Z-test



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Elias Zintzaras, M.Sc., Ph.D.

Professor in Biomathematics-Biometry Department of Biomathematics School of Medicine University of Thessaly

Institute for Clinical Research and Health Policy Studies Tufts University School of Medicine Boston, MA, USA Theodoros Mprotsis, MSc, PhD Teacher & Research Fellow (http://biomath.med.uth.gr) University of Thessaly Email: tmprotsis@uth.gr



Evaluating Asthma Rates: Hospital Sample Versus General Population **One Population Proportion Z-Test**

(https://biomath.med.uth.gr/en/statistics-calculators)



Evaluating Asthma Rates: Hospital Sample Versus General Population

Example

In a hospital, a random sample of $n_1 = 215$ women was collected from patient lists, and r = 39 of them were found to have a history of asthma (i.e., the observed rate of asthma is $p = \frac{39}{215} = 18\%$). It is known that the prevalence rate of the disease is P = 15%

Question

Does the percentage of women diagnosed with asthma in the sample match the prevalence in the general population?

 H_0 : The asthma rate in the hospital sample is equal to the prevalence rate in the general population

$$H_0: p = P$$

Entering data and defining variables



Running the Z-Test

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1. To analyze the data, select Analyze from the menu, then choose Compare Means and Proportions and One-Sample Proportions...



 In window (2) drag the variable asthma from the left panel to the Test Variable(s): box. In the Define Success field, choose Value(s) and enter 1

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Interpretation of the results

SPSS reports the wrong standard error. The correct standard error is 0.0244

	on	e-Sample P	roportion	s Confider	nce intervais		
			Observed		Asymptotic	95% Confide	nce Interval
	Interval Type	Successes	Trials	Proportion	Standard Error	Lower	Upper
asthma = Yes	Agresti-Coull	39	215	.181	.026	.135	.239

The value z = 1.289 is greater than the 5% critical value of the standard normal distribution, which is 1.96

The results ($P \ge 0.05$) of the z-test indicated that the observed rate of asthma (18.14%) did **not significantly differ** from the population prevalence rate (15%)

One-Sample Proportions Tests									
			Observed		Observed -	Asymptotic		Signifi	cance
	Test Type	Successes	Trials	Proportion	Test Value ^a	Standard Error	Z	One-Sided p	Two-Sided p
asthma = Yes	Score	39	215	.181	.031	.026	1.289	.099	.197
	Score (Continuity Corrected)	39	215	.181	.031	.026	1.194	.116	.233

a. Test Value = .15

	On	e-Sample P	roportion	s Confider	nce intervals		
	Interval Type	Successes	Observed Trials	Proportion	Asymptotic Standard Error	95% Confide Lower	ence Interval Upper
nma = Yes	Agresti-Coull	39	215	.181	.026	.135	.239



Practice



The researchers wanted to determine if the percentage of obesity/overweight native Americans was different than that of the general population

2. Kim et al. (2004) studied the measles-rubella vaccination-rates in Korea. They compared the proportion of children with measles antibodies to the World Health Organization (WHO) target proportion (for children aged 5 to 9 years old: 10%) The aim of the study was to test if the proportion of Korean children with the measles antibody in the population was 10% or lower (i.e., better). In the study, 55 children out of 972 had the antibody present



Comparing Influenza Rates in Vaccinated vs. Placebo Groups **Two Proportion Z-Test**



Comparing Influenza Rates in Vaccinated vs. Placebo Groups

	Treat	ment
Influenza	Vaccine	Placebo
Yes	20	80
No	220	140

Example

Of the 240 ($n_1 = 240$) people vaccinated with the real vaccine, 20 ($p_1 = 20$) got influenza, compared to 80 ($p_2 = 80$) out of 220 ($n_2 = 220$) who were vaccinated with a placebo.

Question

Is there any indication that the vaccine was effective?

 H_0 : The vaccination does not affect the influenza rate; the proportions of influenza cases in the vaccinated group (p_1) and the placebo group (p_2) are equal

$$H_0: p_1 = p_2$$

Entering data and defining variables



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3	freq	Numeric	8	2		None)		None	11	I Right	🛷 Scale		

Entering data and defining variables

Select Data from the menu, then choose Weight Cases...



Running the Z-Test



1. To analyze the data, select **Analyze** from the menu, then choose **Descriptive Statistics** and **Crosstabs...**

ta Crosstabs		×		
✓ freq	Row(s): Column(s): Column(s): Column(s): Layer 1 of 1 Previous Next	Statistics Cells Eormat Style Bootstr <u>ap</u>	Crosstabs: Statistics Chi-square Nominal Contingency coefficient Phi and Cramer's V Lambda Uncertainty coefficient Nominal by Interval Eta	× Correlations Crdinal Gamma Somers' d Kendall's tau-b Kendall's tau-c Kappa Risk McNemar
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 In window (2) drag the variable influenza from the left panel to the Row(s): box, and the variable treatment to the Column(s): box. Press the Statistics... button, select Chi-square, and then press Continue and OK

Interpretation of the results

influenza * treatment Crosstabulation

Count

		treatm	ent	
		Real vaccine	Placebo	Total
influenza	Yes	20	80	100
	No	220	140	360
Total		240	220	460

Chi-Square Tests							
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)		
Pearson Chi-Square	53.008 ^a	1	<.001				
Continuity Correction ^b	51.374	1	<.001				
Likelihood Ratio	55.606	1	<.001				
Fisher's Exact Test				<.001	<.001		
Linear-by-Linear Association	52.893	1	<.001				
N of Valid Cases	460						

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 47.83.

b. Computed only for a 2x2 table

 $Z = \sqrt{Pearson Chi - Square} = \sqrt{53.008} = 7.2806$

Since p-value = Asymptotic Significance (2-sided) < 0.001 we reject the null hypothesis

Therefore, there is evidence (P < 0.001) that actual vaccination reduces the risk of contracting influenza, **statistically significant**



Practical exercise



- Researchers want to test the effectiveness of a new anti-anxiety medication. In clinical testing, 64 out of 200 people taking the medication report symptoms of anxiety. Of the people receiving a placebo, 92 out of 200 report symptoms of anxiety. Is the medication working any differently than the placebo? Test this claim using alpha = 0.05.
- 2. Suppose a Drug Company develops a new drug, designed to prevent colds. The company states that the drug is equally effective for men and women. To test this claim, they choose a simple random sample of 100 women and 200 men from a population of 100.000 volunteers.

At the end of the study, 38% of the women caught a cold; and 51% of the men caught a cold. Based on these findings, can we reject the company's claim that the drug is equally effective for men and women? Use a 0.05 level of significance.