Solutions

Give a CI for the proportion of “mother is the only parent” children who still have asthma.

Point estimate: 0.134  
Error Margin: 1.96(0.0077) = 0.0151

\[ 0.119 < p_m < 0.149 \text{ (between 11.9 and 14.9\%)} \]

Approximately how many children from this type family were surveyed?

\[ (0.134)(0.866)/0.0077^2 = 1957 \]

13.4% of 1957 \( \approx \) 262: approximately 262 of the 1957 still have asthma. (263/1957 = 0.134 when rounded to the nearest 0.001.)

Give a CI for the proportion of “father is the only parent” children who still have asthma.

Point estimate: 0.061  
Error Margin: 1.96(0.0124) = 0.0243

\[ 0.037 < p_f < 0.085 \text{ (between 3.7\% and 8.5\%)} \]

Approximately how children from this type family were surveyed?

\[ (0.061)(0.939)/0.0124^2 = 373 \]

This entirely makes sense as the vast majority of one-parent families are headed by women.

Since data are presumably representative of the population, we can estimate the ratio of mother-only to father-only families to be \( 1957/373 = 5.25 \) (to 1) or 21 to 4.

6.1\% of 373 \( \approx \) 23: 23 of the 373 still have asthma.

State and interpret a CI for the difference between proportions of children of mother only and father-only children.

Point estimate: 0.134 – 0.061 = 0.073  
Error Margin: \( \sqrt{0.0151^2 + 0.0243^2} = 0.0286 \)

Using the textbook formula: \( E = 1.96 \sqrt{\frac{0.134 \times 0.866}{1957} + \frac{0.061 \times 0.939}{373}} = 0.0286 \)

\[ 0.044 < p_m - p_f < 0.101 \]

We are 95\% confident that the percent of mother-only children who still have asthma is between 4.4\% and 10.1\% higher than the percent of father-only children.

Give the CI for the difference between proportions of black and white children who still have asthma.

Point estimate: 0.160 – 0.082 = 0.078  
Standard Error: \( \sqrt{0.0101^2 + 0.0037^2} = 0.0108 \)

Error Margin: 1.96(0.0108) = 0.0211  
\[ 0.057 < p_m - p_f < 0.099 \]

We are 95\% confident that the percent of black children who still have asthma is between 5.7\% and 9.9\% higher than the percent of white children.
Testing solutions

Mother vs. Neither

262 of 1957 mother-only children have asthma: 0.1339

47 of 337 neither-mother-nor-father-parent children have asthma: 0.1399

$H_0: p_m = p_{\text{niether}} \quad H_0: p_m < p_{\text{niether}}$

$\bar{p} = 309/2294 = 0.1347$

$Z = (0.1339 - 0.1399)/0.020135 = -0.006/0.020135 = -0.298$

$P$-value = 0.3829

Do not reject $H_0$. There is not sufficient evidence in the sample data to conclude that the (population) rate of asthma is lower for mother-only-parent children than it is for neither-mother-nor-father-parent children.

This difference (0.134 vs. 0.140) is not statistically significant.

Asian vs. American Indian/Alaskan Native

5 of 103 American Indian or Alaskan Native have asthma: 0.0485

34 of 398 Asian Americans have asthma: 0.0854

$H_0: p_{\text{Asian}} = p_{\text{AIAN}} \quad H_0: p_{\text{Asian}} \neq p_{\text{AIAN}}$

$\bar{p} = 39/501 = 0.0778$

$Z = (0.0485 - 0.0854)/0.02962 = -0.0369/0.02962 = -1.246$

$P$-value $= 2 \times 0.1064 = 0.2128$

Do not reject $H_0$. There is not sufficient evidence in the sample data to conclude that the (population) rate of asthma is different for Asian American children than it is for American Indian and Alaskan Native children.

This difference (0.049 vs. 0.085) is not statistically significant.