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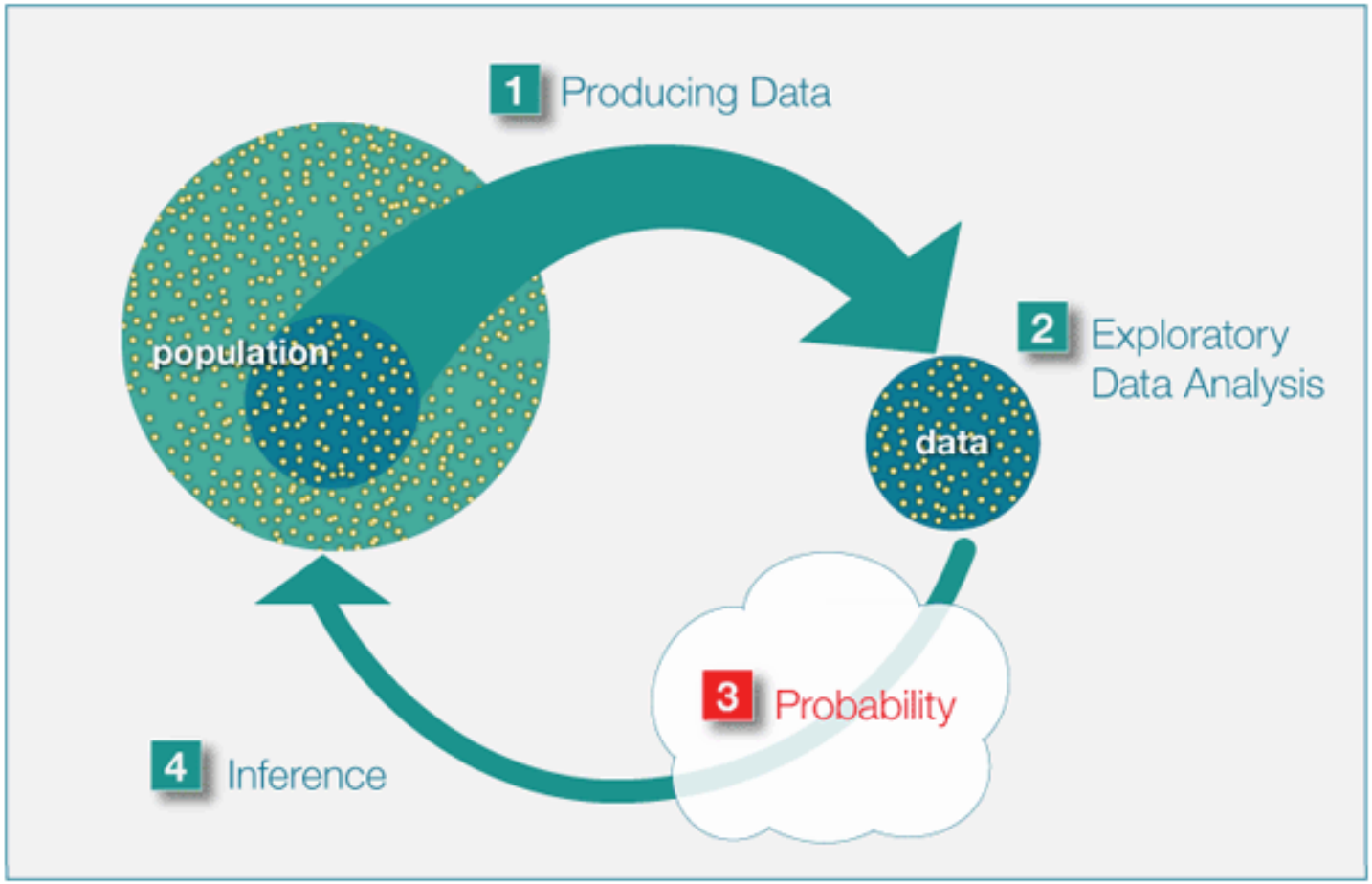
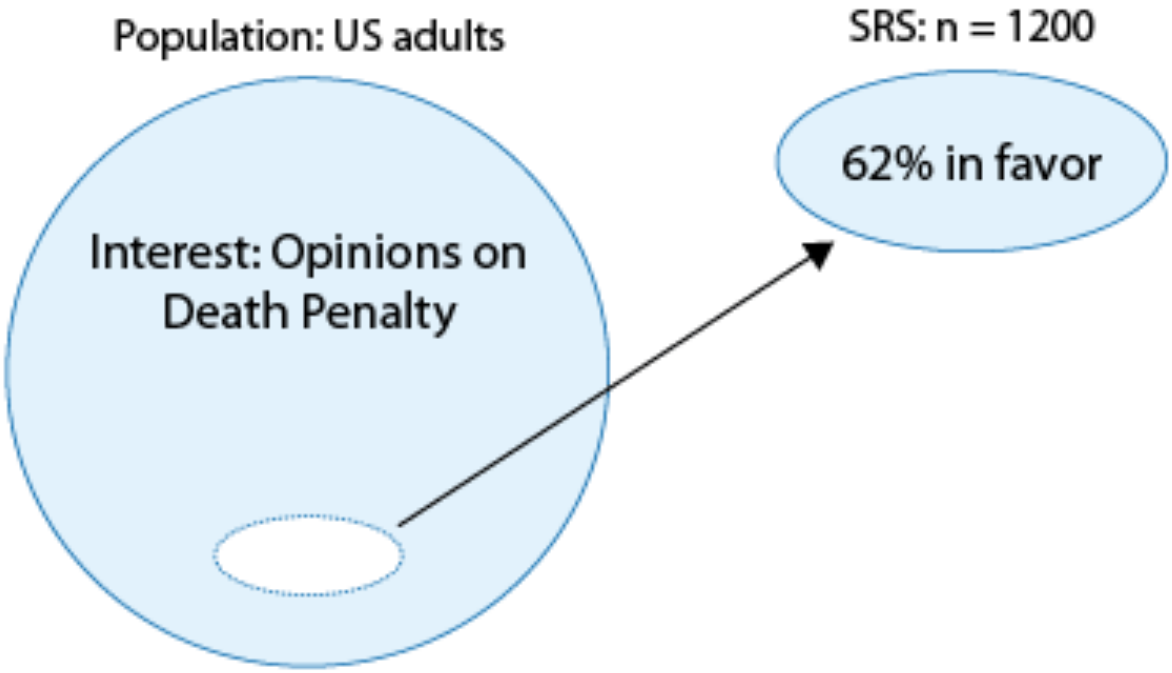
Probability

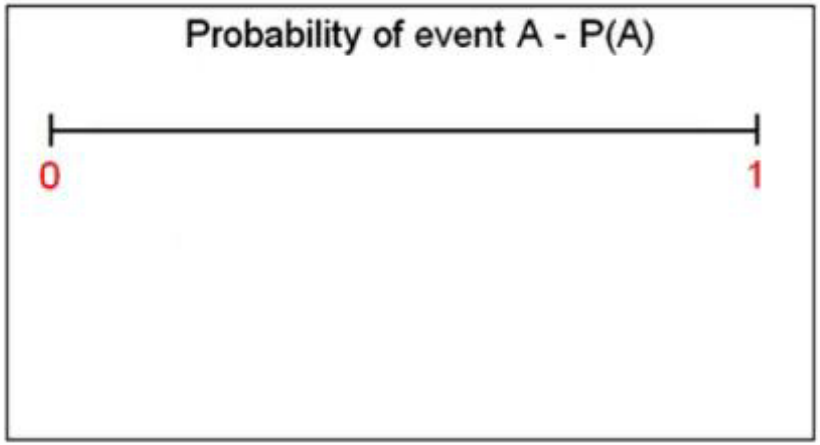


Example

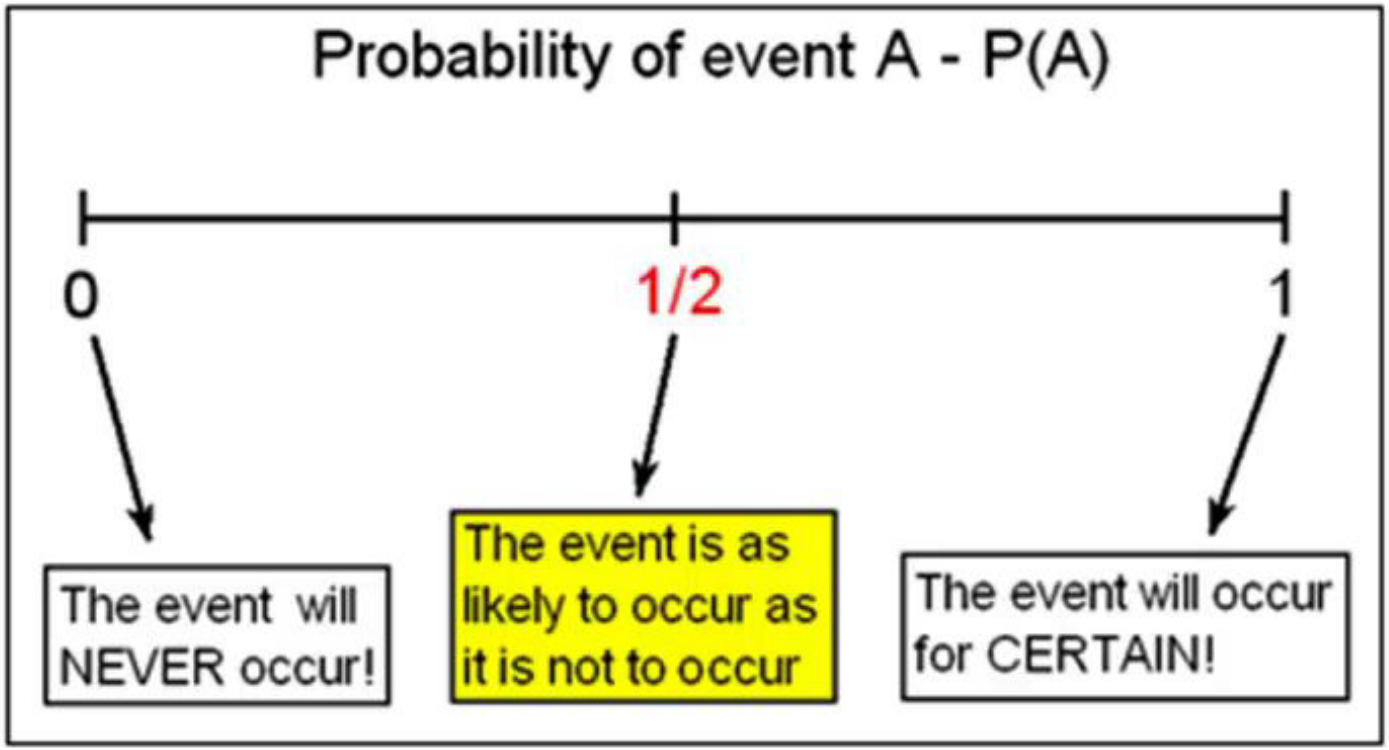


Probability is the Likelihood of Something Happening

The "probability" of an event tells us how likely it is that the event will occur.



What is Probability?



What is Probability?

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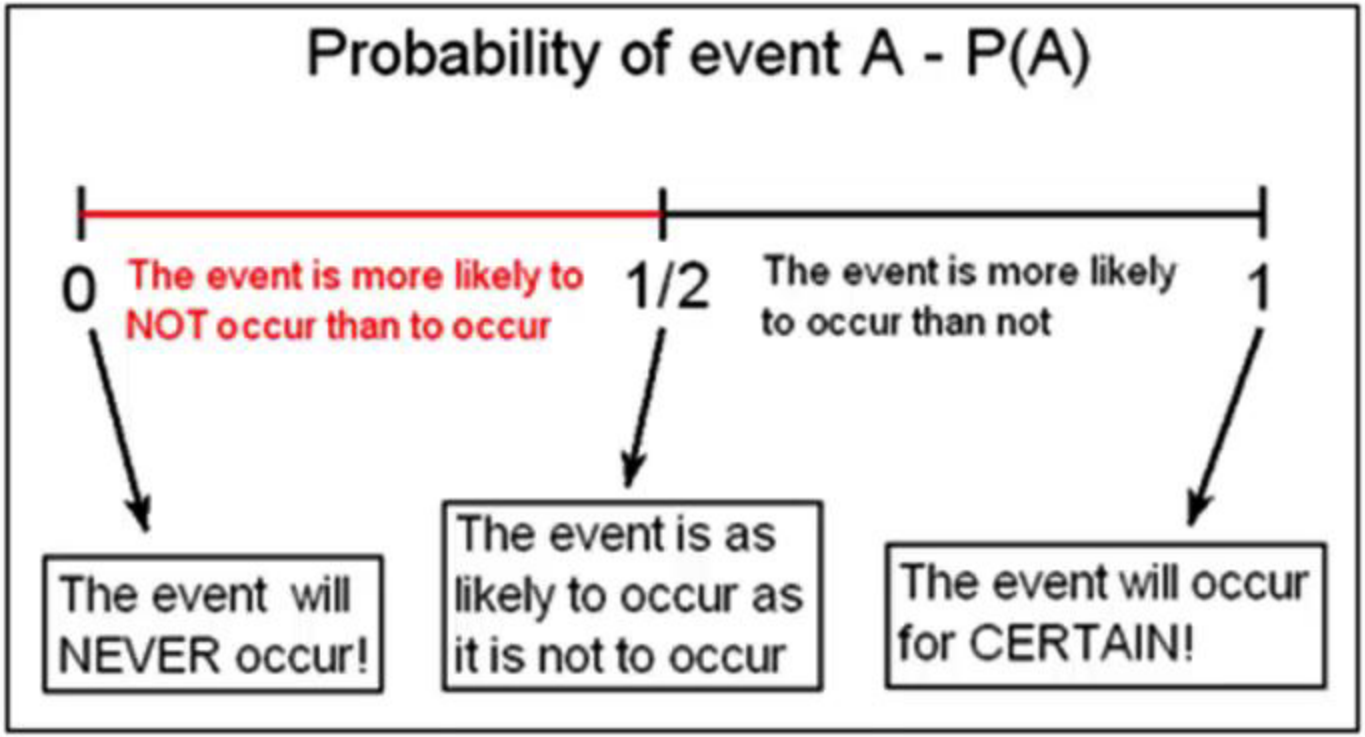
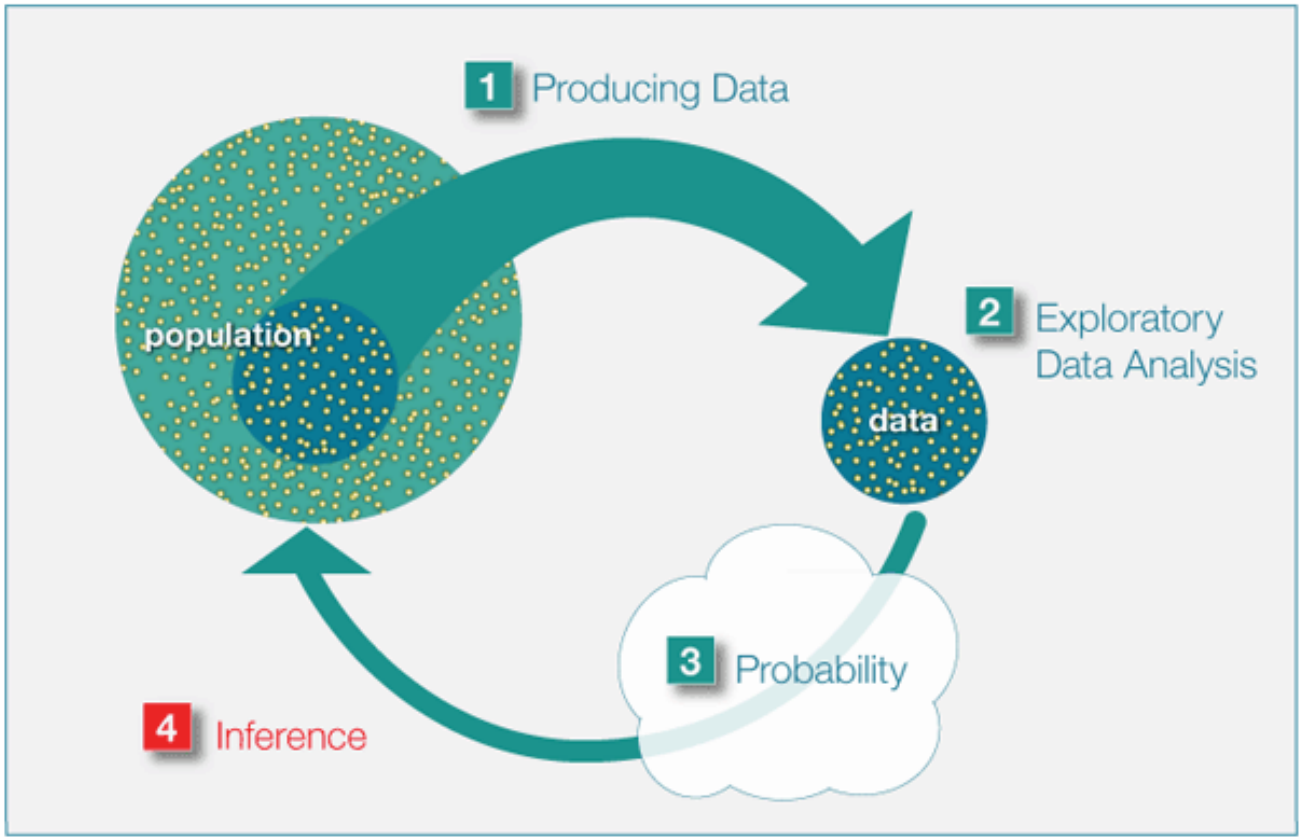


Inference



Sample Variability Example

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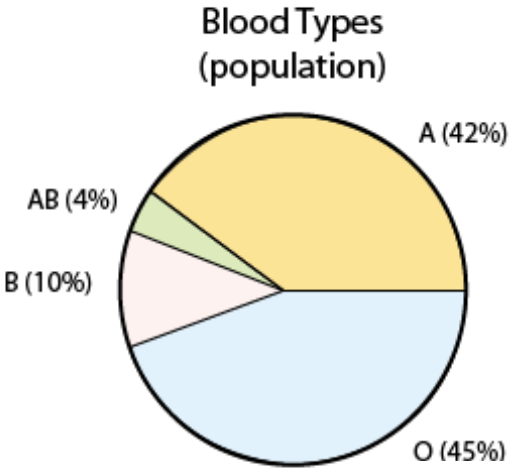
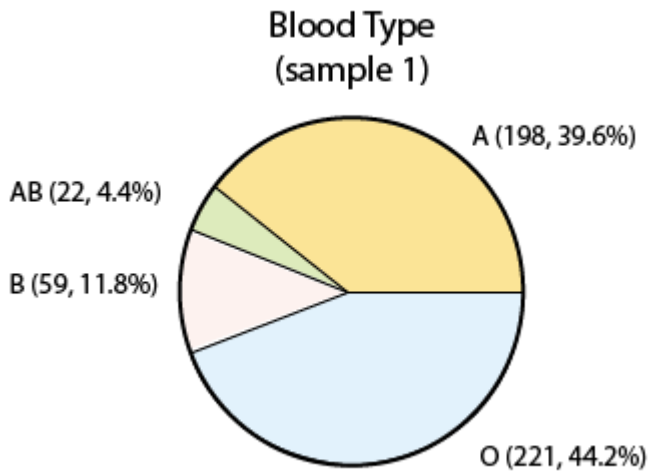
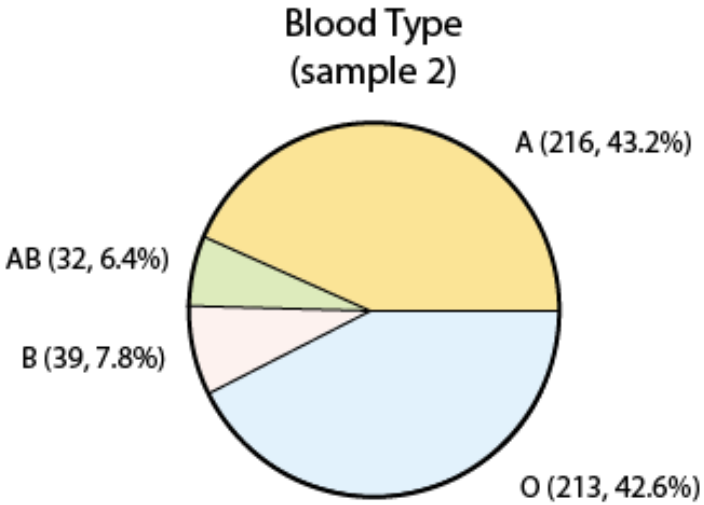
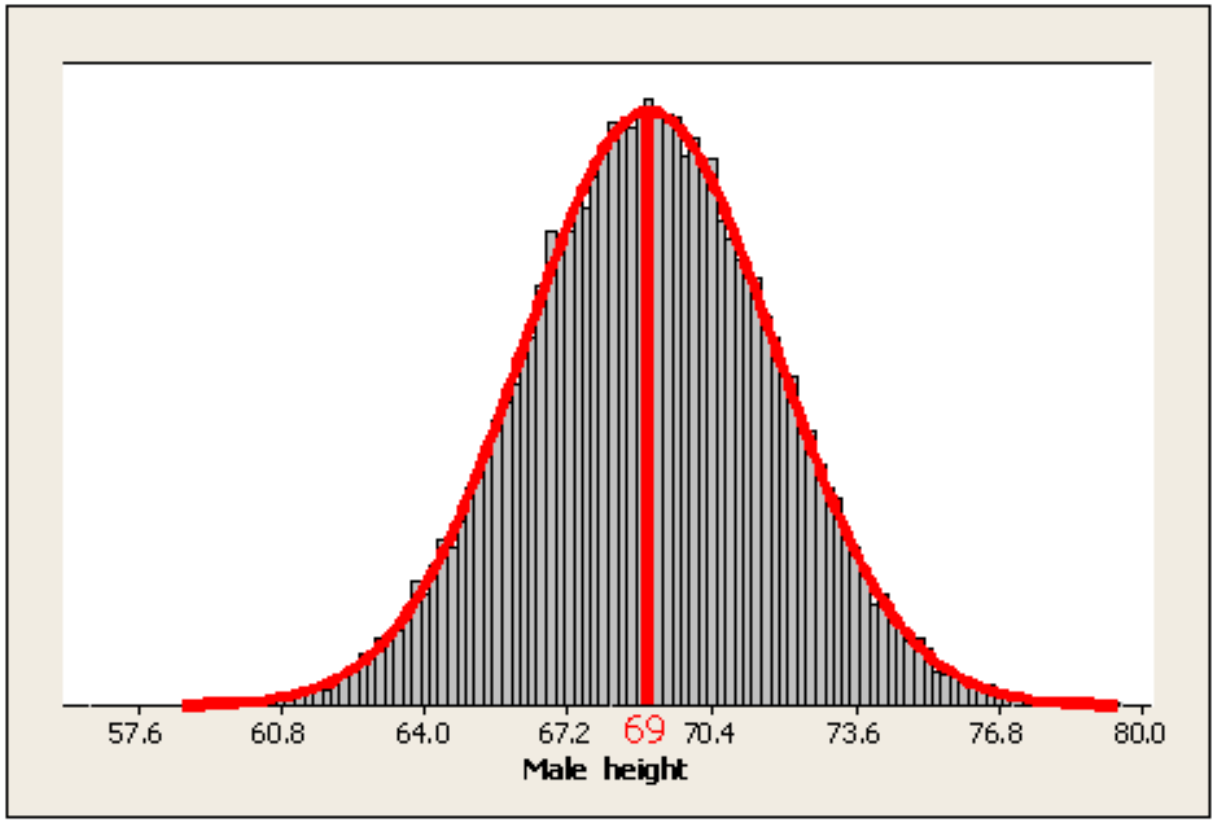






Male Height: US population



$\mu = 69 \qquad \sigma = 2.8$ inches.

Male Height: 2 samples

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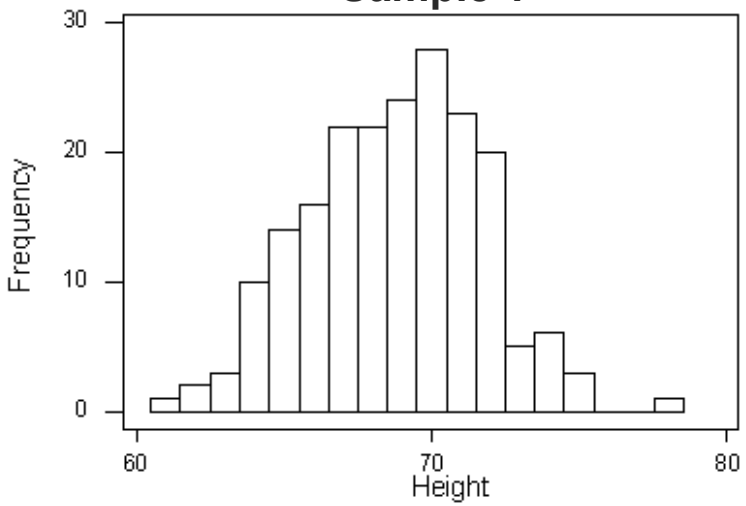
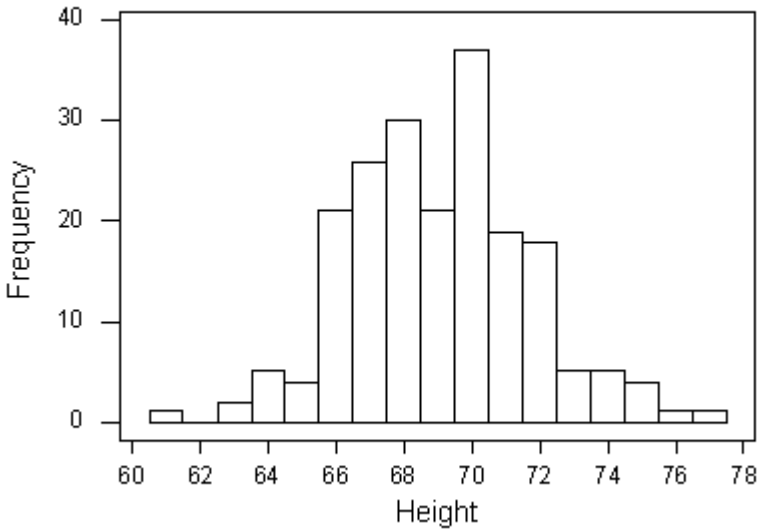
Sample 1



$\bar{x} = 68.7$ s = 2.95 inches

Sample 2



$\bar{x} = 69.065$ s = 2.659 inches

$\mu = 69 \quad \sigma = 2.8$ inches.

Parameter vs. Statistic

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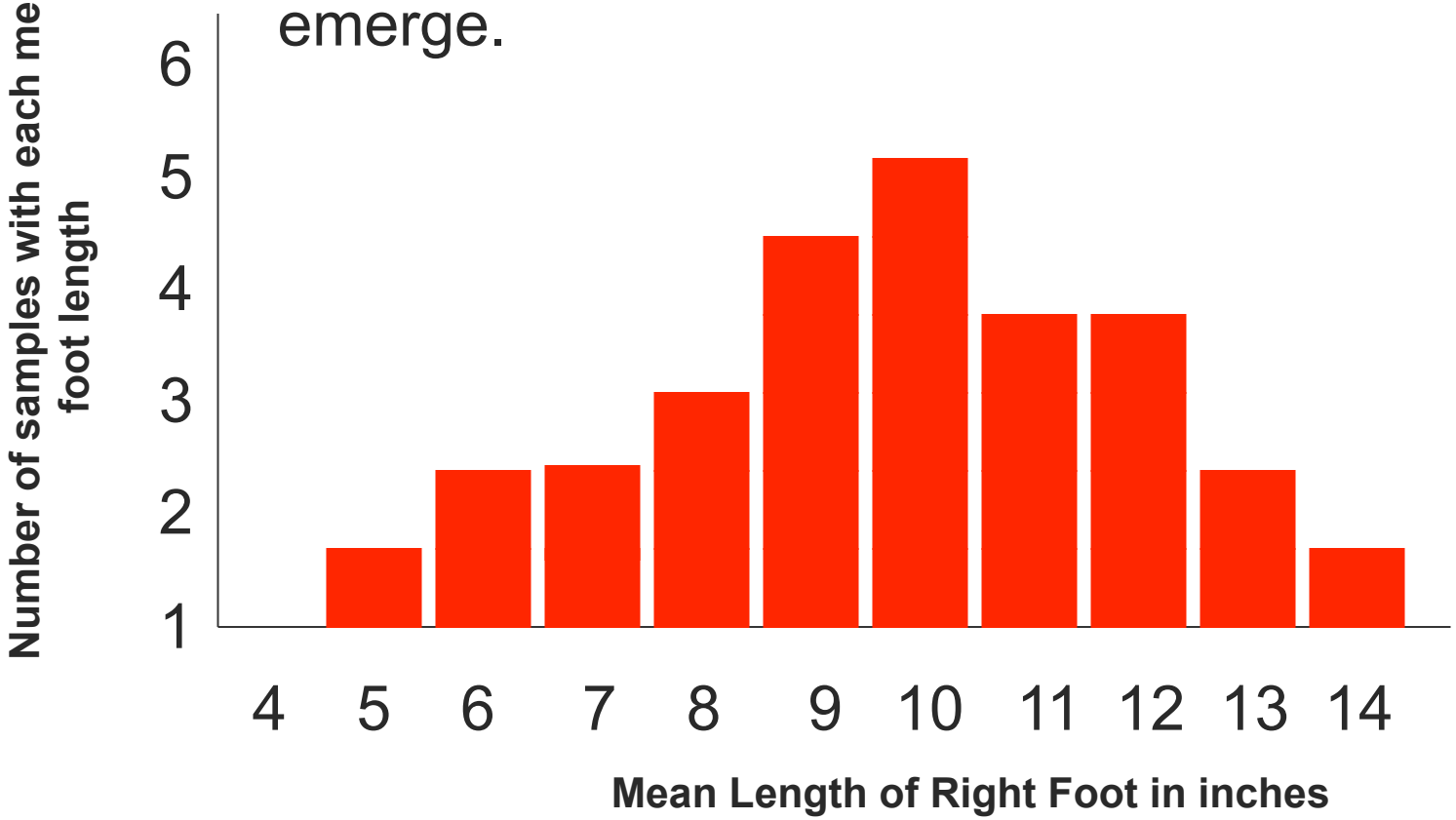
	(Population) Parameter	(Sample) Statistic
Proportion	p	$\hat{p}$
Mean	μ	$\bar{x}$
Standard Deviation	σ	s

As we continued to plot the mean foot length of each random sample, a pattern would begin to emerge.



Sampling Distribution

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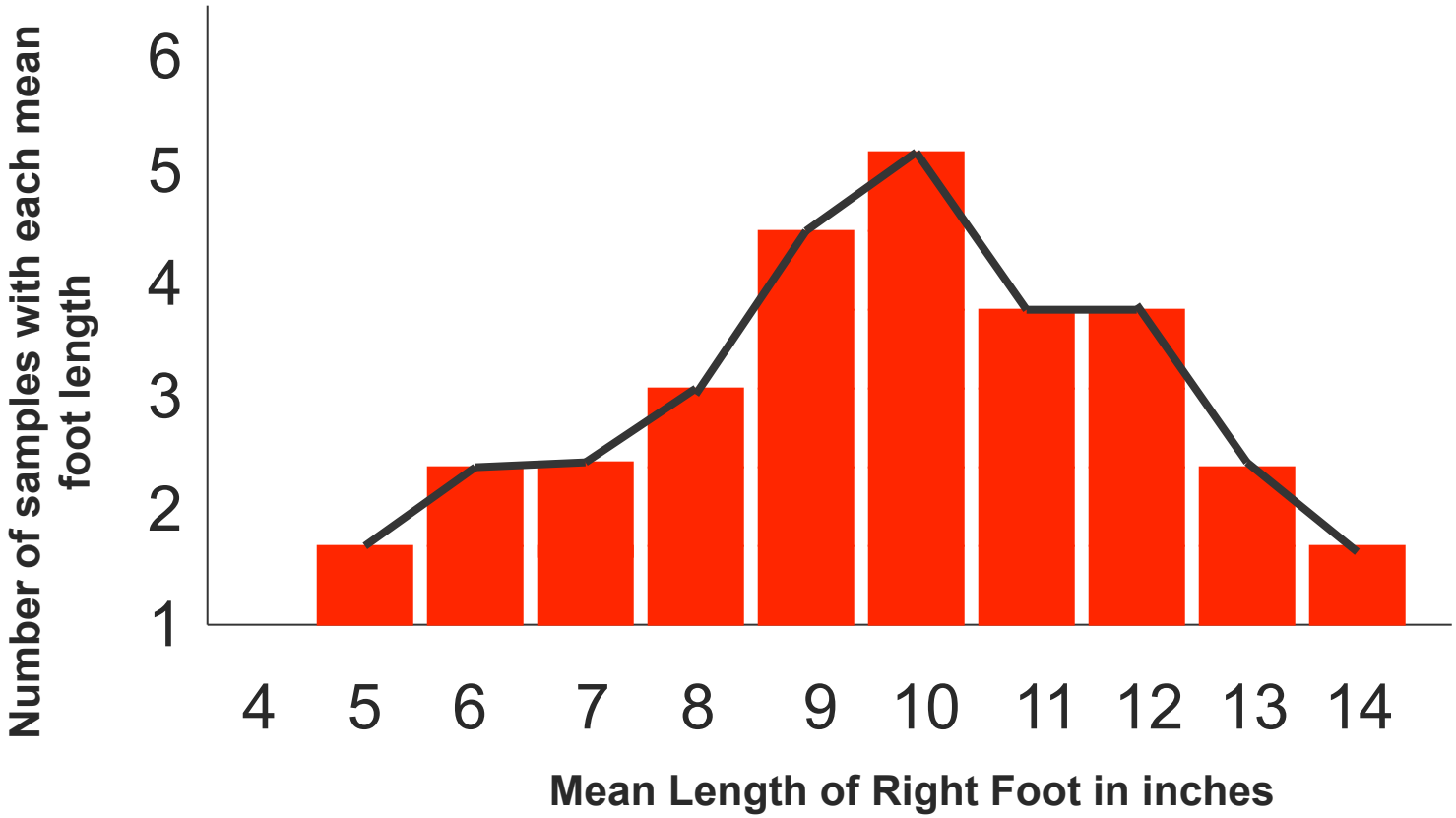

Sampling Distribution

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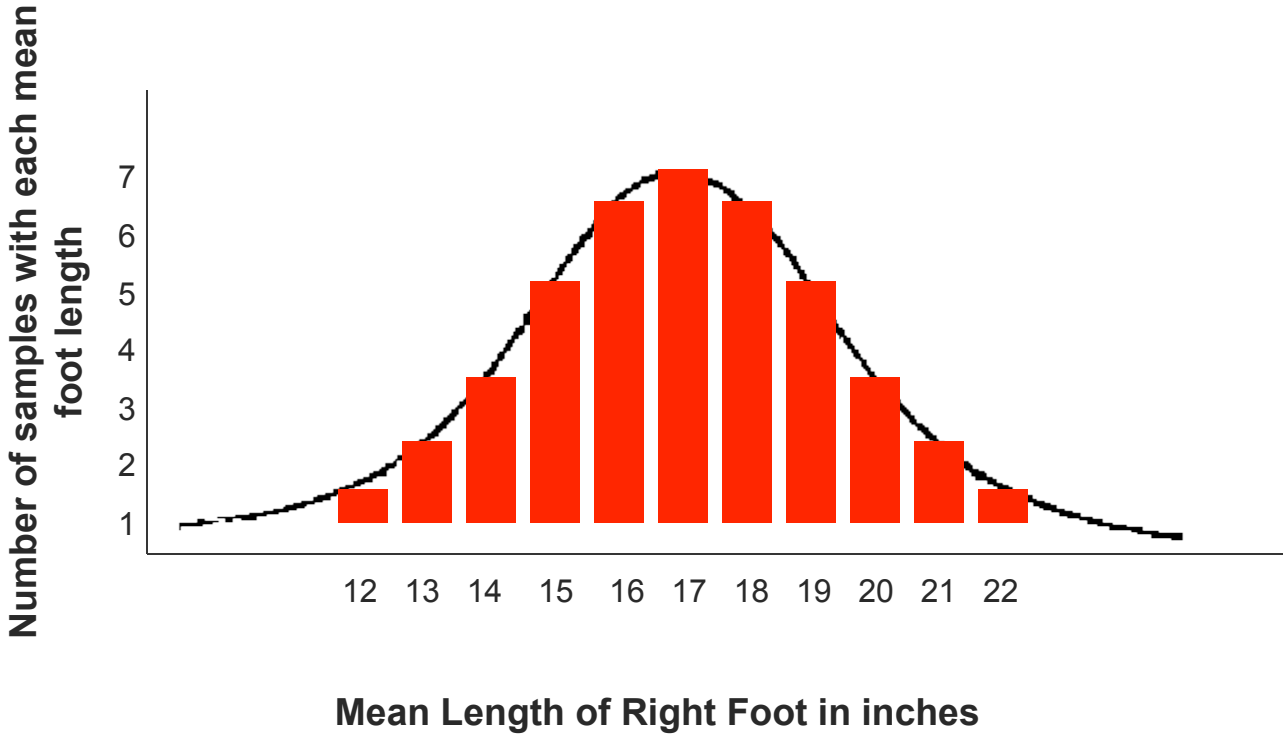

Steps in Hypothesis Testing

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Specifying the null (H_o) and alternate (H_a) hypothesis

Choosing a sample

Assessing the evidence

Drawing conclusions

Specifying the Null and Alternate Hypothesis

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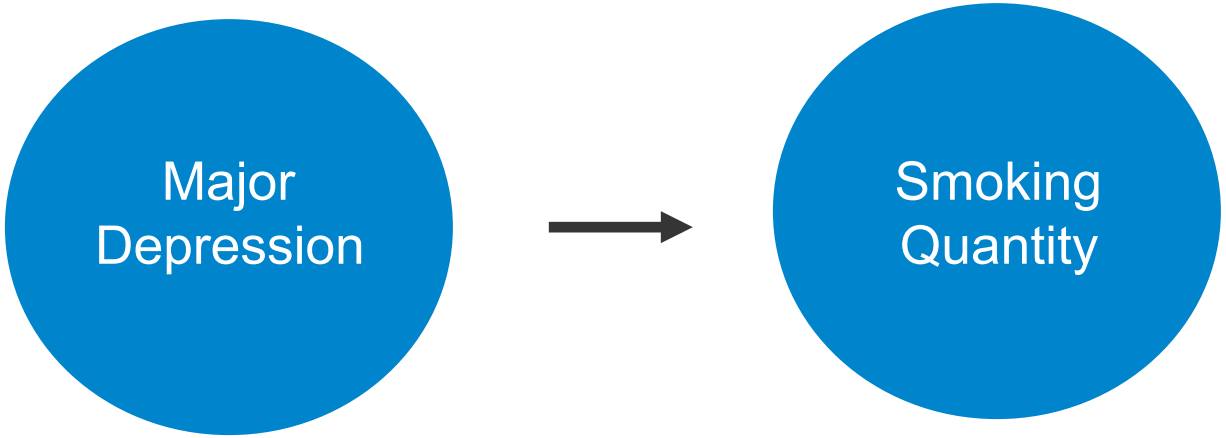

H_o: There is no difference in smoking quantity between smokers with and without depression.

H_a: There is a difference in smoking quantity between smokers with and without depression.

Choosing a Sample

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The NESARC, a representative sample of 43,093 adults in the U.S.

1) current daily smokers

2) age 18 to 25.

n=1320

Young adult, daily smokers with depression smoked an average of **13.9** cigarettes per day (s.d. 9.2).

Young adult daily smokers without depression smoked on average **13.2** cigarettes per day (s.d 8.5)

Assessing the Evidence

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Is there strong enough evidence against the null hypothesis?

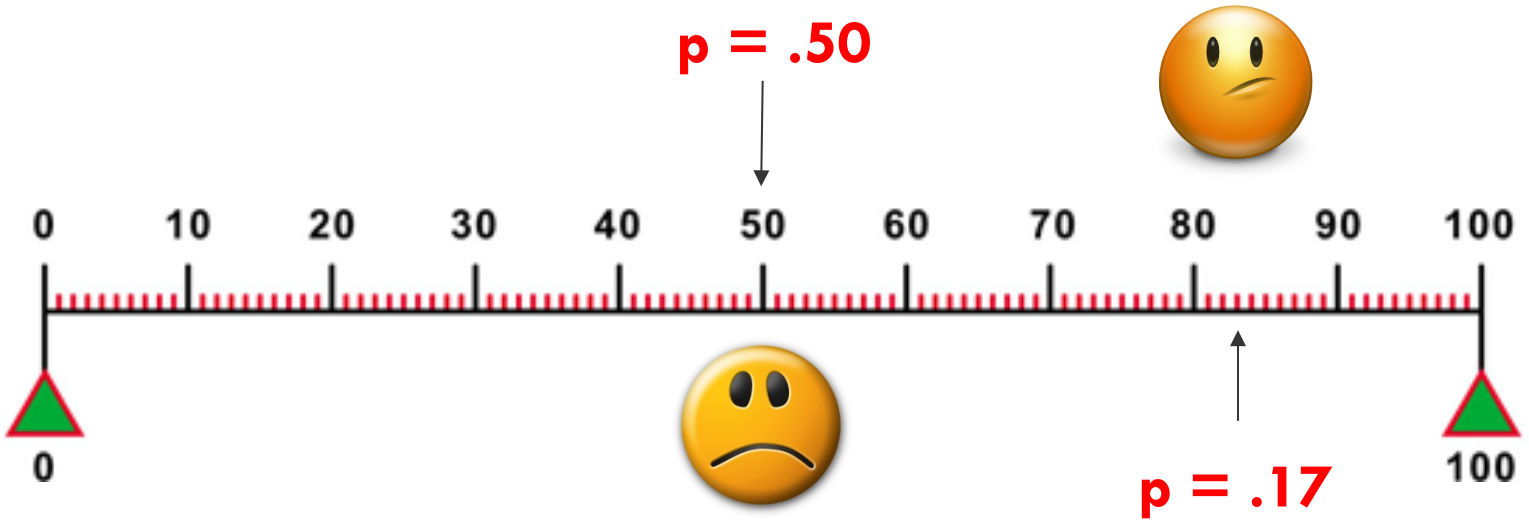
Smokers with depression = **13.9** cigarettes per day (s.d. 9.2).

Smokers without depression = **13.2** cigarettes per day (s.d 8.5)

A difference of 0.7 cigarettes per day

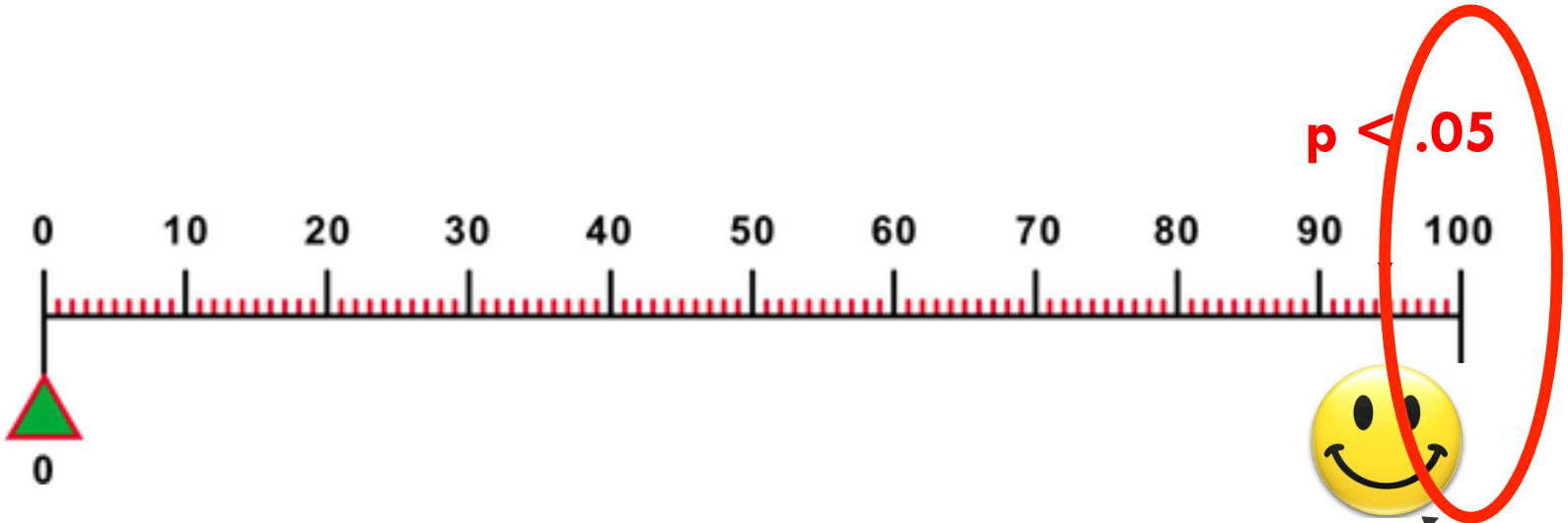
The probability of getting a difference of this size is roughly **0.17**

Drawing Conclusions



Translation: If we took 100 random samples from our population we would be wrong 17 out of 100 times if we rejected the null hypothesis and said that the difference in smoking quantity was difference for smokers with depression compared to those without.

p-value



statistically significant

reject H_o and accept H_a

p =.05 is the Type I error rate

If I change my example…

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The NESARC, a representative sample of 43,093 adults in the U.S.

1) current daily smokers 1) smoked in past 12 months

2) age 18 to 25.

n=1320 n=1706

Young adults with depression smoked an average of **351.7** cigarettes per month (s.d. 300.0).

Young adult without depression smoked on average **313.5** cigarettes per month (s.d 268.2)

A difference of 38.2 cigarettes per month (almost 2 packs) p=.0285

p-value < .05

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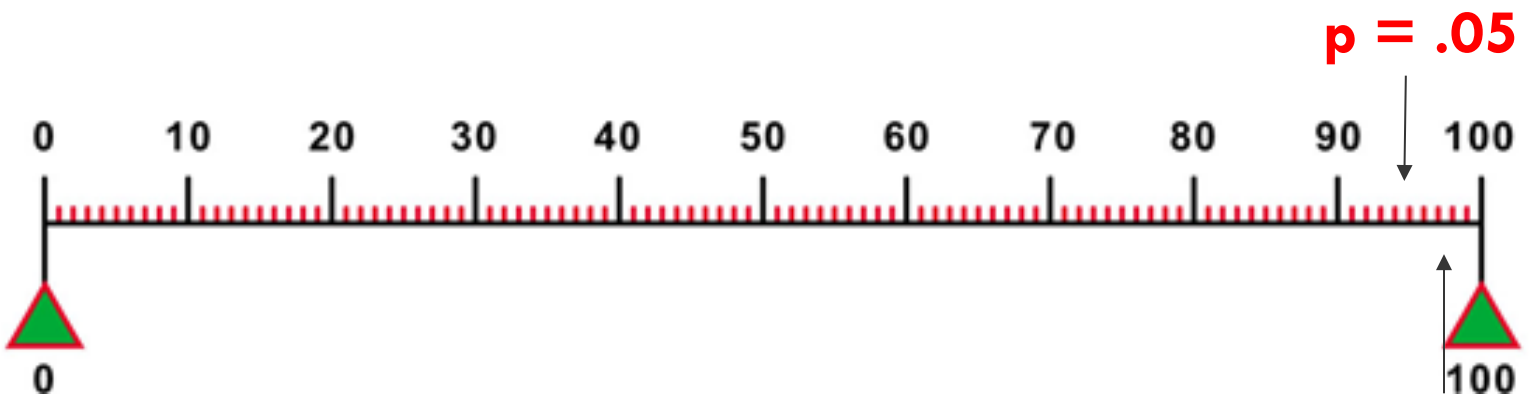

p = .0285

Translation: If we reject the null hypothesis and say that there is a difference between the average number of cigarettes smoked per month among young adults with and without depression, we would be wrong fewer than 3 out of 100 times. We would be correct more than 97% of the time.

Variable types and inferential tools

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		Response	
		Categorical	Quantitative
Explanatory	Categorical	C → C	C → Q
	Quatitative	Q → C	Q → Q