

A study of asthma patients wondered whether the peak expiratory flow for asthma patients differed from morning to evening. In 210 subjects measured in the morning, the mean peak expiratory flow was 377.2 liters/min with a standard deviation of 117.0. In another group of 210 measured in the evening, the mean peak expiratory flow was 383.6 liters/min with a standard deviation of 119.0. Is this enough evidence at the 0.01 level to conclude that the mean peak expiratory flow for all patients measured in the morning differs from that for all patients measured in the evening?

1. **Hypotheses:**

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

Where: μ_1 is the mean peak expiratory flow for all patients measured in the morning and μ_2 is the mean peak expiratory flow for all patients measured in the evening.

2. **Conditions:** We have independent, random observations from 2 populations and there are enough observations in each sample that we can use the Central Limit Theorem. (These all seem reasonable.)

3. **Rejection Region:** Reject H_0 if $TS > 2.576$ or $TS < -2.576$

4. **Test Statistic:**

$$TS = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}}} = \frac{377.2 - 383.6}{\sqrt{\frac{117.0^2}{210} + \frac{119.0^2}{210}}} = -0.555747$$

5. **P-value:** $P = 2 \cdot P(Z < -0.56) = 2 \cdot (.5 - 0.2123) = 2 \cdot 0.2877 = 0.5754$

6. **Conclusion:** We do not have enough evidence ($P = 0.5754$) to conclude that the mean peak expiratory flow differs for those measured in the morning and evening.