Hypothesis Testing

Example: Average intake in children for dietary fat is 70 g of fat per day. Suppose we want to study children who eat a vegetarian diet. Possible hypotheses are

1. **Average fat intake is 70 g per day**
2. **Average fat intake is less than 70 g per day**

**Def: One-sample problem—a single distribution.**

**Def: Hypothesis—statement about parameters in a population or populations. We want to know how likely this is to be true, given the evidence (data). For example,**

**Def: Null hypothesis—Ho—the hypothesis to be tested. This is usually a statement of no difference. The population value of the parameter is not different from some specified value.**

**Def: Alternative hypothesis—H1 or HA—this is the statement we will accept if we reject the null hypothesis.**

**Ho: Mean fat intake in vegetarian children is 70 g per day. Ho: *μ = μ0* or *μ ≥ μ0***

**H1: Mean fat intake in vegetarian children is < 70 g per day. H1: *μ < μ0***

**Possible decisions:**

1. **Accept Ho (really, fail to reject Ho)**
2. **Reject Ho**

**Possible Scenarios:**

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| Jury Trial |
|  | Truth |
| **Verdict** | **Innocent** | **Guilty** |
| **Innocent** | **Correct decision** | **Error** |
| **Guilty** | **Error** | **Correct decision** |

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| --- |
| Test of hypothesis |
|  | Truth |
| **Results of Test** | **Ho** | **H1** |
| **Accept Ho** | **Correct decision** | **Type II error*****β*** |
| **Reject Ho** | **Type 1 error*****α*** | **Correct decision** |

**Def: Type I error is the probability of rejecting Ho when Ho is true.**

**Def: Type II error is the probability of accepting Ho when H1 is true.**

**Example: We have developed a new procedure to improve survival of premature infants. If the hospital adopts these procedures, there will have to be new rooms and new equipment purchased. This is very costly.**

1. **What does a Type I error imply?**
2. **What does a Type II error implies?**

**Def: Level of significance: *α* = Probability of a Type I error. This is the area under the curve below (or above) the critical value. This is the probability of rejecting Ho when Ho is true.**

**Def:*β*: Probability of a Type II error.**

**Def: *1-β*—Power of a test. This is the**

**Pr (rejecting Ho|H1 is true).**

**Goal: Make *α*, *β* as small as possible. Usually, as *α*↑, *β*↓ and as *α*↓, *β*↑.**

**Fix *α* (0.05 or 0.01). Find a test to minimize*β*.**

**Best test for the fat experiment is one based on.**

**Def: Acceptance Region—These are the values of  for which Ho is accepted.**

**Def: Rejection Region—These are the values of  for which Ho is rejected.**

**Note: For this example, we are conducting a one-sided or one-tailed test. We will only reject Ho for values of  that are low.**

**Def: One-tailed—this is a test in which values of parameter under H1 either > or < values under Ho but not both.**

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