

Descriptive Inference Examples for Single Variables Using Confidence Intervals

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Example 1: Confidence Intervals for Proportions

Research Question:

What **proportion** of non-Hispanic African-Americans
age 18+ in the U.S. in 2015-2016
had systolic blood pressure greater than 130 mmHg?

Inference Approach:

Provide a **95% confidence interval estimate**
(*lower and upper limits*) for this population proportion

Step 1: Estimate the Population Proportion

- **Number** of black respondents with **non-missing data** on first systolic blood pressure measurement: 1135
- **Best Points Estimate:** *Assuming simple random sample of black adults*, sample proportion is $\frac{465}{1135} = 0.4097$
- **Interpretation:** Estimate 40.97% of all such black adults in 2015-16 had systolic blood pressure greater than 130 mmHg

Step 2: Compute Estimated Standard Error

Standard error = $\sqrt{\text{sampling variance of sample proportion}}$
= standard deviation of the sampling distribution of all possible sample proportions if repeated samples of 1135 were obtained

$$\textbf{Estimated standard error} = \sqrt{\frac{0.4097(1-0.4097)}{1135}} = 0.0146$$

Step 3: Form the Confidence Interval

Best Estimate \pm Margin of Error

Best Estimate \pm “a few” (estimated) standard errors

Large sample size \rightarrow 95% multiplier = 1.96

Lower Limit: $0.4097 - 1.96 \times 0.0146 = 0.3811$

Upper Limit: $0.4097 + 1.96 \times 0.0146 = 0.4383$

Inference about the Population Proportion

95% confidence interval for the population proportion of non-Hispanic African-Americans age 18+ in U.S. in 2015-2016 with systolic blood pressure greater than 130 mmHg is:
(0.3811, 0.4383)

- **“95% confidence”** → 95% of intervals formed this way expected to cover the true population proportion!
- **Inference:** if hypothesized proportion was 0.35, 95% confidence interval suggests 0.35 **not a plausible value**

Example 2: Confidence Intervals for

Research Question:

What was the **mean** systolic blood pressure for non-Hispanic African-Americans age 18+ in U.S. in 2015-2016?

Inference Approach:

Provide a **95% confidence interval estimate** (*lower and upper limits*) for this population mean

Step 1: Estimate the Population Mean

- **Number** of black respondents with **non-missing data** on first systolic blood pressure measurement: 1135
- **Best Point Estimate:** *Assuming simple random sample of black adults*, sample mean is 128.252 mmHg
- **Interpretation:** Our estimate of the mean systolic blood pressure for all such black adults in 2015-2016 is 128.252 mmHg

Step 2: Compute Estimated Standard Error

Standard error = $\sqrt{\text{sampling variance of sample mean}}$
= standard deviation of the sampling distribution of all possible sample means if repeated samples of 1135 were obtained

Sample standard deviation of the 1135 blood pressure measurements is 19.958 mmHg

Estimated standard error = $\frac{19.958}{\sqrt{1135}} = 0.592 \text{ mmHg}$

Step 3: Form the Confidence Interval

Best Estimate \pm Margin of Error

Best Estimate \pm “a few” (estimated) standard errors

Large sample size \rightarrow 95% multiplier = 1.96

Lower Limit: $128.252 - 1.96 \times 0.592 = 127.091$ mmHg

Upper Limit: $128.252 + 1.96 \times 0.592 = 129.413$ mmHg

Inference about the Population Mean

95% confidence interval for the population mean systolic blood pressure of non-Hispanic African-Americans age 18+ in U.S. in 2015-2016 is:

(127.091 mmHG, 129.413 mmHg)

- “95% confidence” → 95% of intervals formed this way expected to cover the true population proportion!
- **Inference:** if hypothesized mean was 128 mmHg, 95% confidence interval suggests 128 is a **plausible value**

Alternative Inferential Approaches

Hypothesis testing approach

→ reject or fail to reject null hypotheses about specific values of population mean or proportion of interest, at a certain significance level (e.g. 5%)

Confidence intervals

→ advantage of providing range of plausible values for population mean or proportion of interest, with a certain confidence level (e.g., 95%)