Introduction to Biostatistics (171:161)
Breheny

Assignment 11
Due: Tuesday, April 22

1. An investigator is planning a study in which it is much cheaper to give patients a placebo than the real treatment. To save money, he wants to give the placebo to 90 people and the treatment to 10 people. Why might this be a bad idea?

2. Breast-feeding infants for the first few months after their birth is considered to be better for their health than bottle-feeding. Increasing the number of babies who are breastfed is a goal of many people in public health. According to several observational studies, withholding the bottle in hospital nurseries increases the likelihood that mothers will continue to breast-feed after leaving the hospital. As a result, withholding bottled-milk supplementation has been recommended.

   A controlled experiment was performed at a hospital in Montreal and published in *Pediatrics*. The study involved two nurseries. In the "traditional" one, supplemental feedings were given when the mother was sleeping or if the infant still seemed hungry after breast-feeding. In the experimental one, nurses discouraged supplementation and woke mothers up in the night to breast-feed if their child was hungry.

   Over the four-month period of the experiment, 393 mothers and their infants were assigned to the traditional nursery, and 388 to the experimental one.

   (a) It wouldn't be ethical to deny mothers in the experimental nursery the option of bottle-feeding their children, so this option was available (albeit discouraged) for those mothers. To observe the effect of the nursery policies, the investigators measured the amount of bottle-feeding in the two nurseries. They found that in the traditional nursery, the infants consumed 36.6 ± 44.3 ml/day (mean $\pm$ SD) of bottled milk, while in the experimental nursery, the infants consumed 15.7 ± 43.6 ml/day (mean $\pm$ SD). The pooled standard deviation was 44.0 ml/day. Were mothers' decisions to bottle-feed affected by treatment, or could this difference be explained by chance?

   (b) Construct a 95% confidence interval for the difference in milk consumption between the two groups.

   (c) Nine weeks after their stay in the hospital, the mothers were asked if they were still breast-feeding their infants. Of the mothers in the traditional group, 215 answered yes, while in the experimental group, 210 answered yes. Could this difference be explained by chance?

   (d) The investigators also looked at the weight lost by each infant during their stay at the hospital, expressed as a percentage of birth weight (most newborns lose weight during the first few days of life outside the womb). In the traditional nursery, infants lost $5.1\% \pm 2.0\%$ (mean $\pm$ SD) of their weight, while in the experimental nursery, the infants lost $6.0\% \pm 2.0\%$ of their weight. What is the pooled standard deviation?

(e) Infants in the experimental nursery lost more weight than the infants in the traditional nursery; could this difference be explained by chance?

(f) Construct a 95% confidence interval for the difference in weight loss between the two groups. Be sure to mention which group of babies fared better.

(g) Suppose you were in charge of the nursery at the University of Iowa Labor & Delivery Unit and you were presented with this study. Would you discourage supplemental feedings? Why or why not?

(h) The results of the controlled experiment did not agree with the observational studies mentioned at the beginning of this problem. Can you think of any reason for this disagreement? Which would you trust more?

3. ⌨ The course website contains a data set that lists the sex and ages at death (in days) of 16 children who died of sudden infant death syndrome in Seattle from 1973-1982.

(a) What are the standard deviations of the ages at death for the two sexes (*i.e.* provide two standard deviations, one for each sex)? Based on these sample sizes, would you expect Student's t-test and Welch's t-test to give similar answers?

(b) Test whether or not the difference in age at death for males and females could be due to chance using Student's t-test.

(c) Test whether or not the difference in age at death for males and females could be due to chance using Welch's t-test.

(d) Construct a 95% confidence interval for the difference in age at death for males and females, based on the assumption of equal variability in males and females.

(e) Construct a 95% confidence interval for the difference in age at death for males and females, without assuming that variability is equal in males and females.

(f) Which approach (Welch/Student, equal/unequal SD) do you think is most appropriate in this circumstance? Why?