Stat 251/OBEE 216

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Solution for Project 3

1

Was the <u>proportion</u> of infants with negative BE different from the proportion of infants with positive BE, in the study?

There are total of 30 infants,
14 with BE < 0 (NBE)
12 with BE > 0 (PBE)
4 with BE = 0

Thus, $\hat{p}_{NBE} = \frac{14}{30} \approx 0.47$ and $\hat{p}_{PBE} = \frac{12}{30} = 0.40$

A Two Independent Samples of Proportions is used with normal distribution

$H_0\colon \; p_{NBE} = p_{PBE}$

$H_A\colon \; p_{NBE} \neq p_{PBE}$

<u>Test Statistic</u>

$$z = \frac{(\hat{p}_{NBE} - \hat{p}_{PBE}) - 0}{\sqrt{\frac{\hat{p}_{NBE}(1-\hat{p}_{NBE})}{n_1} + \frac{\hat{p}_{PBE}(1-\hat{p}_{PBE})}{n_2}}} \quad \text{where } n_1 = n_2 = 30$$

$$= \frac{(14/30 - 12/30)}{\sqrt{\frac{\frac{14}{30}(1-\frac{14}{30})}{30} + \frac{\frac{12}{30}(1-\frac{12}{30})}{30}}} = 0.52$$

<u>P-value</u>

$$p = 2 * P(Z > |z|)$$
$$= 0.6015$$

<u>Confidence Interval (95%)</u>

$$(\hat{p}_{NBE} - \hat{p}_{PBE}) \pm z_{\alpha/2} SE_{(p_{NBE} - p_{PBE})}$$
$$0.07 \pm 1.96 * 0.1276 \approx (-0.1783, 0.3183)$$

<u>Conclusion</u>

At $\alpha = 0.05$, $0.6015 = p > \alpha = 0.05$. Thus, we fail to reject H_0. Based on the evidence, we do have enough evidence to reject null, which the difference in the proportion of infants with negative and positive BE is not statistically significant. When examining the 95%CI, it contains the value zero, which implies zero can be one of the possible true population value. Thus, it is supportive of the conclusion of rejecting null.

2

For the two groups, D &L, are there statistical differences in the IMV levels?

Since the groups, D & L, do not share equal sample sizes, we should use the two independent samples t test with unequal variance assumed.

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Two-sample t test with unequal variances

------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       D |      16      71.875    5.678817    22.71527    59.77089    83.97911
       L |      14    64.07143    4.575934    17.12158    54.18573    73.95713
---------+--------------------------------------------------------------------
combined |      30    68.23333    3.714737    20.34645    60.63584    75.83082
---------+--------------------------------------------------------------------
    diff |            7.803571    7.293019               -7.149001    22.75614
------------------------------------------------------------------------------
Satterthwaite's degrees of freedom:  27.4498

                      Ho: mean(D) - mean(L) = diff = 0

     Ha: diff < 0               Ha: diff ~= 0              Ha: diff > 0
       t =   1.0700               t =   1.0700               t =   1.0700
   P < t =   0.8530         P > |t| =   0.2939           P > t =   0.1470
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Hypotheses

H_0: $\mu_{IMV_D} = \mu_{IMV_L}$

H_A: $\mu_{IMV_D} \neq \mu_{IMV_L}$

Test Statistic

From the above output, t = 1.0700

P-value

p = 0.2939

Conclusion

At $\alpha = 0.05$, $0.2939 = p > \alpha = 0.05$. Thus, we fail to reject H_0. Based on the evidence, we do have enough evidence to reject null, which the difference in the proportion of infants with negative and positive BE is not statistically significant.

3.

What is a 95% CI for the ratio of the variances of the two groups (D vs L) with respect to the concentration of oxygen in the blood stream? How do we interpret this CI?

Status = D

Variable	Obs	Mean	Std. Dev.	Min	Max
pO2	16	67.875	39.93307	33	182

Status = L

Variable	Obs	Mean	Std. Dev.	Min	Max
pO2	14	106.2857	76.39213	38	281

From the above summary table, we obtain

$$S_1^2 = 39.9331^2 = 1594.6525 \quad n_1 = 16$$
$$S_2^2 = 76.3921^2 = 5835.7529 \quad n_2 = 14$$

Thus, the critical values are

$$F_{(16-1,14-1,0.025)} = 0.34189 \qquad F_{(16-1,14-1,0.975)} = 3.05271$$

<u>Hypotheses</u>

$$H_0:\ \sigma_1^2 = \sigma_2^2$$
$$H_A:\ \sigma_1^2 \neq \sigma_2^2$$

The 95% CI for $\frac{\sigma_1^2}{\sigma_2^2}$ will be

$$\left[\frac{s_1^2}{s_2^2} * \frac{1}{F_{(16-1,14-1,0.025)}},\quad \frac{s_1^2}{s_2^2} * \frac{1}{F_{(16-1,14-1,0.975)}}\right]$$
$$\left[\frac{1594.6525}{5835.7529} * \frac{1}{3.05270},\quad \frac{1594.6525}{5835.7529} * \frac{1}{0.34189}\right] = (0.0895, \quad .7993)$$

<u>Interpretation</u>

Since the 95% CI doesn't not contain 1, which means the true population ratio between the variances will not be 1. Thus, we reject the null that the variances are equal since their ratio cannot not be 1.