inference for other estimators

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nearly normal sampling distributions

sample mean	$\bar{x}$
difference between sample means	$\bar{x}_1 - \bar{x}_2$
sample proportion	$\hat{p}$
difference between sample proportions	$\hat{p}_1 - \hat{p}_2$

unbiased estimator

An important assumption about point estimates is that they are unbiased, i.e. the sampling distribution of the estimate is centered at the true population parameter it estimates.

- That is, an unbiased estimate does not naturally over or underestimate the parameter, it provides a "good" estimate.
- The sample mean is an example of an unbiased point estimate, as well as others we just listed.

confidence intervals
for nearly normal point estimates

$$point\ estimate \pm z^{\star} \times SE$$

practice

A 2010 Pew Research foundation poll indicates that among 1,099 college graduates, 33% watch The Daily Show (an American late-night TV show). The standard error of this estimate is 0.014. Estimate the 95% confidence interval for the proportion of college graduates who watch The Daily Show.

$\hat{p} = 0.33$

$SE = 0.014$

$\hat{p} \pm z^{*} SE$

$0.33 \pm 1.96 \times 0.014$

0.33 ± 0.027

$(0.303, 0.357)$

hypothesis testing for nearly normal point estimates

$$Z = \frac{point\ estimate - null\ value}{SE}$$

practice

The 3rd NHANES collected body fat percentage (BF%) and gender data from 13,601 subjects ages 20 to 80. The average BF% for the 6,580 men in the sample was 23.9, and this value was 35.0 for the 7,021 women. The standard error for the difference between the average male and female BF%s was 0.114. Do these data provide convincing evidence that men and women have different average BF%s. You may assume that the distribution of the point estimate is nearly normal.

1. **Set the hypotheses**

$H_0: \mu_{men} = \mu_{women}$ $H_A: \mu_{men} \neq \mu_{women}$

2. **Calculate the point estimate**

$\bar{x}_{men} - \bar{x}_{women} = 23.9 - 35 = -11.1$

3. **Check conditions**

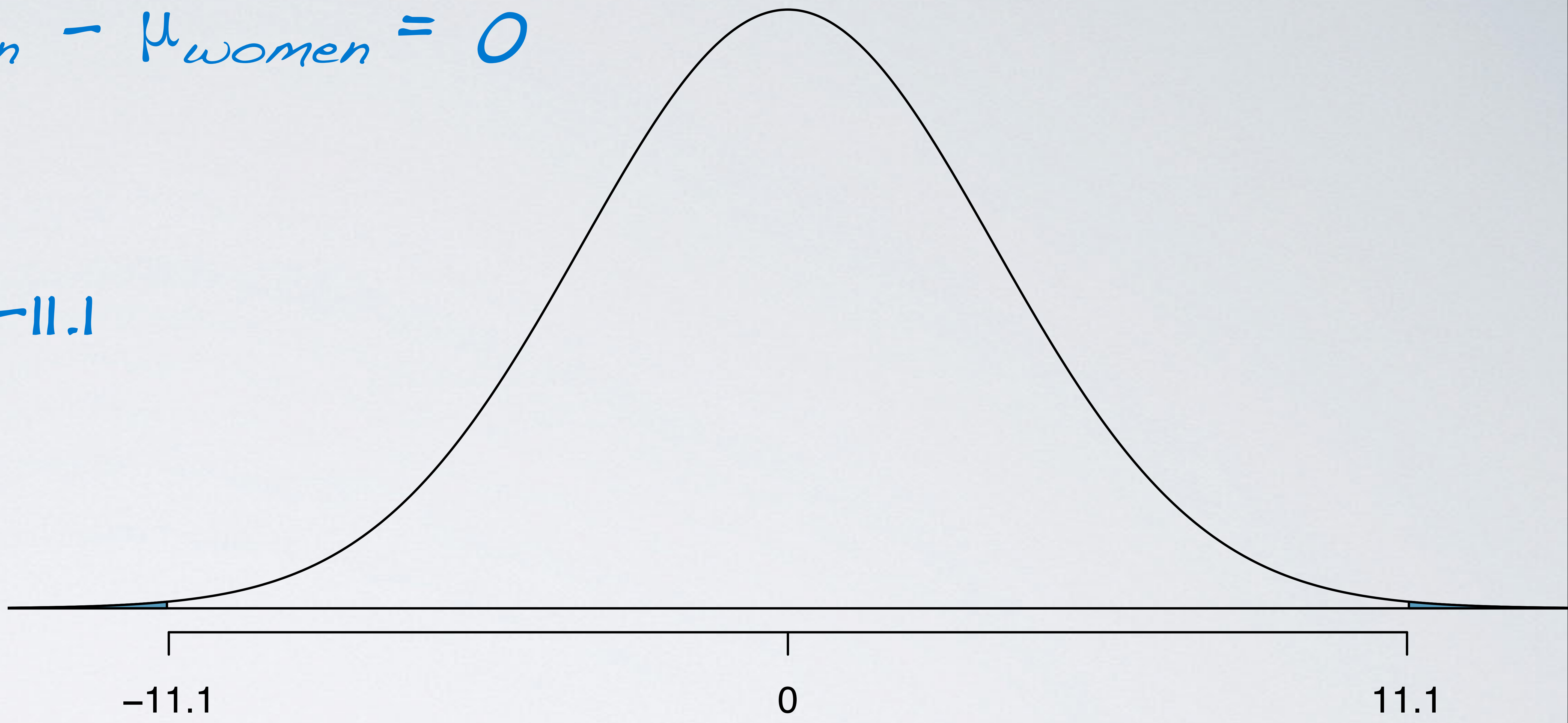
practice

$H_0: \mu_{men} = \mu_{women} \rightarrow \mu_{men} - \mu_{women} = 0$

$H_A: \mu_{men} \neq \mu_{women}$

$\bar{x}_{men} - \bar{x}_{women} = 23.9 - 35 = -11.1$

$$Z = \frac{-11.1 - 0}{0.114} \approx -97.36$$



p-value $\approx 0 \longrightarrow$ Reject H_0

These data provide convincing evidence that the average BF% of men and women are different.