

Ch 9.2 Hypothesis Errors

Ch 9.2 Outcomes and Type I and Type II Errors

Conclusion from Hypothesis Test are based on sample observations which are determined by chance. Hypothesis conclusion may not always reflect the actual true population parameters.

	H0 is true	H0 is false
Reject H0	Type 1 error	correct
Fail to reject H0	Correct	Type 2 error

Type I error: Rejecting a null hypothesis but actually the hypothesis is true. Probability of making a type 1 error is α . If result of type 1 error is serious, we will want to use a low α instead of the default of 0.05.

Type II error: Failing to reject a null hypothesis when you should have rejected it because the null hypothesis is actually false. The probability of making a type II error is β . The power of the Test is $1 - \beta$.

Note: we may not know if we have made hypothesis error, but we can plan for it by adjusting the significant level α .

Ex1. Claim that a medical procedure will increase likelihood (more than 50%) of a baby girl.

a) Discuss the type 1 and type II error in the context of the problem.

Answer:

Claim: $p > 0.5$, $H_0: p = 0.5$

Type 1 error is the mistake of concluding the procedure increase percentage of girl to more than 50% but actually the true percentage of girl is only 50%. The sample evidence leads us to believe that the medical procedure is effective but actually it is not.

Type II error is the make of concluding that the percent of girl after using the procedure is only 50% but the real percent of girl using the procedure is more than 50%. Concluding the procedure is not effective, but actually it is effective.

b) Evaluate which error is more serious and advise on the level of significance.

Type I error is more serious from the public perspective, a lower α is advisable because probability of making a Type 1 error is α .

Ex2:

A company manufacturing computer chips finds that 8% of all chips manufactured are defective. Management is concerned that employee inattention is partially responsible for the high defect rate. In an effort to decrease the percentage of defective chips, management decides to offer incentives to employees who have lower defect rates on their shifts. The incentive program is instituted for one month. If successful, the company will continue with the incentive program. Describe what is Type I and Type II errors in the context of the question.

Answer:

claim: $p < 0.08$ $H_0: p = 0.08$

Type I error: The mistake of concluding that the incentive program can lower defective rate to less than 8% but actually the defective rate is still 8%. Concluding that the incentive program is useful but actually it is not useful.

Type II error: The mistake of concluding that the defective rate is 8% but actually the defective rate after the incentive program is less than 8%. Conclude that the incentive program is not useful but actually it is useful.

b) Discuss if type I or type II error is more serious.

Should management use a high or low significant level?

Ans:

Type I error means company will spend money on something that is not useful. So to avoid unnecessary expense, Type I error should be avoided.

Hence a low significant level may be better.

If cost is a priority, Type I error should be avoided so a lower α is better.

Type II error means you bypass a good program that can decrease defective rate or increase profit. Type II error should be avoided if profit is a priority, hence a lower α is unnecessary.

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