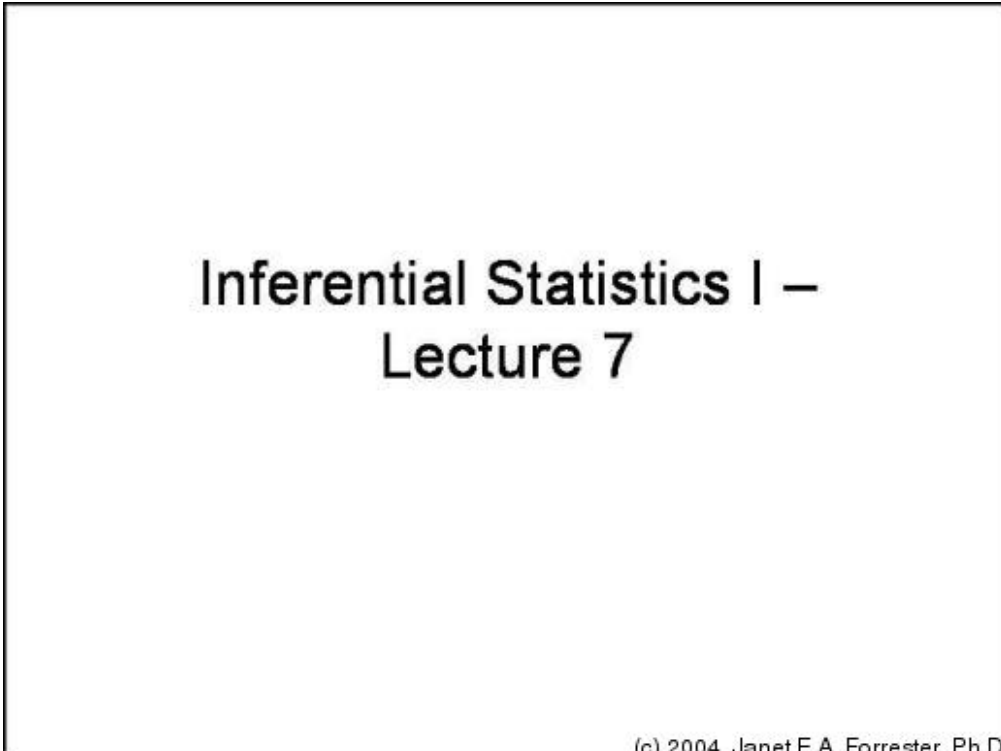


1.

## Introduction Slide



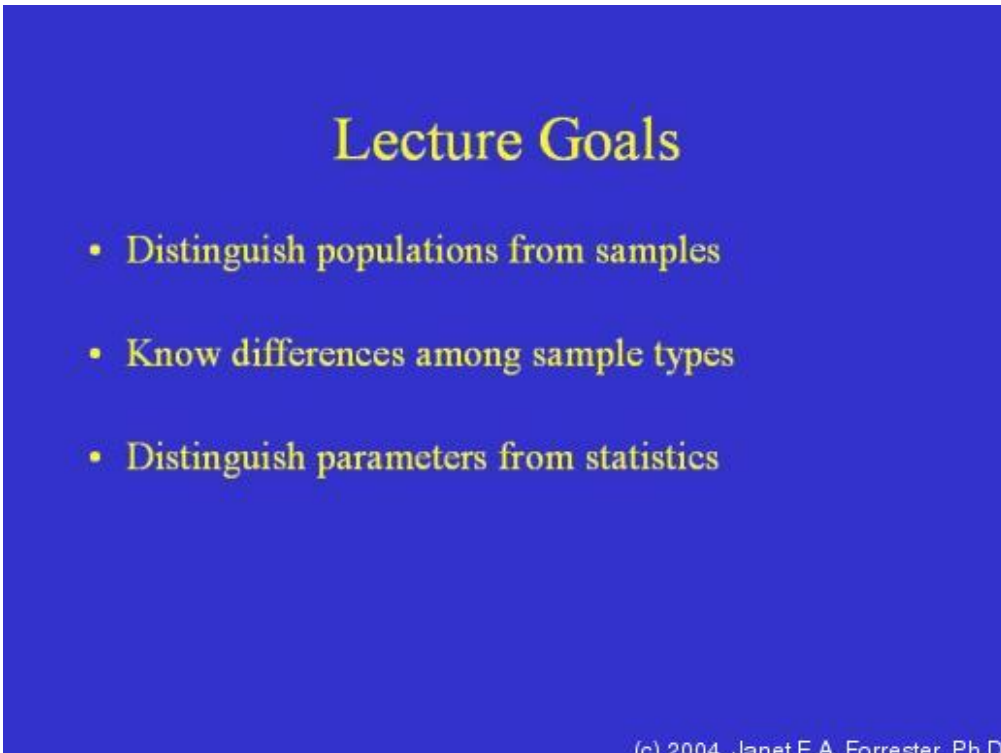
Inferential Statistics I –  
Lecture 7

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2.

## Lecture Goals



Lecture Goals

- Distinguish populations from samples
- Know differences among sample types
- Distinguish parameters from statistics

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This slide has a blue background and contains the title 'Lecture Goals' in yellow text. Below the title is a bulleted list of three goals: 'Distinguish populations from samples', 'Know differences among sample types', and 'Distinguish parameters from statistics'. A copyright notice '(c) 2004, Janet E.A. Forrester, Ph.D.' is in the bottom right corner.

3. Lecture Goals, cont.

## Lecture Goals cont'd

- Understand Central Limit Theorem and its application to inferential statistics
- Distinguish standard deviation from standard error
- Know how to calculate a confidence interval
- Know how to interpret a confidence interval

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4. Populations vs. samples 1

## Populations vs. samples

- **Census:**
  - everyone in population
  - E.g. All American residents
- **Sample:**
  - a representative subgroup of population
  - E.g. Representative subgroup of American residents

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5. Populations vs. samples 2

## Populations vs. samples

- In medical research:
  - Population:
    - All patients candidates for treatment
  - Sample:
    - All patient candidates for treatment who volunteer for your study
    - *Infer* results from volunteers (sample) to other candidates for the same treatment (population)

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6. Some types of samples

## Some types of samples

- **Simple random sample:**
  - Everyone in population has a equal chance of being in sample
- **Stratified random sample:**
  - Divide population into men and women
  - Take simple random sample of each
- **Convenience sample:**
  - E.g. volunteers for your study

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7. Populations vs. samples 3

### Populations vs. samples

Characteristics	Population (Parameter)	Sample (Statistic)
Mean	$\mu$	$\bar{X}$
Proportion	$\pi$	$p$
Standard deviation	$\sigma$	S or SD
Variance	$\sigma^2$	$S^2$
Correlation coefficient	$\rho$	$r$
Slope of a line	$\beta$	$b$
Relative risk	RR	rr
Odds ratio	OR	or

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8. Populations vs. samples 4

- ### Populations vs. samples
- Parameters represent “truth”
  - Statistics have associated error
    - The study of statistics is about estimating that error
    - Central limit theorem tells us how much error to expect in our sample estimates (i.e. sample statistics)
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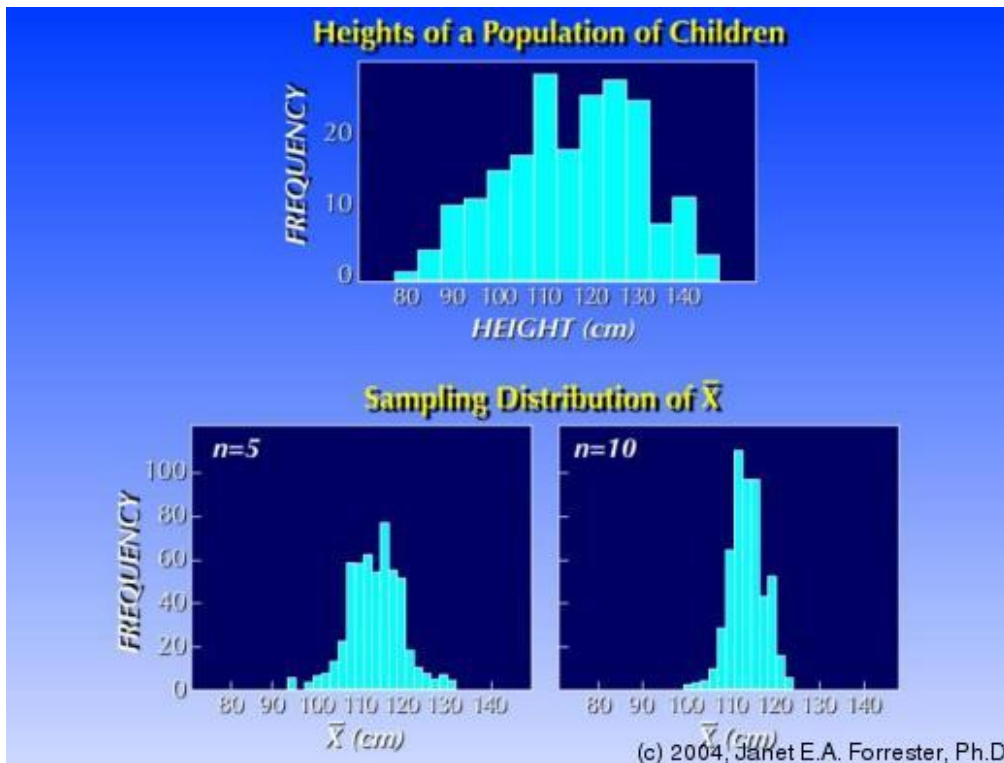
9. Example of Central Limit Theorem in action

**Example of Central Limit  
Theorem in action**

$\bar{X} \longrightarrow \mu ?$

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10. Inferential Statistics I: Sampling Distribution - 1



11.

### Central Limit Theorem - 1

## Central Limit Theorem - 1

- If the population distribution is Gaussian, the *sampling distribution* will be Gaussian
- Even if the population distribution is not Gaussian, the sampling distribution will be approximately Gaussian, if the sample size is large ( $>30$ )

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12.

### Central Limit Theorem -2

## Central Limit Theorem -2

- The mean of the sample means = the population mean

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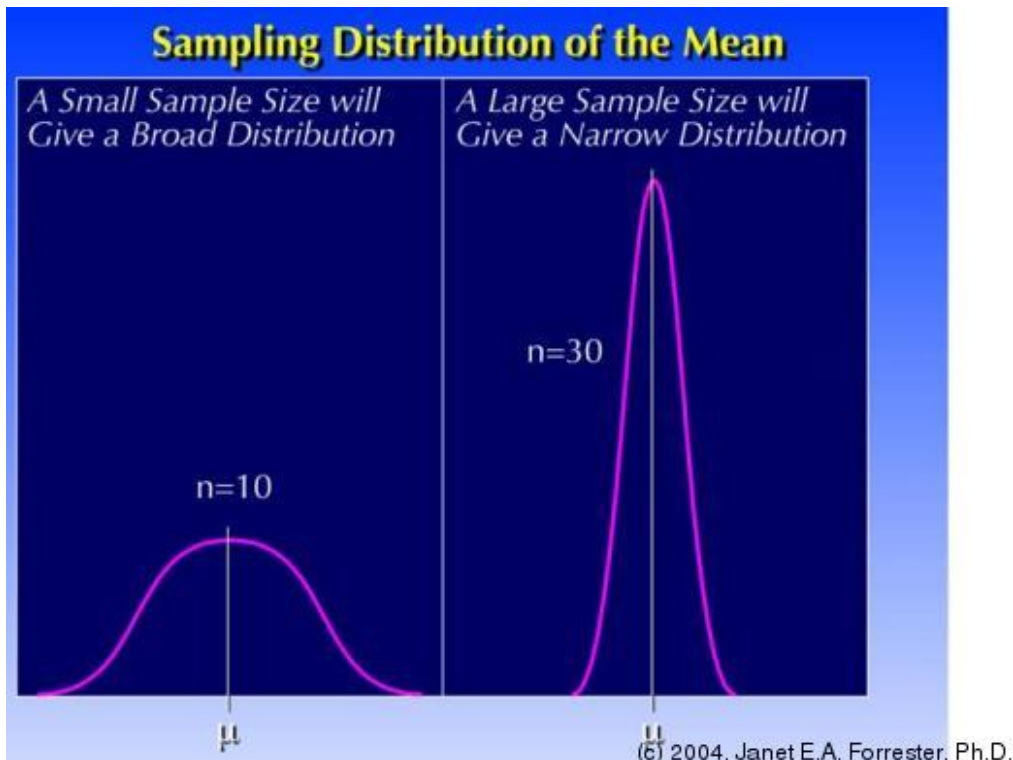
13. Central Limit Theorem - 3

## Central Limit Theorem - 3

- The standard deviation of the sampling distribution is called the “standard error” and is related to the population standard deviation by the formula:  $SE = \sigma / \sqrt{N}$

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14. Sampling Distribution of the Mean



15.

## Sampling

- If the sampling distribution is Gaussian then it must follow the 68-95-99% rule (see pg 37 of syllabus). Therefore...
- In 95% of samples, the sample mean will fall within 1.96 standard errors of the population mean,  $\mu$ .
- Same as saying...
- In 95% of samples,  $\mu$  will fall within 1.96 standard errors of the sample mean,  $\bar{X}$

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16.

## Confidence Interval

- Use this to calculate a 95% confidence interval for  $\mu$ .
- To calculate a 95% confidence interval for  $\mu$  :

$$95\% \text{ CI} = \bar{X} \pm 1.96 \text{ SE}$$

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17. General formula for a confidence interval

**General formula for a confidence interval**

$$\bar{X} \pm Z \sigma / \sqrt{N}$$

<u>Confidence</u>	<u><math>\alpha/2</math></u>	<u>Z score</u>
90%	0.05	1.65
95%	0.025	1.96
99%	0.005	2.58

The *higher* the confidence level, the *wider* the confidence interval.

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18. Inferential Statistics I: Sampling Distribution - 2

**95% of Confidence Intervals will include  $\mu$**

19/20  
(95%)

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