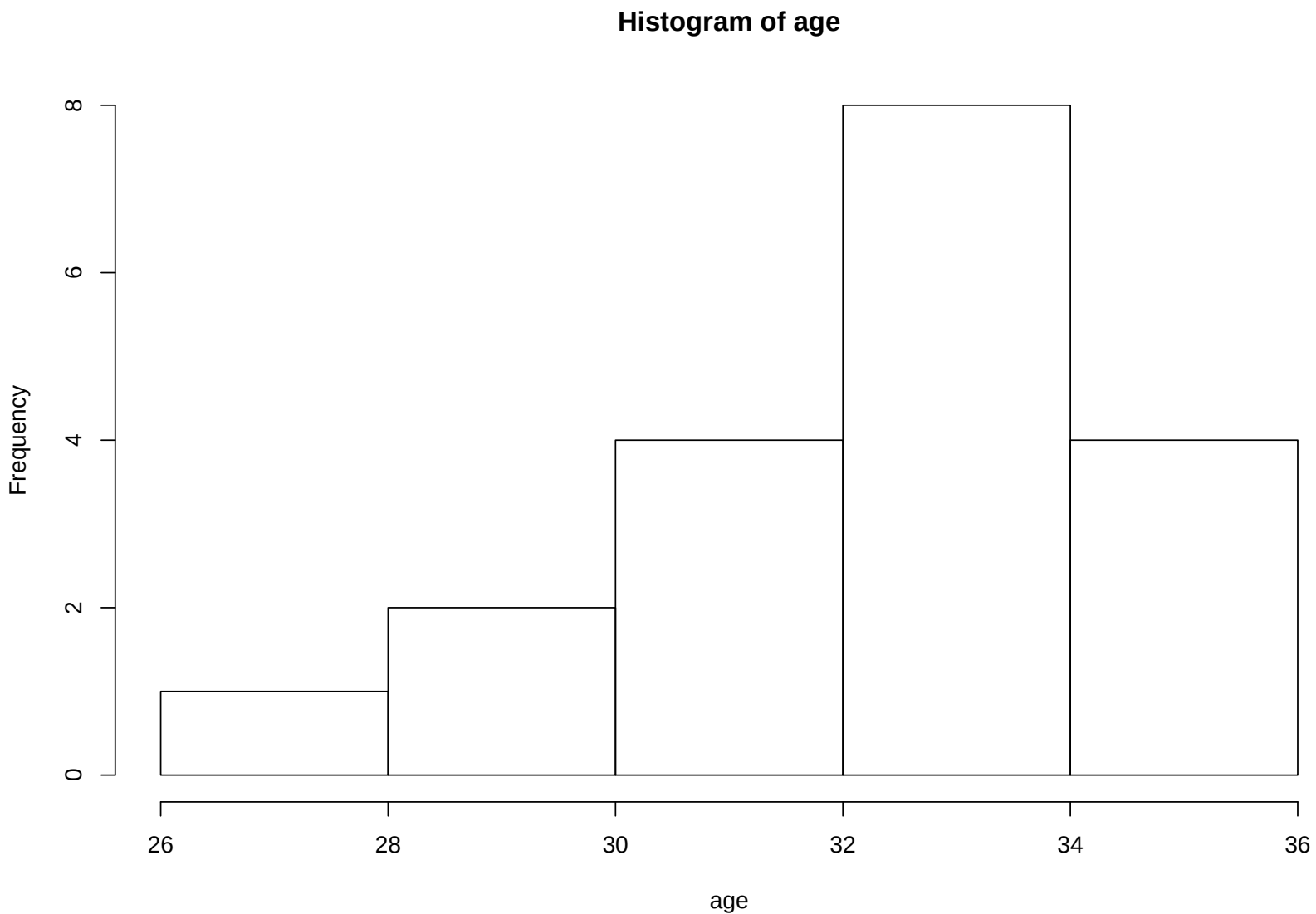
Descriptive statistics

Guess my age

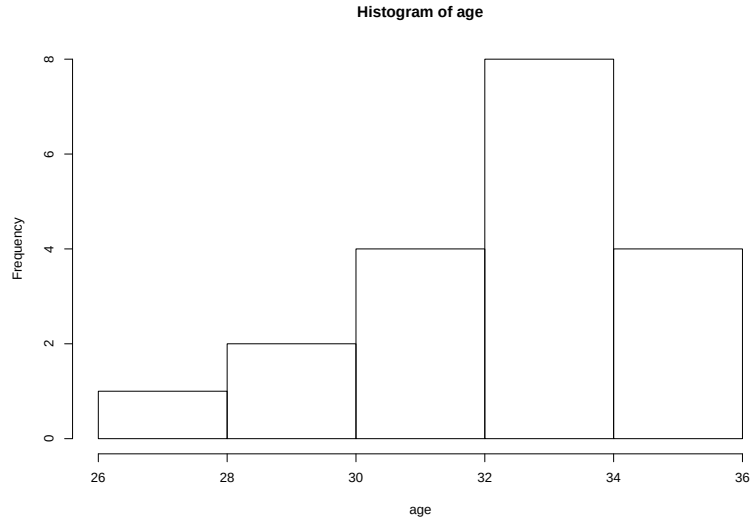
Graph your estimates

```
hist(age)
```



Do you think these data are good estimates of my age?

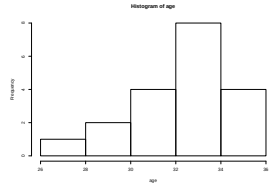
https://pollev.com/franciscorod726



Why / Why not?

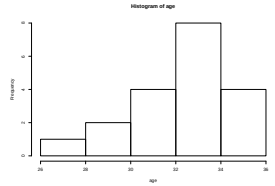
Data are hardly ever objective.
We decide **what to measure, when, where, and how**.
Always consider:
How well do these numbers reflect what we are trying to measure?

Summarise that distribution



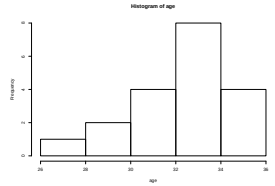
- **Central tendency / location**

Summarise that distribution



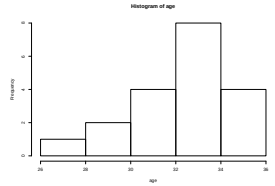
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$

Summarise that distribution



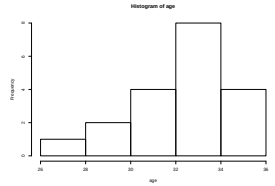
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)

Summarise that distribution



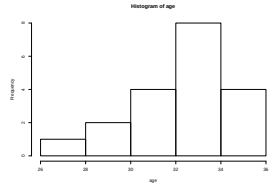
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)

Summarise that distribution



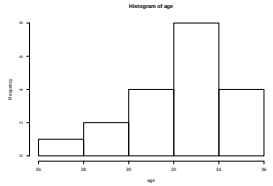
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**

Summarise that distribution



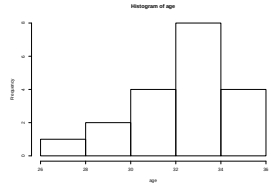
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range

Summarise that distribution



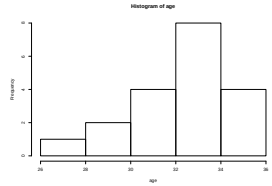
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range
  - quantiles (quartiles, percentiles. . .)

Summarise that distribution



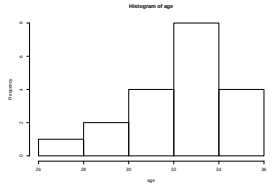
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range
  - quantiles (quartiles, percentiles. . .)
  - standard deviation: $SD = \sqrt{\frac{\sum (x - \mu)^2}{n - 1}}$

Summarise that distribution



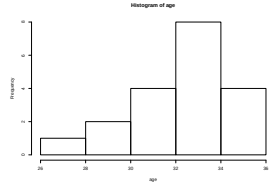
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range
  - quantiles (quartiles, percentiles. . .)
  - standard deviation: $SD = \sqrt{\frac{\sum (x - \mu)^2}{n - 1}}$
  - standard error: $SEM = \frac{SD}{\sqrt{n}}$

Summarise that distribution



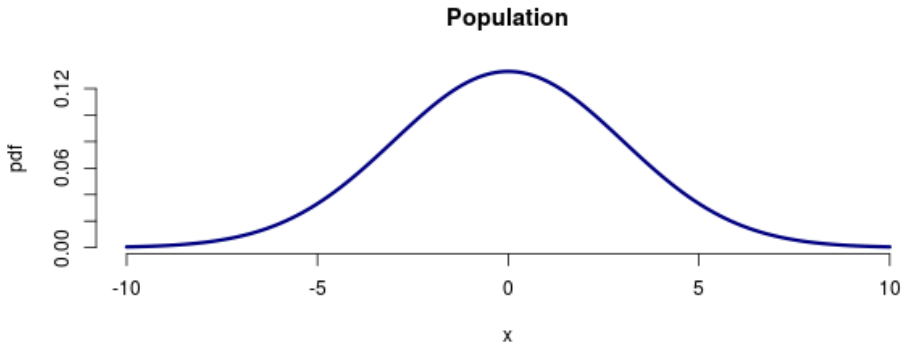
- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range
  - quantiles (quartiles, percentiles. . .)
  - standard deviation: $SD = \sqrt{\frac{\sum (x - \mu)^2}{n - 1}}$
  - standard error: $SEM = \frac{SD}{\sqrt{n}}$
  - coefficient of variation (CV = SD / mean)

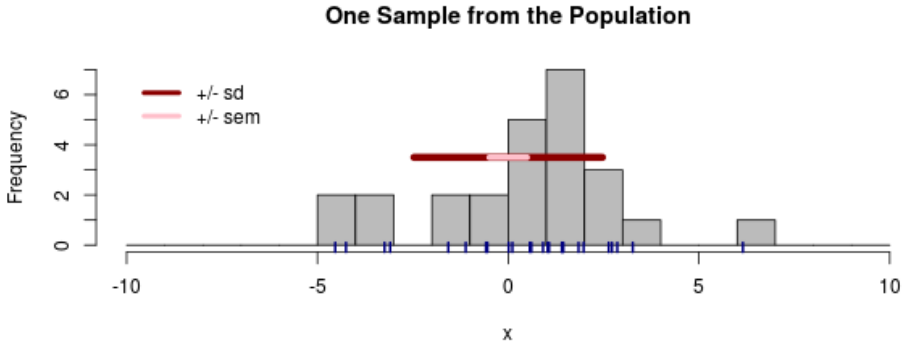
Summarise that distribution

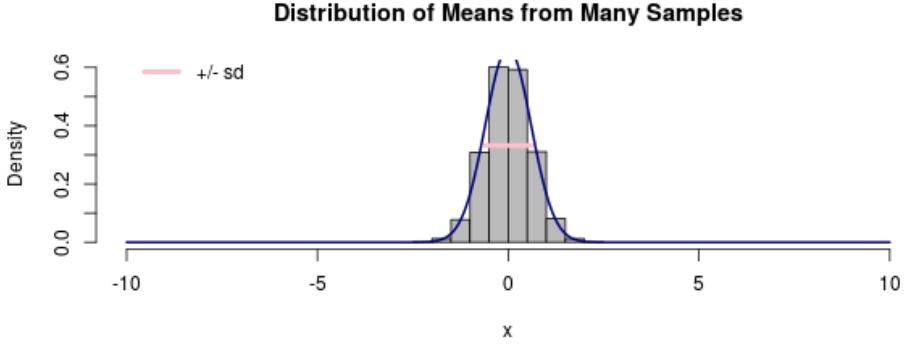


- **Central tendency / location**
  - mean: $\frac{a_1 + a_2 + a_3}{n}$
  - median (50% percentile)
  - mode (most frequent value)
- **Variation / Spread**
  - min, max, range
  - quantiles (quartiles, percentiles. . .)
  - standard deviation: $SD = \sqrt{\frac{\sum (x - \mu)^2}{n - 1}}$
  - standard error: $SEM = \frac{SD}{\sqrt{n}}$
  - coefficient of variation (CV = SD / mean)
  - confidence intervals

Relationship between SD and SEM

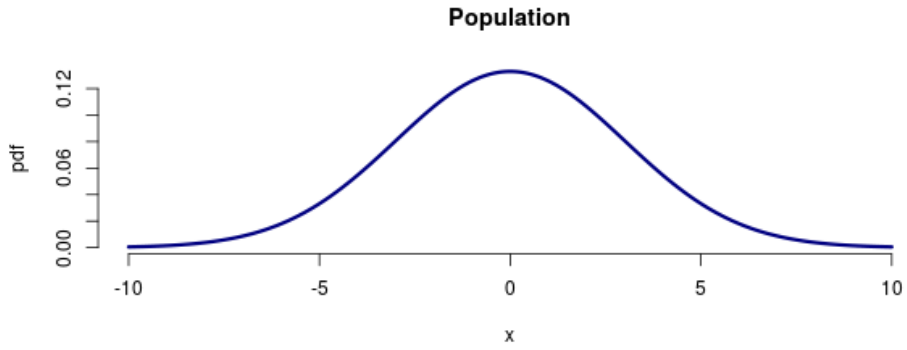


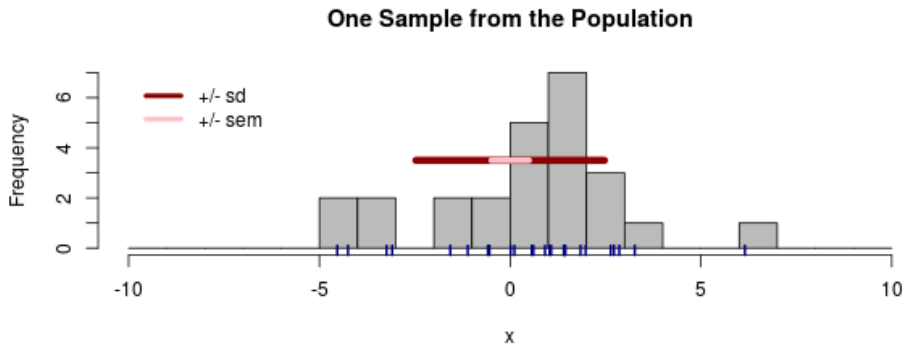


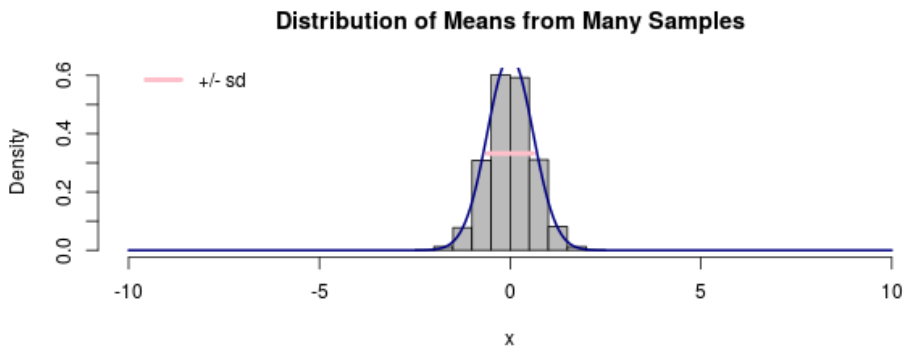


- SD quantifies scatter in population

Relationship between SD and SEM

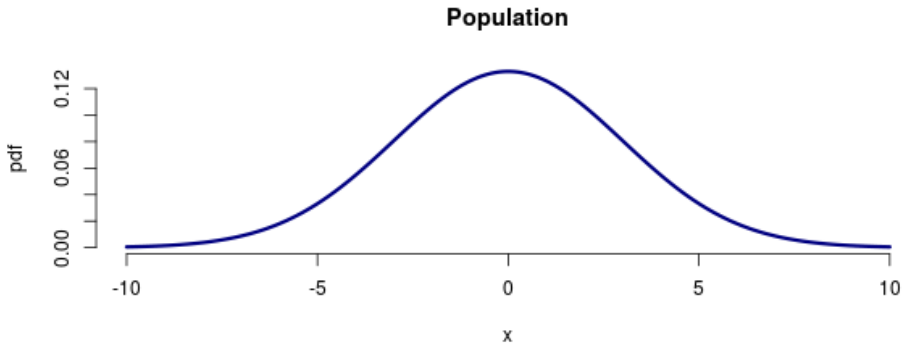


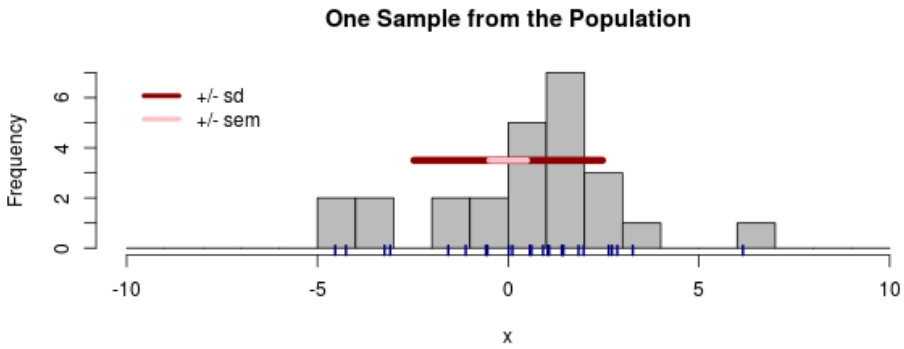


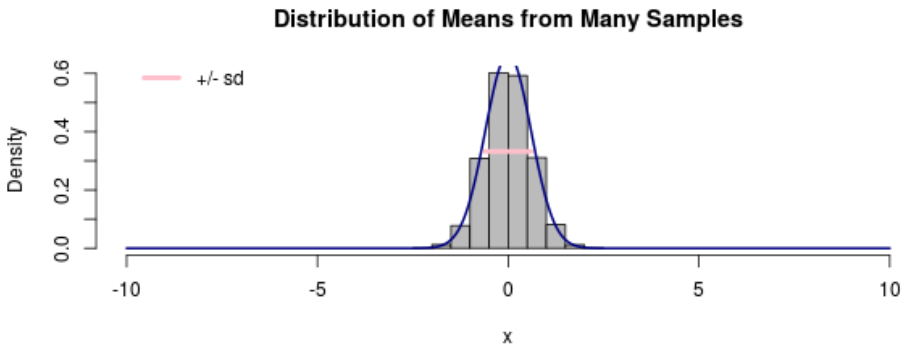


- SD quantifies scatter in population
- SEM quantifies uncertainty in parameter estimate (population mean)

Relationship between SD and SEM

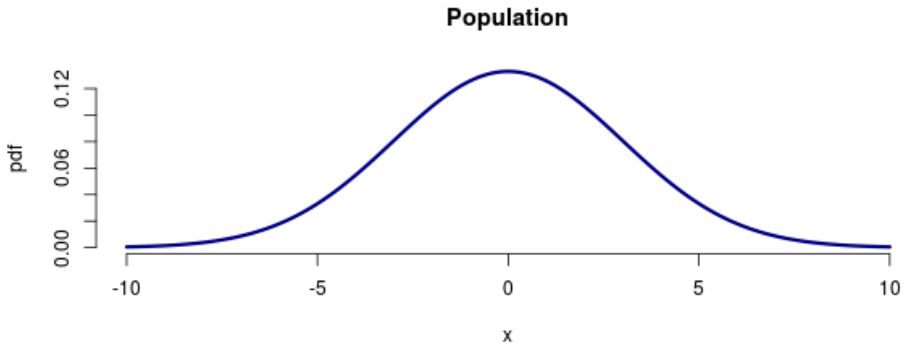


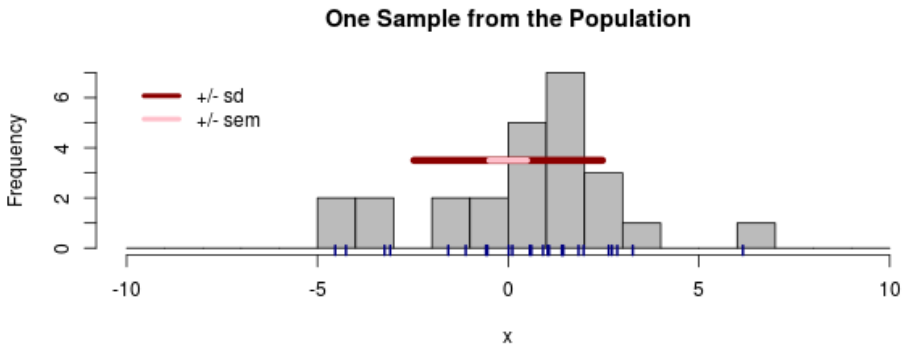


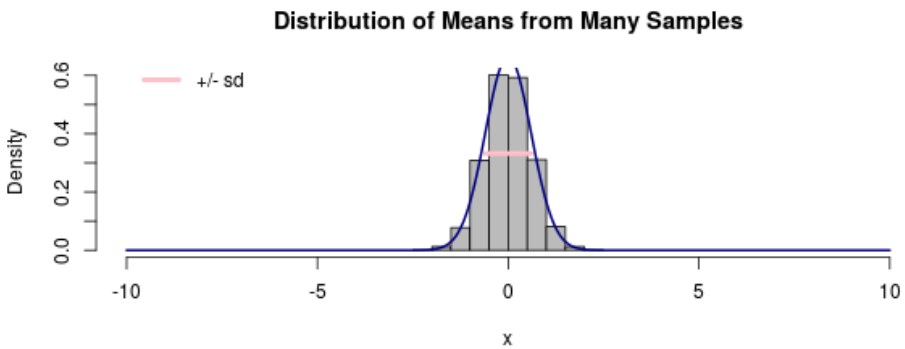


- SD quantifies scatter in population
- SEM quantifies uncertainty in parameter estimate (population mean)
- SEM = SD/sqrt(n)

Relationship between SD and SEM

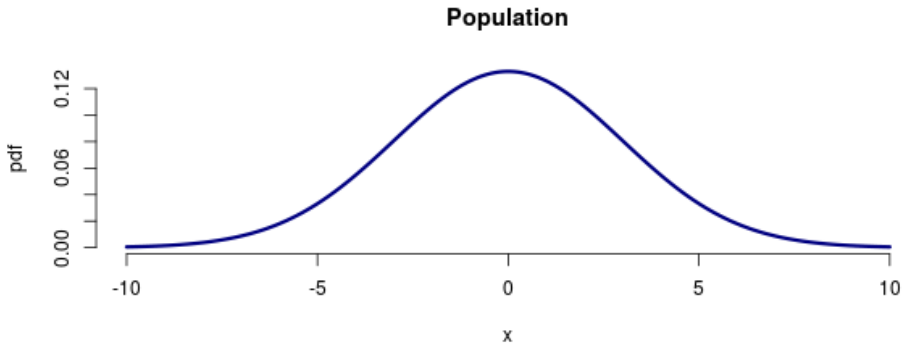


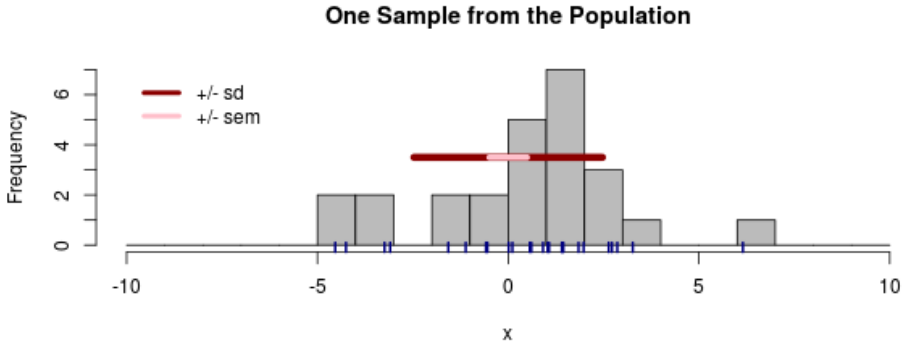


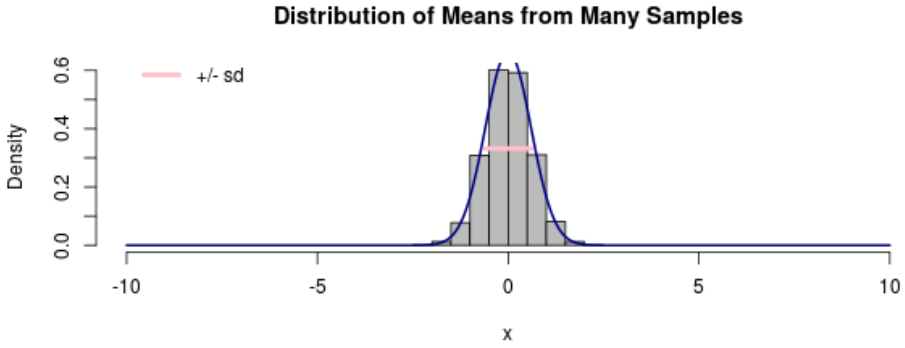


- SD quantifies scatter in population
- SEM quantifies uncertainty in parameter estimate (population mean)
- SEM = SD/sqrt(n)
- SEM decreases with sample size (mean better known), SD does not.

Relationship between SD and SEM

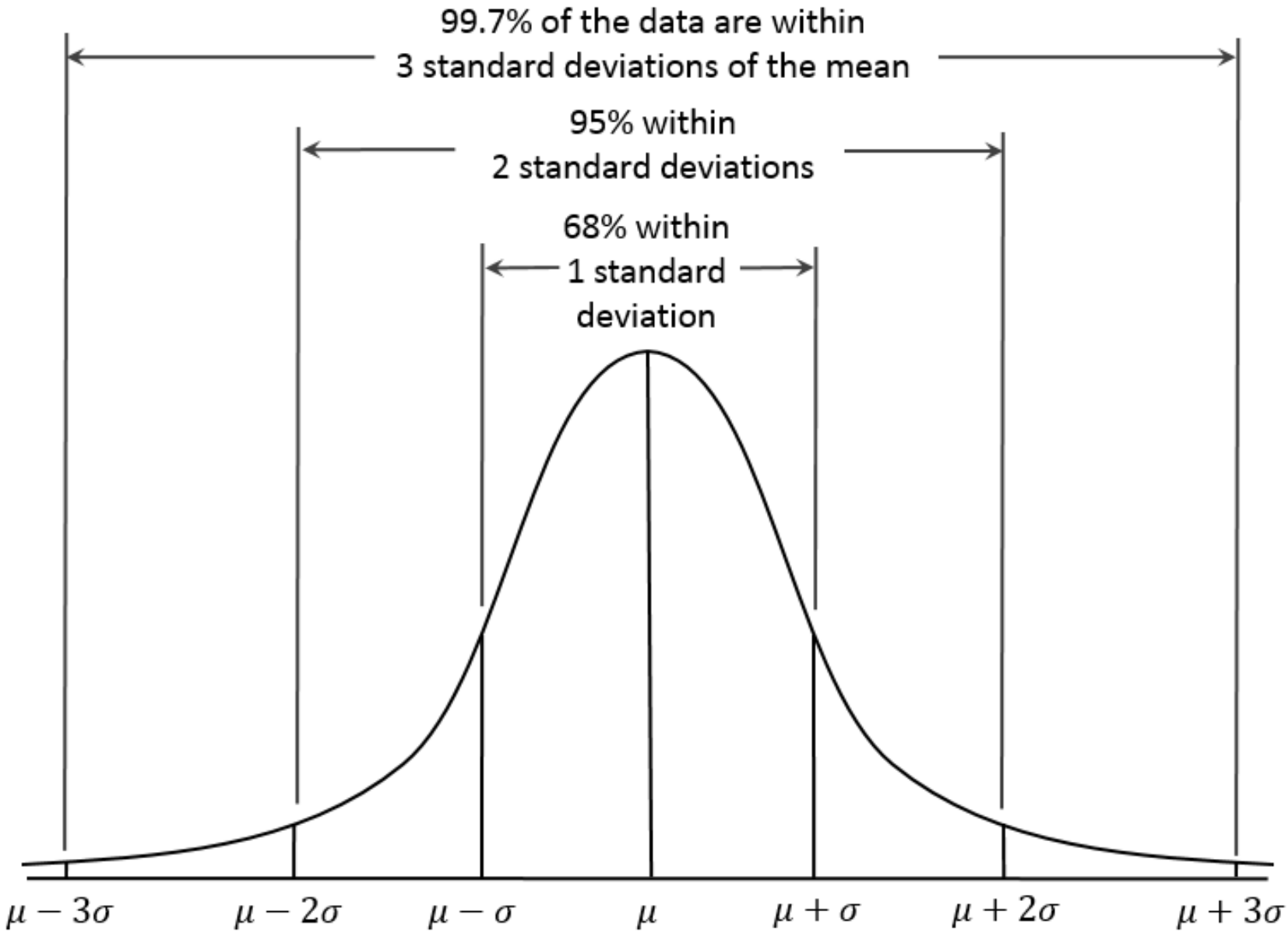






- SD quantifies scatter in population
- SEM quantifies uncertainty in parameter estimate (population mean)
- SEM = SD/sqrt(n)
- SEM decreases with sample size (mean better known), SD does not.
- https://gallery.shinyapps.io/sampling_and_stderr/

In a Normal distribution



What statistical descriptors are best? (and why)

https://pollev.com/franciscorod726