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Statistics 13 **Instructor: Nicolas Christou**

Test for the difference between two population means

Example 1:
An investigator wishes to test whether there is a difference of 10 mg/dl in cholesterol level between a control group and a diet intervention group (low-fat). The sample means of the cholesterol level for $n = 100$ subjects in each group are $\bar{x}_1 = 230$ mg/dl and $\bar{x}_2 = 215$ mg/dl. Assume that for both groups the standard deviation is $\sigma = 16$ mg/dl. Test the hypothesis that the difference is more that 10 mg/dl.

Example 2:
A study was conducted to investigate the effect of an oral antiplaque rinse on plaque buildup on teeth. For this study, 14 subjects were divided into 2 groups of 7 subjects each. Both groups were assigned to use oral rinses for a 2-week period. Group 1 used rinse that contained an antiplaque agent, while group 2 received a similar rinse except that it contained no antilpaque agent. A plaque index that measures the plaque buildup was recorded after 2 weeks. The sample mean and sample standard deviation for the 2 groups are shown beklow:

	Group 1	Group 2
Sample size	7	7
Sample mean	0.78	1.26
Sample standard deviatuion	0.32	0.32

a. State the null and alternative hypotheses that should be used to test the effectiveness of the antiplaque rinse.

b. Assume that $\sigma_1^2 = \sigma_2^2 = \sigma^2$ but unknown, and that the 2 populations follow the normal distribution. Compute the appropriate test statistic.

c. What is your conclusion using $\alpha = 0.05$

Test for the difference between two population means
Sample size determination

Suppose that we want to test the following hypothesis:
$H_0 : \mu_1 - \mu_2 = 0$
$H_a : \mu_1 - \mu_2 > 0$
To perform this test a sample of n observations from each population is to be selected. Assume that the populations are normally distributed with known variances σ_1^2 and σ_2^2 respectively.

a. If we require $1 - \beta$ power of the test and we are willing to accept Type I error α, find an expression for the sample size needed to detect a shift in the difference between the two population means from $\mu_1 - \mu_2 = 0$ to $\mu_1 - \mu_2 = \delta$ ($\delta > 0$).

b. Find the sample size needed to detect with probability 90% a 10 mg/dl difference in cholesterol level between a low-fat diet group and a control group if we can accept a Type I error $\alpha = 0.05$. Assume $\sigma = 28$ mg/dl for both groups.