## Agenda

- 1. Inference for a single numerical mean
- 2. Paired-samples t-test

**Gifted Children** An investigator is interested in understanding the relationship, if any, between the analytical skills of young gifted children and the following variables: father's IQ, mother's IQ, average number of hours per week the child watched an educational program on TV during the past three months, average number of hours per week the child watched cartoons on TV during the past three months. The analytical skills are evaluated using a standard testing procedure. Data were collected from schools in a large city on a set of 36 children who were identified as gifted children soon after they reached the age of four.

For 25 of the 36 children, the child's mother's IQ was higher than that of the father. Find a 95% confidence interval for the true proportion of gifted children whose mothers have higher IQs than their fathers.

**Inference for a Mean** We know how to make inferences about the value of a population proportion p, for a binary variable. The critical step was to construct an approximation of the sampling distribution of the sample proportion,  $\hat{p}$ . What if the the variable that we want to make inferences about is *numerical*? In this case we need to approximate the sampling distribution of the sample mean,  $\bar{x}$ . How can we do this?

**Gifted Children's scores** Use the information presented below to construct a 95% confidence interval for the mean analytical score among gifted children.

```
require(openintro)
require(mosaic)
favstats(~score, data = gifted)
## min Q1 median Q3 max mean sd n missing
## 150 155 159 162 169 159.1389 4.630043 36 0
```

1. Compute the standard error of the mean.

- 2. Compute the *t*-statistic.
- 3. Find the appropriate critical value in the appropriate t-distribution. [Use the qt(p = ??, df
   = ??) function in R.]
- 4. Write down the confidence interval and interpret it in context.
- 5. Assume that the standard deviation presented above was actually the standard deviation of the scores in the whole population. Compute the confidence interval again, and compare the new interval to the one you found previously (using the *t*-distribution). Are they importantly different?

## **Practice Problems**

1. NECCO is acquiring information about the machines making Clark candy bars. The wrapper says the candy bar is 50 grams. Is this true? Each Clark Bar should weigh 1.75 oz, or about 50 grams. NECCO takes a random sample of 25 bars and finds a mean weight of 48 grams for this sample and a standard deviation of 4 grams. Test an appropriate hypothesis.

2. Should you generate electricity with your own personal wind turbine? That depends on whether you have enough wind on your site. To produce enough energy, your site should have an annual average wind speed above 8 mph. One candidate site was monitored for a year, with speeds recorded every 6 hours. A total of 1114 readings of wind speed averaged 8.019 mph with a standard deviation of 3.813 mph. What would you tell the landowner about whether this site is suitable for a small wind turbine? Test an appropriate hypothesis.

**Inference for Paired Data: Gifted Children's Parents** Since in this data set, the IQ of both parents is recorded for all children, the IQ data is naturally paired.

1. Find a 90% confidence interval for the mean IQ of the mothers. Do the same for the fathers. Do they overlap?

2. Test the hypothesis that the mothers of gifted children have different IQs, on average, than the fathers. Write out all of the steps. What do you conclude?

## **Practice Problem**

- 1. A sample of n = 9 college students is used to evaluate the effectiveness of a new Study Skills Workshop. Each students grade point average (GPA) is recorded for the semester before the workshop and for the semester after the workshop. The average GPA improved by an average of 0.60 points, 95% CI: [.37, .83]. Based on the condence interval, is the Study Skills Workshop effective in improving students GPAs? Explain your reasoning.
- 2. Find the SE of the mean difference based on the information provided.