Statistics for Public Health Research

Lecture 4

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Inferential Statistics
Estimation of the Mean

- **Estimation** is a procedure by which a numerical value or values are assigned to a population parameter based on the information collected from a sample.
- **Population parameter /** Mean, median, mode, variance, and standard deviation

Prem S. Mann (1998)

Inferential Statistics
Estimation of the Mean

- Estimating the *true population mean*, (μ) and *true population proportion*, (*p),* from assigned value of sample (mean & proportion).

The sample mean, is an estimator of the population mean, (μ) ; and

The sample proportion, $\hat{p}$, is an estimator of the population proportion, *p*.

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The estimation procedure involves the following steps.

1. Select a sample from studied population

2. Collect the required information from the members of the sample.

3. Calculate the value of the sample statistic.

4. Assign value(s) to the corresponding population parameter.

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Types of Estimates

1-) Point Estimate/ The value of a sample statistic that is used to estimate a population parameter is called a *point estimate*.

Point estimate of a population parameter = Value of the corresponding sample statistic

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Estimation of the Mean

Example of Point Estimate.

Suppose we take a sample of 10,000 employees and determine that the mean income per month, for this sample is SR9000. Then, using the sample mean as a point estimate for population mean of the mean income per month, , for all employees is about SR 9000.

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Types of Estimates

- **2-) Interval Estimate/** It is an interval is constructed around the point estimate, and it is stated that this interval is likely to contain the corresponding population parameter.

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Types of Estimates

- **2-) Interval Estimate/** It involves of more than one point, it consists of a range of values that include population parameter, e.g. Confidence interval.

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Example of Interval Estimate/ Confidence Interval

The confidence level is denoted by (1 - α)100%, where is the Greek letter *alpha*.

When expressed as probability, it is called the *confidence coefficient* and is denoted by 1 - α .

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Example of Interval Estimate/ Confidence Interval

There are three common confidence intervals

90% CI

95% CI

99% CI

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How to calculate confidence interval from a sample mean with normal distribution ?

Mean (+ -) Z score (Standard Error)

- **90% CI = Mean (+ -) 1.65 (Standard Error)**
- **95% CI = Mean (+ -) 1.96 (Standard Error)**
- **99% CI = Mean (+ -) 2.58 (Standard Error)**

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How to calculate confidence interval from a sample mean with normal distribution ?

You should calculate (Standard Error (SE) to calculate confidence interval.

Standard Error = Standard deviation / $\sqrt{n}$ (square root sample size)

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Estimation of the Mean

Standard Error = Standard deviation / √n (square root sample size)

Standard error of the sample mean measures how precisely the population mean is estimated by the sample mean. The sample size increases, the size of the error decreases.

The variability of data increases, the size of error increases.

We can estimate more accurate the population parameter if there is less standard error. The high variability gives more increasing in SE.

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Example / The mean income of 100 employees in city (A) is SR5000, with standard deviation SR500. Calculate 95% confidence interval for the mean income of employees in city (A).

- **95% CI = Mean (+ -) 1.96 (Standard Error)**

Standard Error = 500 / √100 = 500 / 10 = 50

95% CI = 5000 (+ -) 1.96 * 50 = 5000 (+ -) 98

95% CI = (5000 – 98) to (5000 + 98) = 4902 to 5098

Reference

- **Prem S. Mann 1998, Introductory Statistics, 7th edn, New York, USA.**

Good Luck for All Students

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سبحان الله وبحمده سبحان الله العظيم

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أستغفر الله