

Exam II – Take Home

Reference Ranges for Senior Subjects

The data for your project comes from a nutritional study conducted at Youngstown State University during 1997-1998. One hundred seventy eight subjects completed the study in which the researchers investigated levels of calcium, inorganic phosphorous and alkaline phosphatase in subjects age 65 or higher. The research study wanted to determine if reference ranges established for the general population applied to subjects in this age range. Researchers also wanted to discover if a difference existed for men and women.

The data appears in the data file **ranges2.xls** which is available at <http://csuohio.edu/holcombj/mth147/exam2.htm> Note that some variables may not be used for this assignment, but may be used for the take-home Final Examination.

Variable guide:

age	Age in years
sex	1=male, 2=female
alkphos	Alkaline Phosphatase in IU/L (International Units Per Liter)
ca	Calcium (mg/dL)
iphos	Inorganic Phosphorus mg/dL
agegroup	1=65-69, 2=70-74, 3=75-79, 4=80-84, 5=85 or over
lowca	0=no, 1=yes, for calcium lower than 9 mg/dL
lowphos	0=no, 1=yes, for phosphorus level lower than 3.0
highalp	0=no, 1=yes, for alkaline phosphatase higher than 115
over80	0=no, 1=yes (subject is 80 or higher)

The Medical Laboratory Reviewer established reference range levels for the general population for calcium and inorganic phosphorus (among others). For calcium that range was 9.0-10.5 mg/dL. Thus the variable **lowca** is an indicator variable to show if the subject was below the level of 9.0. The reference range for inorganic phosphorus is 3.0-4.5. Thus **lowphos** indicates whether the subject was below 3.0. A study by Jernigan established a reference range of 30-115 for alkaline phosphatase. The variable **highalp** indicates whether a subject had a value higher than 115.

Begin your report by providing a summary of the discrete variables of **sex**, **agerange**, and **lowphos**. (raw numbers and percents). Also perform a summary analysis of **age** and **iphos** (create a 5 number summary and histogram). Describe the shape of the histograms and determine if the mean or the median is the better measure of center.

Create a 2x2 contingency table of **sex** vs. **lowphos**. Let A be the event of being a man, B be the event of being a woman, C the event of not having low phosphorus (**lowphos=0**) and D be the event of having low phosphorus (**lowphos=1**). Determine the following:

1. $P(C)$
2. $P(D)$
3. $P(A \cap D)$
4. $P(B \cap D)$
5. $P(B \cup C)$
6. $P(D|A)$
7. $P(D|B)$

Were mature women or men more likely to have low phosphorus levels? How did you decide? Was this surprising?

Treating being male as a risk factor and having low phosphorus as the disease, calculate the relative risk for low phosphorus comparing men to women. Interpret its meaning.

Calculate the probability of low calcium given the subject was 80 or over. Calculate the probability of low calcium given the subject was 65-79. Which is higher?

If phosphorus levels are normally distributed and 3.0-4.5 represents a range of plus or minus 2 standard deviations from the mean – what percent should we expect to be below 3.0? Looking at your answer to the probability of having low phosphorus [$P(D)$], do you feel that perhaps the reference range of 3.0-4.5 is not accurate? Were any of your results above surprising? Why or why not. Make sure this paragraph is at least 5 sentences.

Answers for Test

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	91	51.1	51.1	51.1
	Female	87	48.9	48.9	100.0
	Total	178	100.0	100.0	

AGEGROUP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	56	31.5	31.5	31.5
	2.00	70	39.3	39.3	70.8
	3.00	38	21.3	21.3	92.1
	4.00	11	6.2	6.2	98.3
	5.00	3	1.7	1.7	100.0
	Total	178	100.0	100.0	

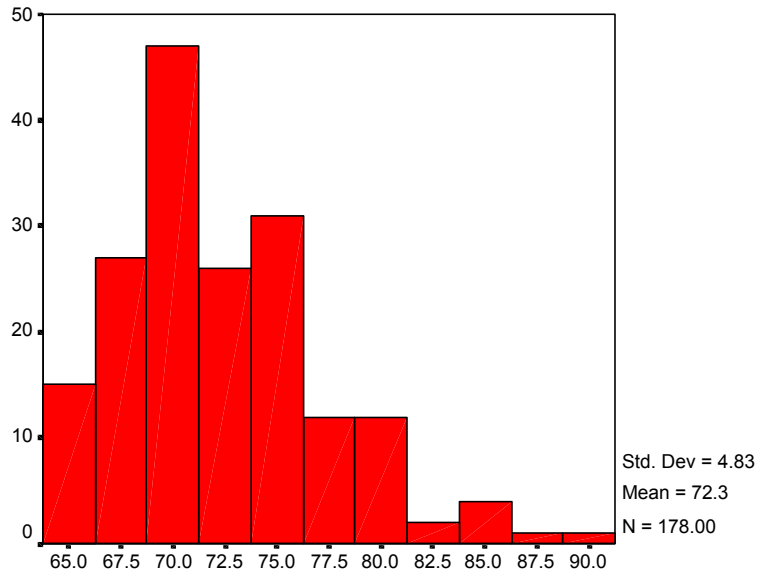
LOWPHOS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	142	79.8	79.8	79.8
	Yes	36	20.2	20.2	100.0
	Total	178	100.0	100.0	

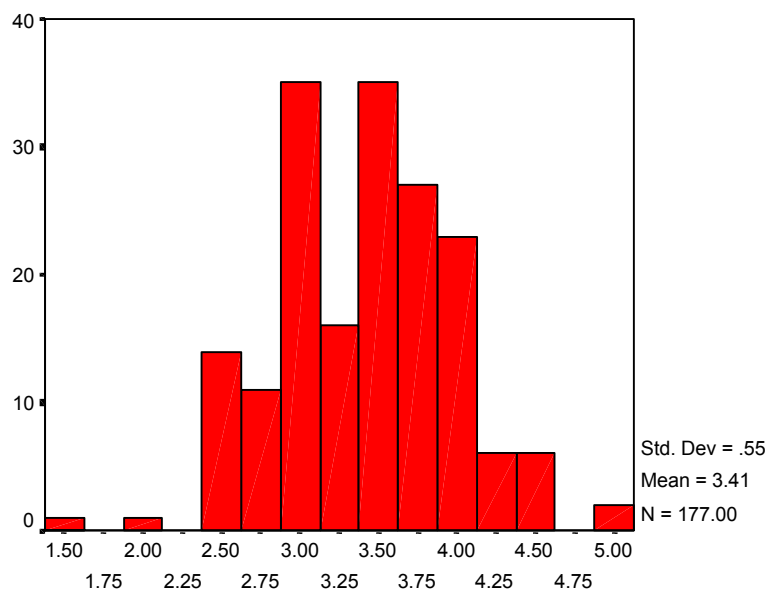
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	178	65	89	72.30	4.83
Calcium	178	7.6	11.0	9.411	.543
Inorganic Phosphorus	177	1.6	5.0	3.415	.549
Alkaline Phos.	178	42	219	92.37	30.57
Valid N (listwise)	177				

Medians – age is 71.5, calcium – 9.4, phosphorus – 3.5, alk phos – 85



Age



Inorganic Phosphorus

Sex * LOWPH Crosstabulation

Count

		LOWPH		Total
		No	Yes	
Sex	Male	66	25	91
	Female	76	11	87
Total		142	36	178

OVER80 * LOWPHOS Crosstabulation

			LOWPHOS		Total
			No	Yes	
OVER80	No	Count	136	28	164
		% within OVER80	82.9%	17.1%	100.0%
	Yes	Count	6	8	14
		% within OVER80	42.9%	57.1%	100.0%
Total		Count	142	36	178
		% within OVER80	79.8%	20.2%	100.0%