Intro to Stats I

Jorge Valdes

9/26/2018

Introduction

- Perhaps the biggest myth out there is that stats is *just math*.
- It's not as simple as $2 + 2 = 4$, rather Statistics is the science of description, probability, and inference.
- It is a set of procedures and best practices for making educated guesses.
- Instead of finding *exact* solutions; there are only *better* and *worse* ones built off a set of assumptions.
- This contrast is what becomes so challenging for new researchers to grasp.

Taking a different perspective

- Much like our approach with R this semester, I want you to become familiar with some basic concepts in Statistics, so that you can then have the information necessary to make *informed choices*
- These choices should be guided by your research questions, common practice in your discipline, and due diligence in research what statistical methods may be appropriate

Taking a different perspective 2

- Do not make the mistake of believing that a single class or a person (senior student, professor, stats consultant) will be able to "teach" you what analysis is best for you
- The first questions will always be:
  - what is/are your research question(s)?
  - what kind of data do you have?

Two flavors

- *Descriptive* statistics (today's topic)
- *Inferential* statistics

Descriptive statistics basics

- When we have a dataset before us, there are 3 characteristics that are helpful to know about that dataset:
  - central measure
  - distribution/frequency
  - spread/dispersion

Central Measures

- Most commonly referred to as *average* but this term is not technically specific
- 3 primary central measures (1st 2 most common for us):
  - mean: the sum of all values divided by the number of values
  - median: the number of values divided by two
  - mode: most frequent value within a variable

Central Measures in R

```r
a <- c(2,5,7,9,12)
mean(a)
```

```
## [1] 7
```

```r
median(a)
```

```
## [1] 7
```

```r
b <- c(2,6,7,18,20)
mean(b)
```

```
## [1] 10.6
```

```r
median(b)
```

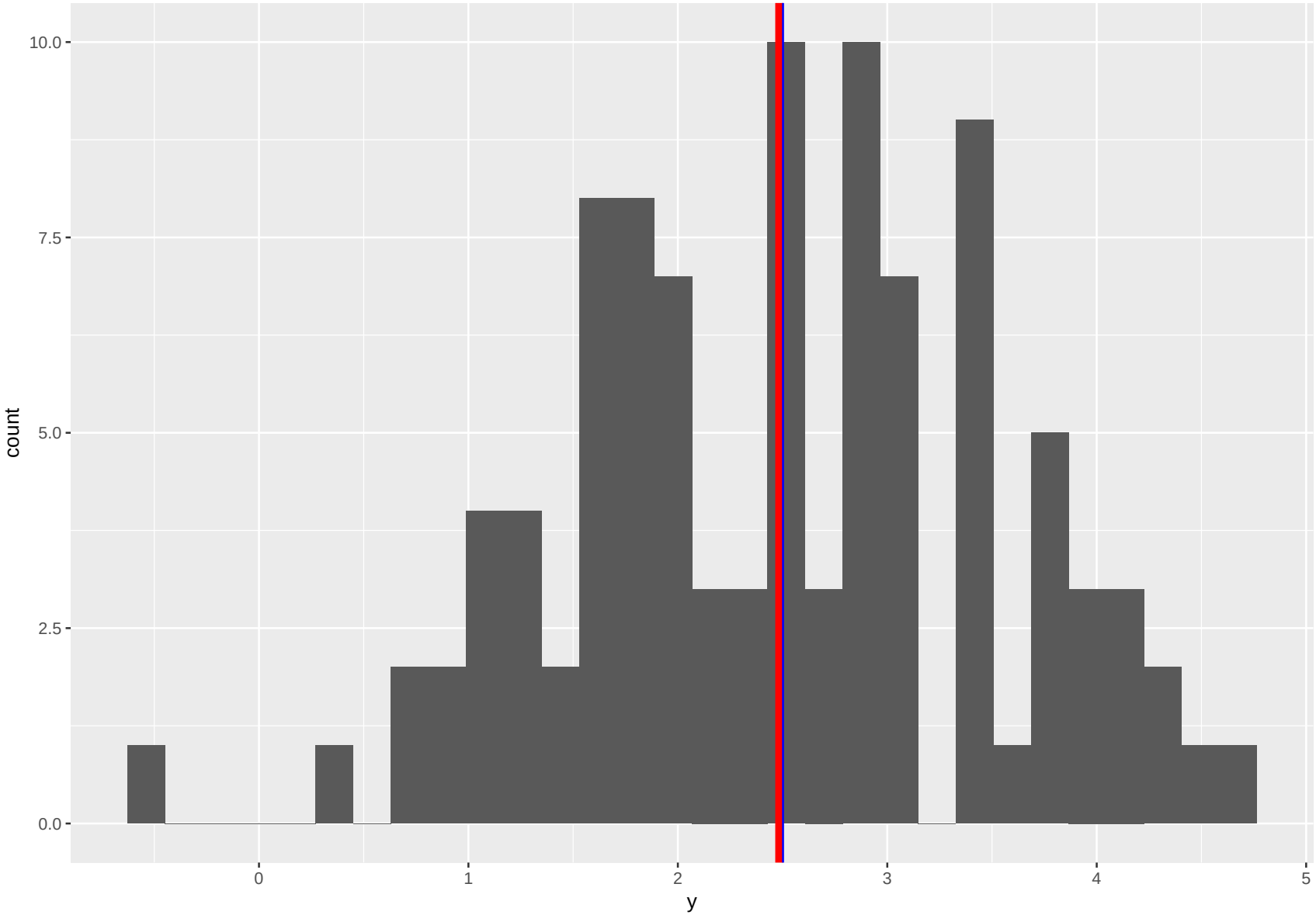
```
## [1] 7
```

Question

- Why do we need two different measures to describe the central tendency?
- We'll want to look at a graph to plot a distribution

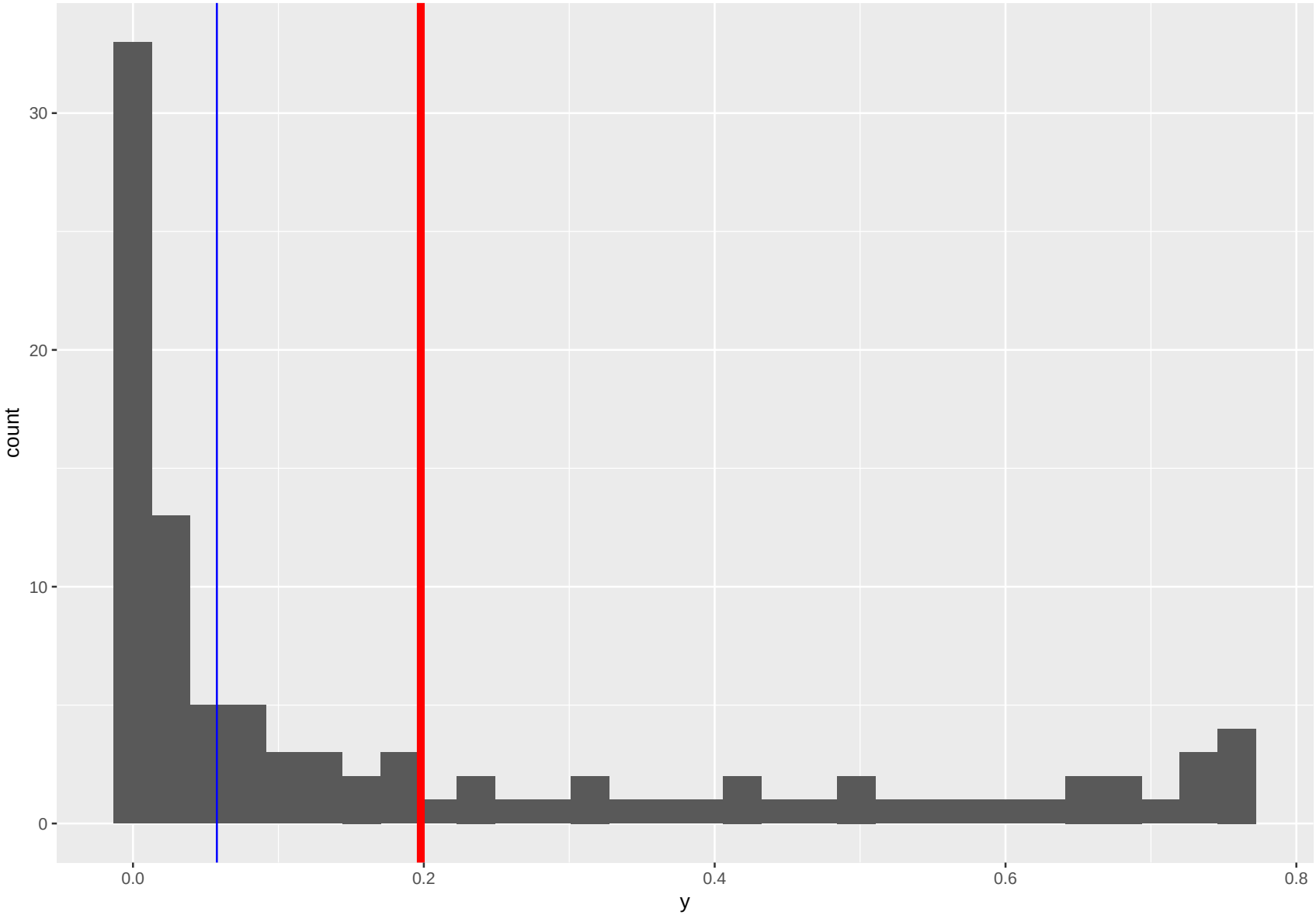
Normal distribution

```
## `stat_bin()` using `bins = 30`. Pick better value with `
```



Non-normal distribution

```
## `stat_bin()` using `bins = 30`. Pick better value with `
```



Distributions

- Distributions are best viewed with a histogram
- Many of the statistical models that we use are based on an assumption of *normality*, even though our dataset may not actually be normal
- Normal distributions are characterized by a bell-shaped curve and look symmetric
- The mean and median of normal distributions are (nearly) identical
- Skewed distributions have a "tail"
- The direction of the tail pulls the mean value, whereas the median is closer to the peak of the curve (the mode is the peak)

Distributions Johson Chap 1

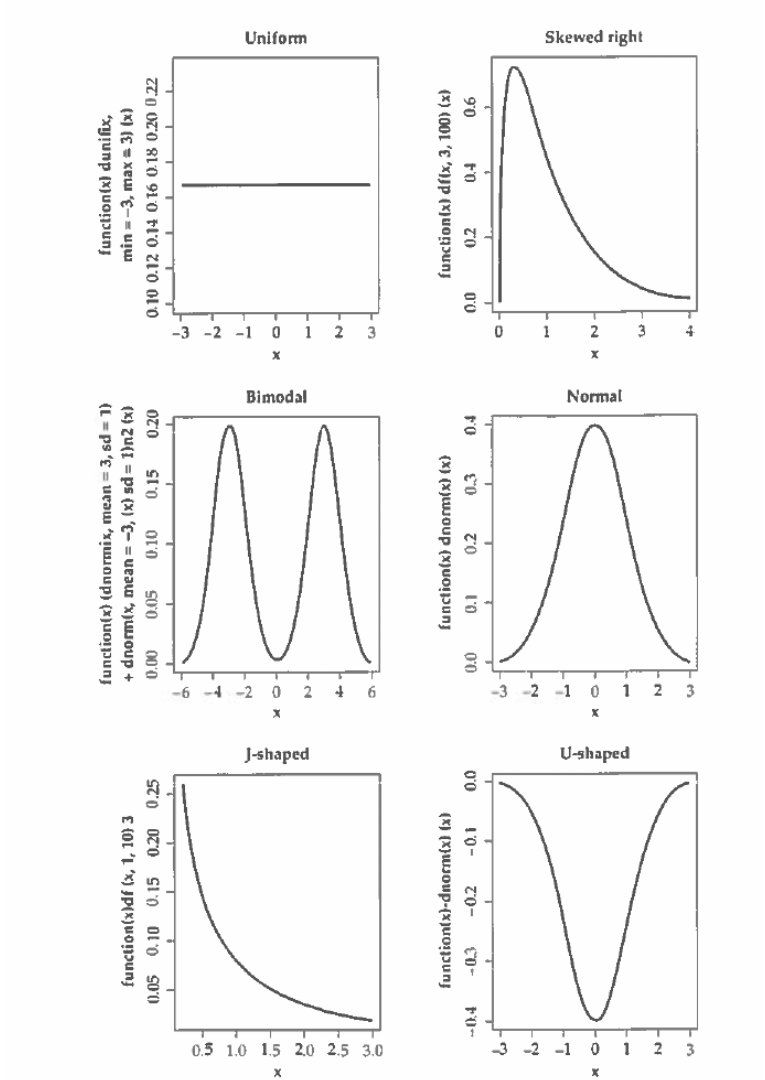


Figure 1.6 Types of probability distributions.

Figure 1: Distributions from Johnson Chapter 1

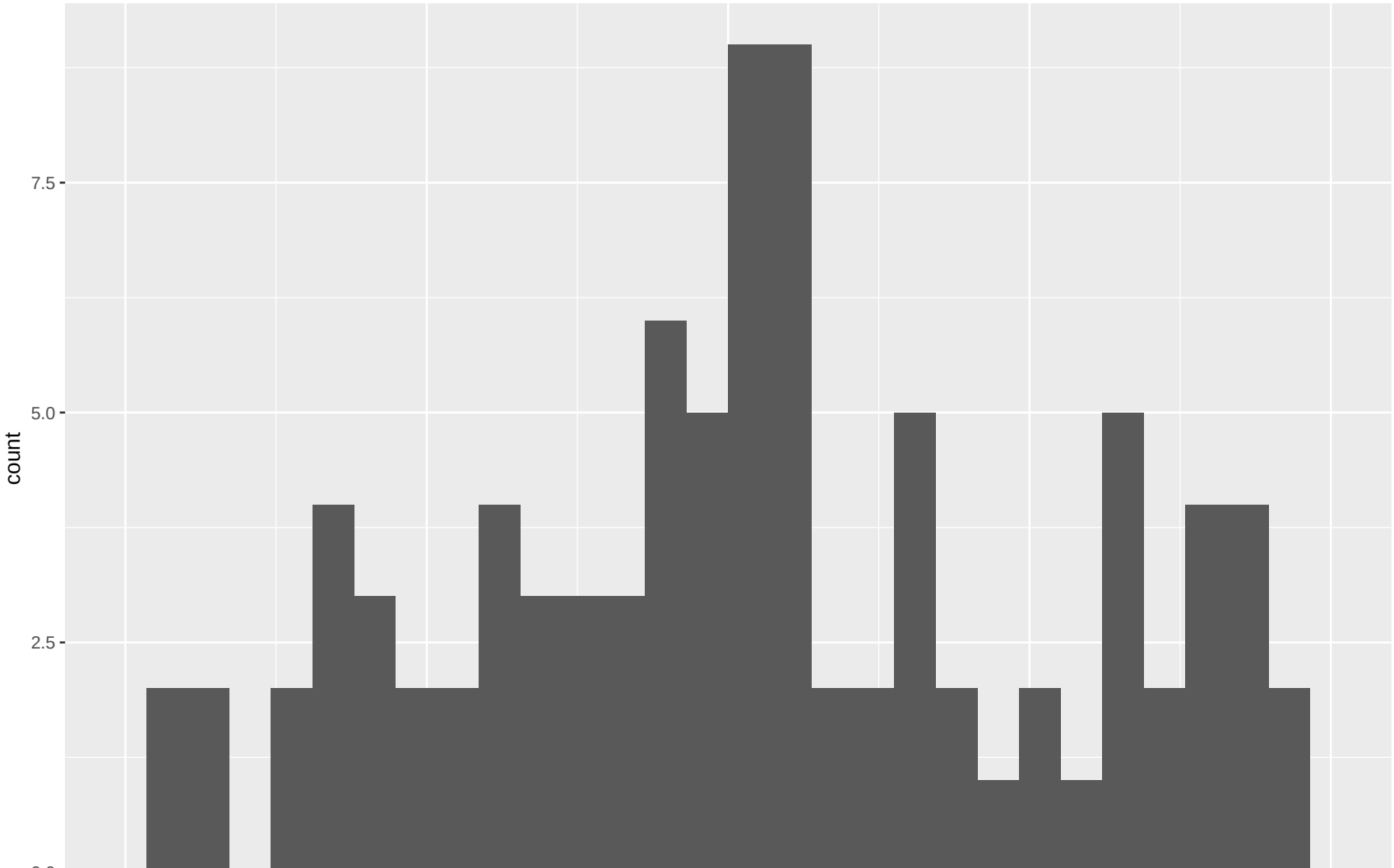
Dispersion/Spread

- We've talked about the central measure of a dataset as well as the overall shape of a dataset
- Now we need a description of how clustered or spread out is the dataset
- This is known as the spread or dispersion of a distribution
- Measures of dispersion/spread
  - range: min and max values of a distribution
  - variance: squard absolute deviation from mean for each value
  - standard deviation: square root of variance
- Standard deviation is a commonly reported measure in our field

Standard Deviation of 25, Mean of 50

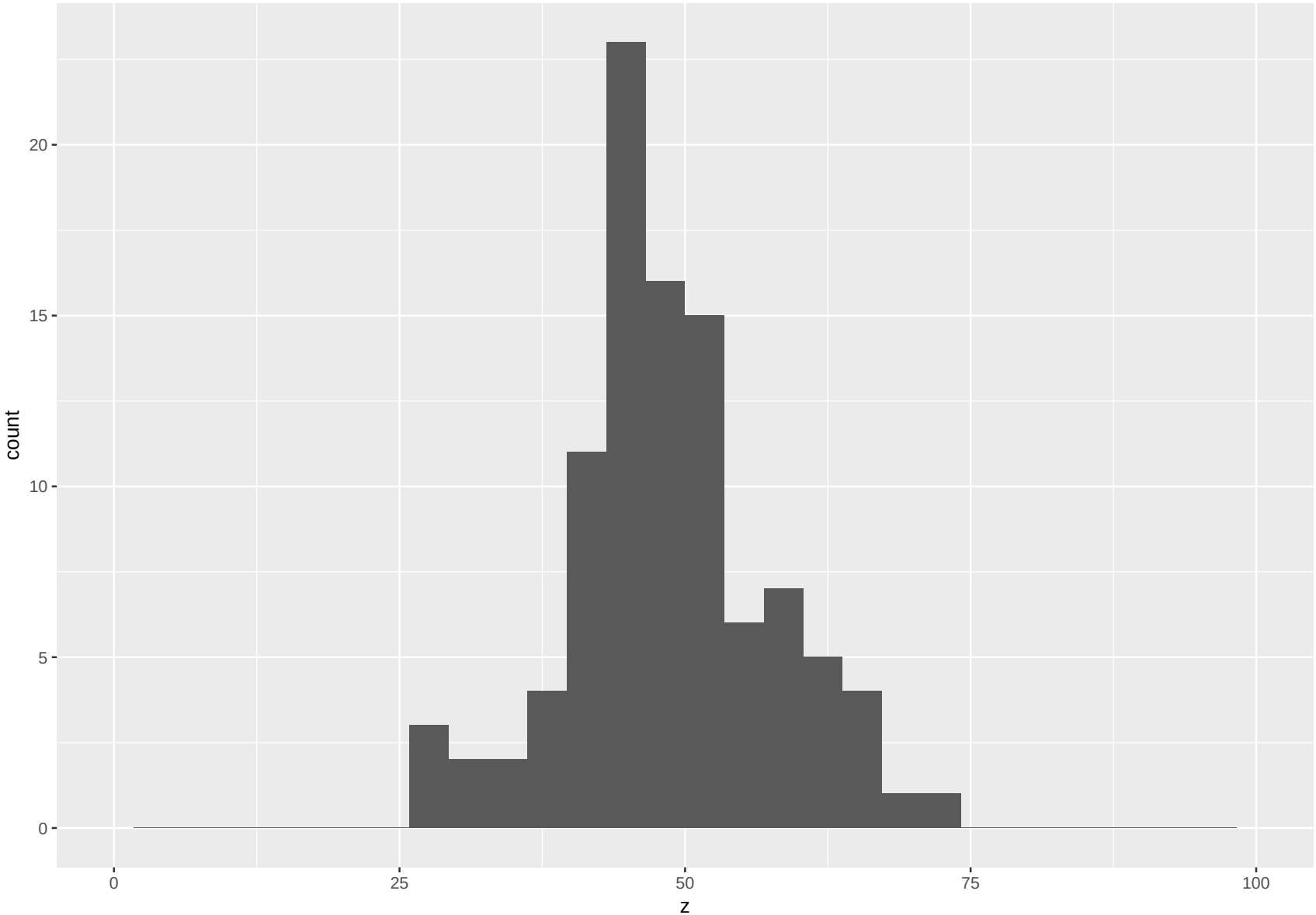
```
## `stat_bin()` using `bins = 30`. Pick better value with `
```

```
## Warning: Removed 7 rows containing non-finite values (st
```



Standard deviation of 10, Mean of 50

```
## `stat_bin()` using `bins = 30`. Pick better value with `
```



Standard Deviations cont.

- Standard deviations help us understand how much of the distribution is captured from the mean
- 1 standard deviation captures about 68% of the distribution
- 2 standard deviations captures about 95% of the distribution
- 3 standard deviations captures about 99.7% of the distribution

Visualizing Standard Deviations

Standard deviations distribution