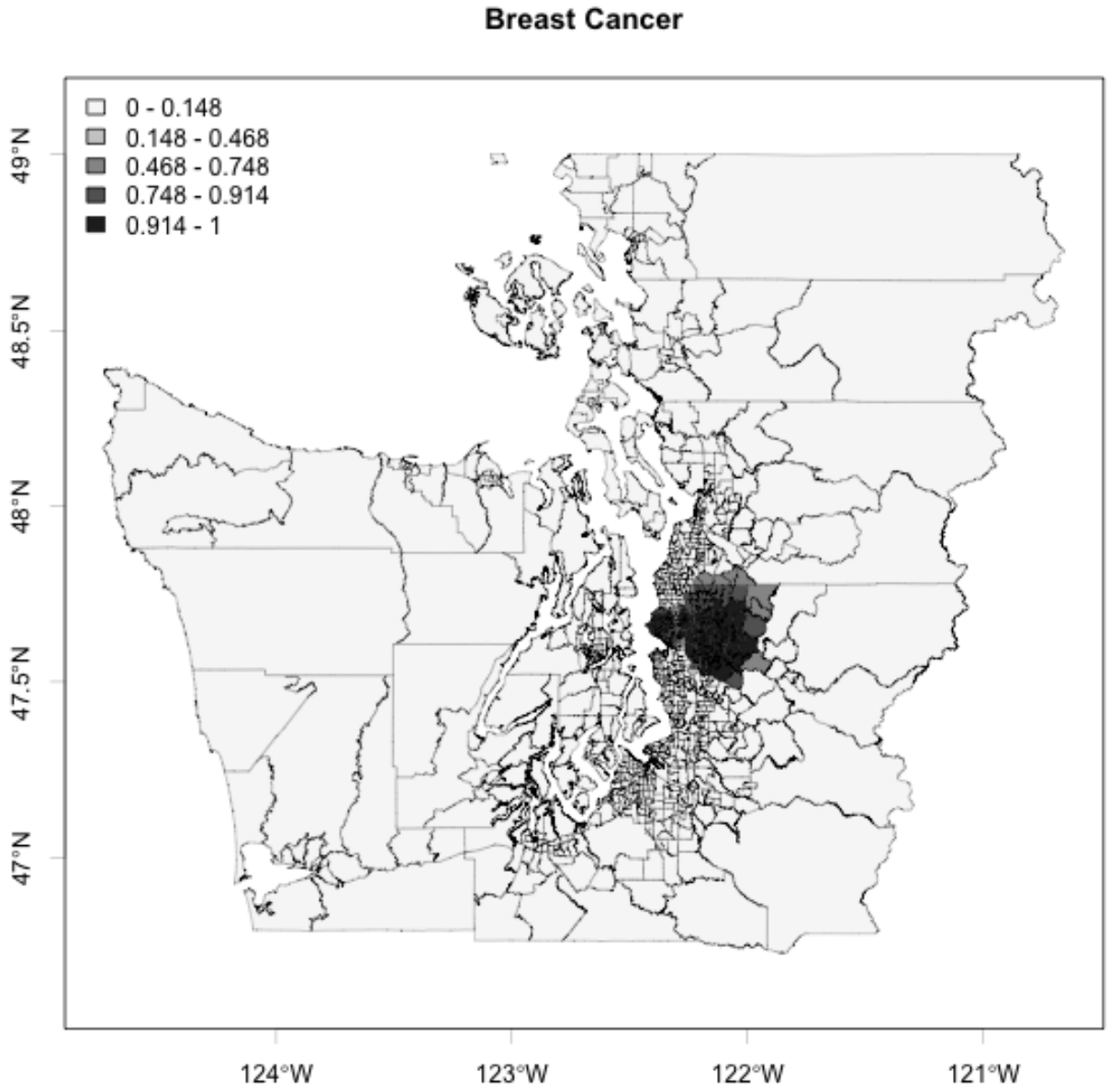
We modeled the (Bayesian) probability of cluster membership for each of the $n = 887$ census tracts in Western Washington in 2000, using cancer data from 1995–2005, controlling for age, race, and gender.

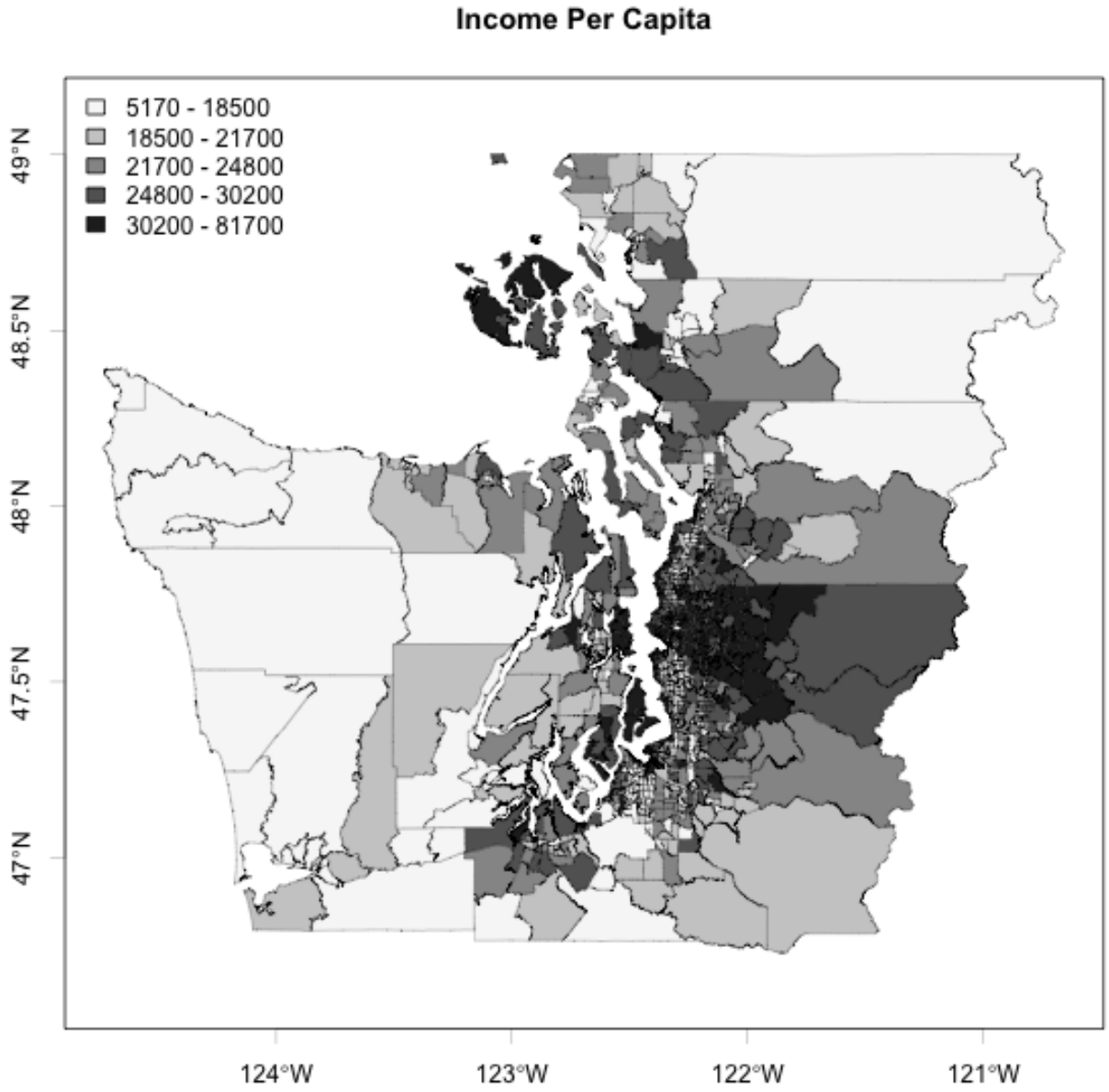
Brain Cancer Controlling for Age, Race, & Gender



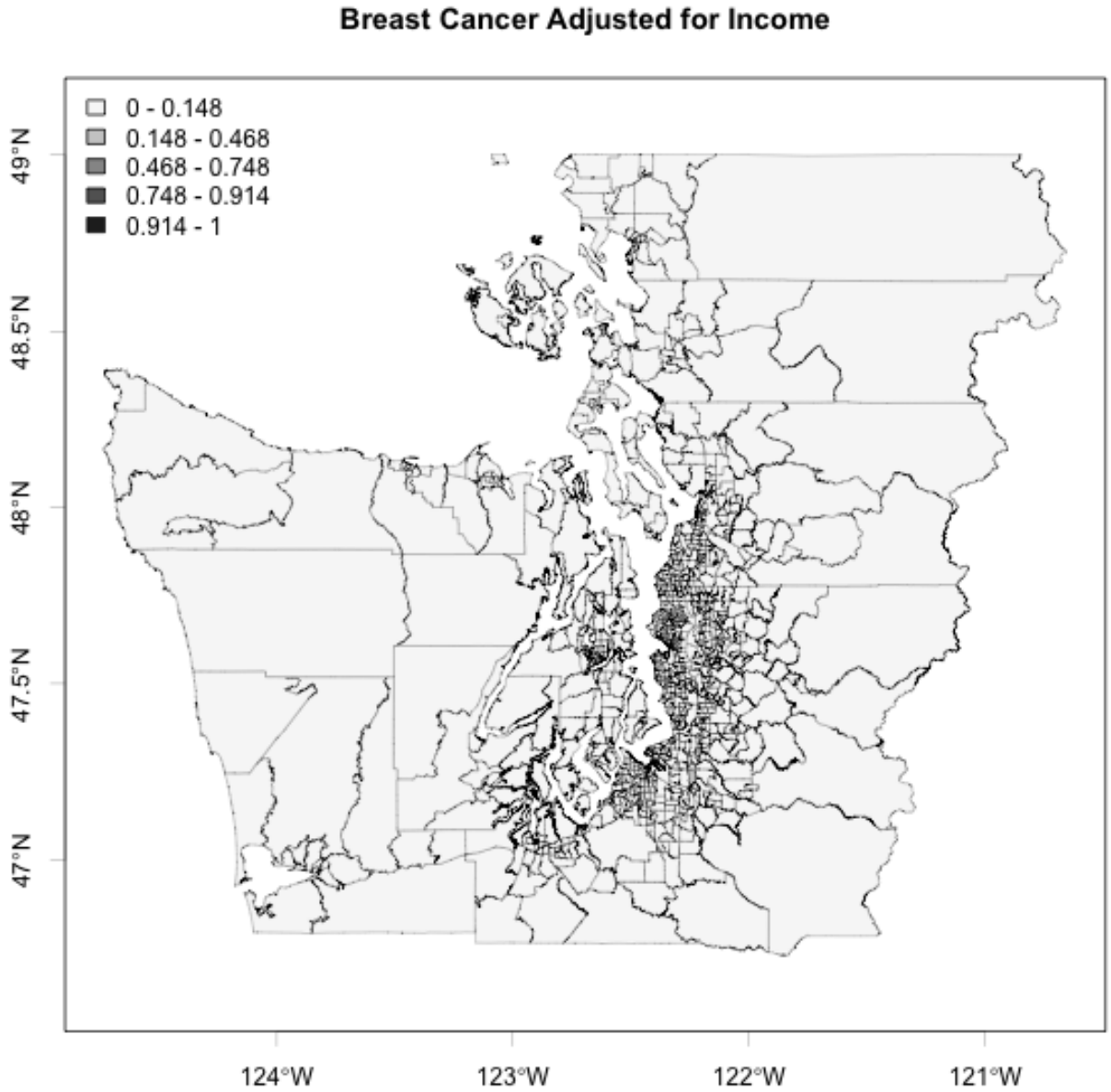
Breast Cancer Controlling for Age, Race, & Gender



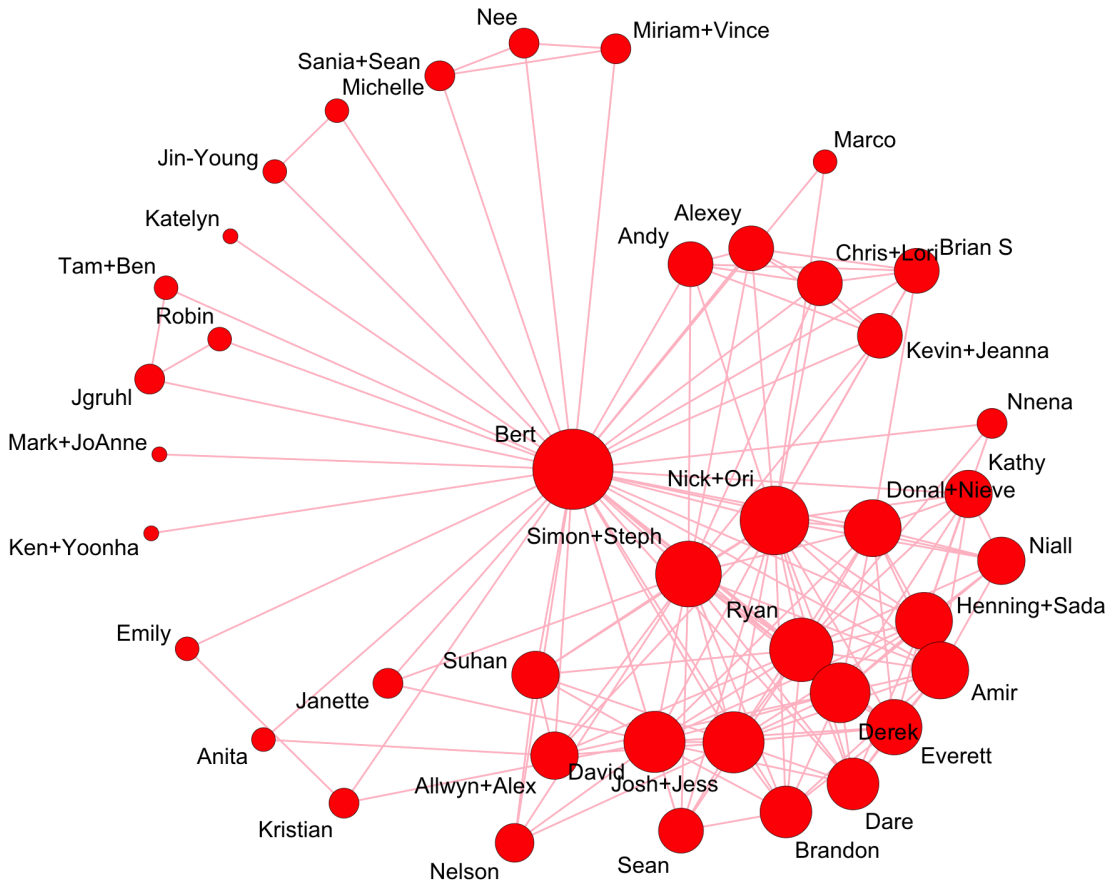
Income per Capita Quintiles



Breast Cancer Adjusted for Income as Well



Example: Social Network Display of a Recent Party I Had



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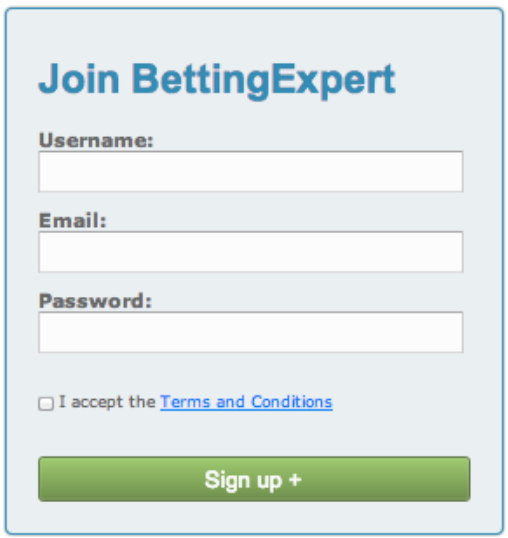
- Will reassuring potential new users to a gambling website that we won't spam them increase the sign-up rate?

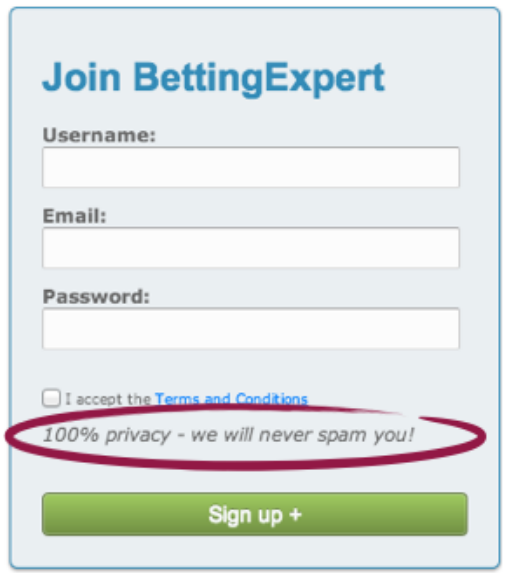
Evaluating the efficacy of a ‘treatment’

Website Experiments

Control:



Treatment:



Example of a treatment vs control

Two other examples in the media of late

- Facebook's tinkering with user's emotions (link)
- OkCupid's admission that they experiment on human beings (link)

Variables

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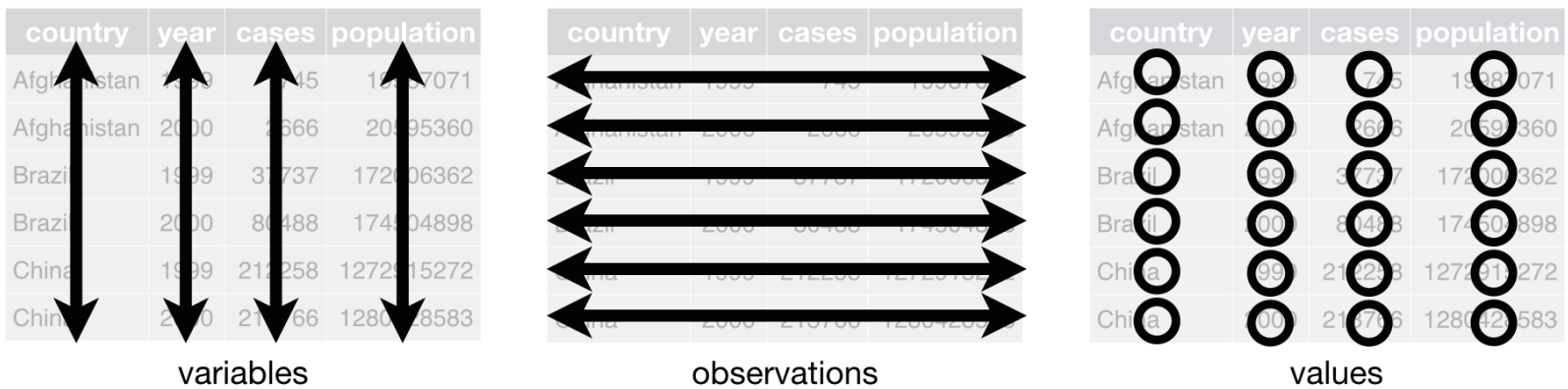

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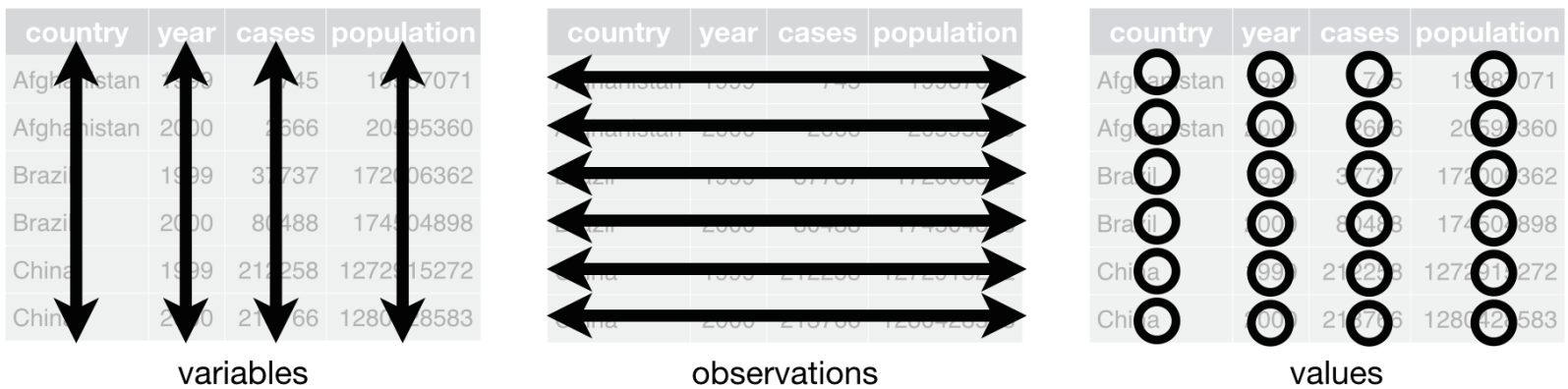

This is also called long/tidy format.

Data Summaries

Consider the variable "federal spending per capita" in each of the 3,143 counties in the US. One can hardly digest this:

```
   [1]   6.068095   6.139862   8.752158   7.122016   5.130910   9.973062   9.311835  15.439218
   [9]   8.613707   7.104621   6.324061  10.640378   9.781442   8.982702   6.840035  20.330684
  [17]   9.687698  11.080738   7.839761   9.461856   9.650295   7.760627  25.774791  13.948106
   ...
[3121]   7.520731  10.246400   3.106800  17.679572   4.824044   7.247212   8.484211   8.794626
[3129]   9.829593   8.100945  17.090715   4.855849   6.621378  22.587359  10.813260  11.422522
[3137]   9.580265   4.368986   5.062138   6.236968   4.549105   8.713817   6.694784
```

Data Summaries

We boil them down via summary statistics: single values summarizing a large amount of data.

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Using the `summary()` command in `R`:

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
  0.000   6.964   8.669   9.991  10.860 204.600       4
```

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We can best display the relationship between two variables using a scatterplot AKA bivariate plot:

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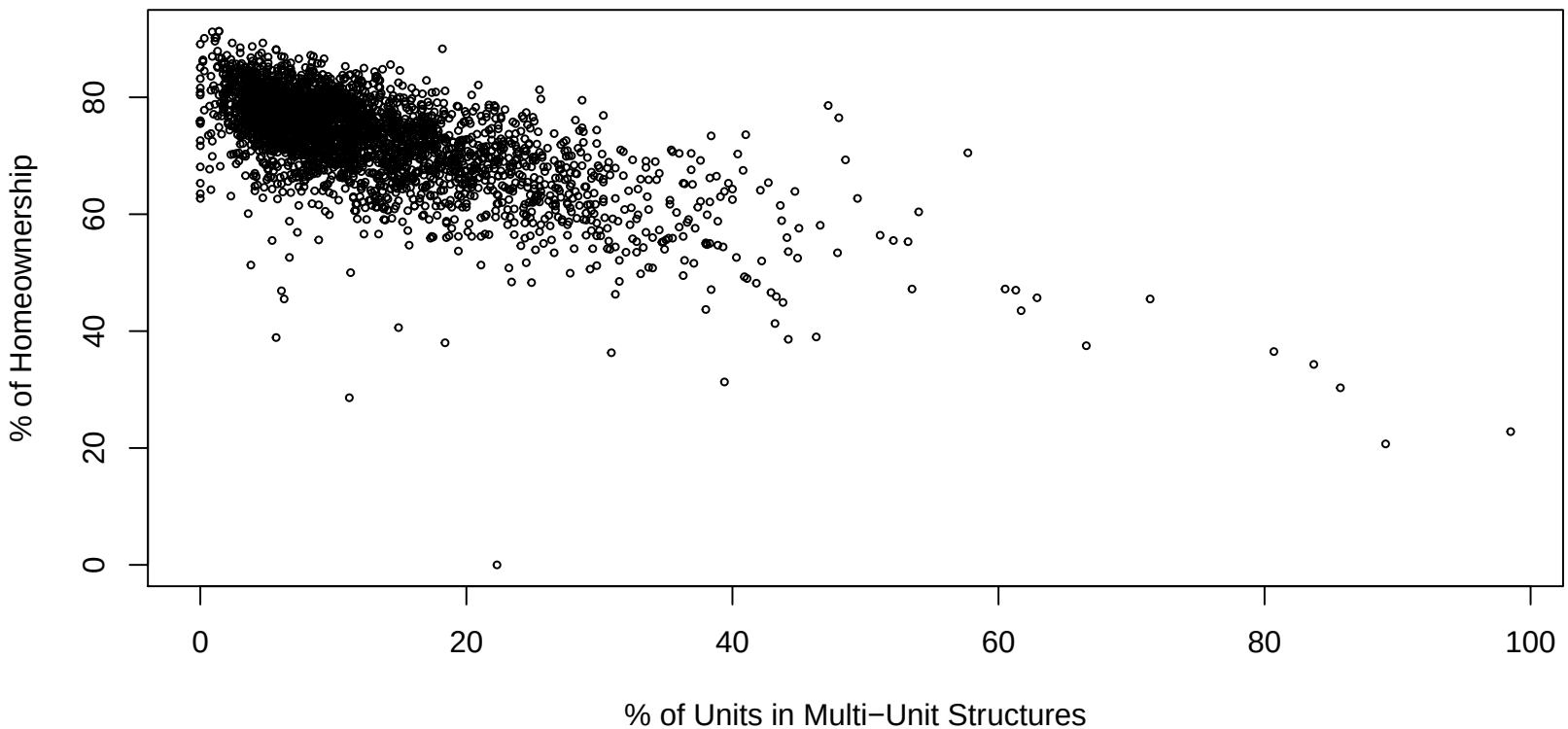

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We can have either a negative association (as the value of one variable increases, the other decreases) or a positive association.

Relationships between variables

We can consider a third variable in the previous plot.