

## 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 **ranges3.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:

<b>age</b>	Age in years
<b>sex</b>	1=male, 2=female
<b>alkphos</b>	Alkaline Phosphatase in IU/L (International Units Per Liter)
<b>ca</b>	Calcium (mg/dL)
<b>iphos</b>	Inorganic Phosphorus mg/dL
<b>agegroup</b>	1=65-69, 2=70-74, 3=75-79, 4=80-84, 5=85 or over
<b>lowca</b>	0=no, 1=yes, for calcium lower than 9 mg/dL
<b>lowphos</b>	0=no, 1=yes, for phosphorus level lower than 3.0
<b>highalp</b>	0=no, 1=yes, for alkaline phosphatase higher than 115
<b>over80</b>	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 **highalp** (raw numbers and percents). Also perform a summary analysis of **age** and **alkphos** (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. **highalp**. Let A be the event of being a man, B be the event of being a woman, C the event of not having high alkaline phosphatase (**highalp=0**) and D be the event of having high alkaline phosphatase (**highalp=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 high phosphatase levels? How did you decide? Was this surprising?

Treating being female as a risk factor and having high alkaline phosphatase as the disease, calculate the relative risk for high alkaline phosphatase comparing women to men. Interpret its meaning.

Calculate the probability of high alkaline phosphatase given the subject was 80 or over. Calculate the probability of high alkaline phosphatase given the subject was 65-79. Which is higher?

If alkaline phosphatase levels are normally distributed and 30-115 represents a range of plus or minus 2 standard deviations from the mean – what percent should we expect to be above 115? Looking at your answer to the probability of having high alkaline phosphatase [ $P(D)$ ], do you feel that perhaps the reference range of 30-115 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	

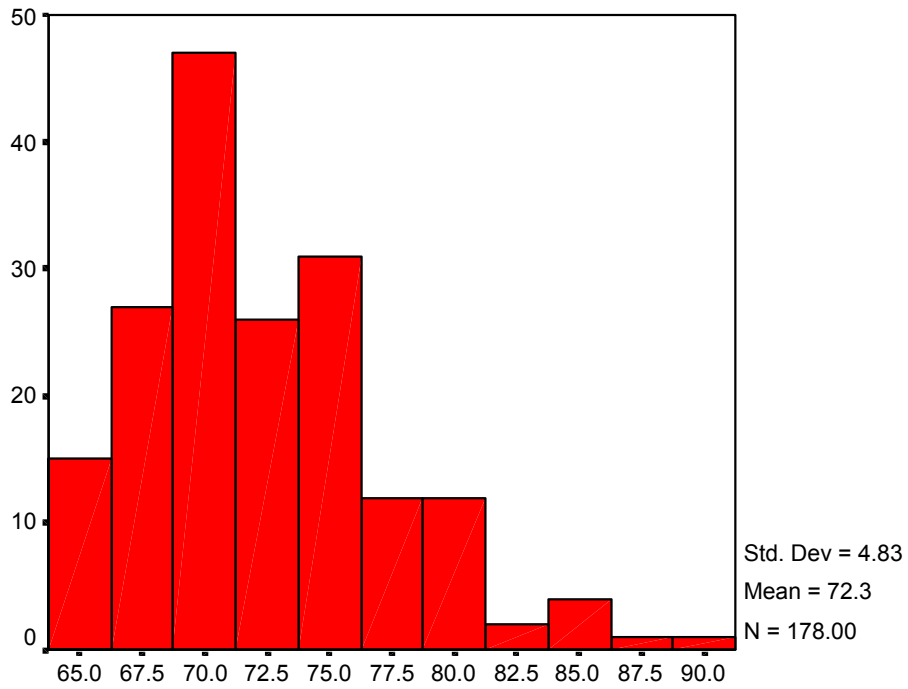
**HIGHALP**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	144	80.9	80.9	80.9
	Yes	34	19.1	19.1	100.0
	Total	178	100.0	100.0	

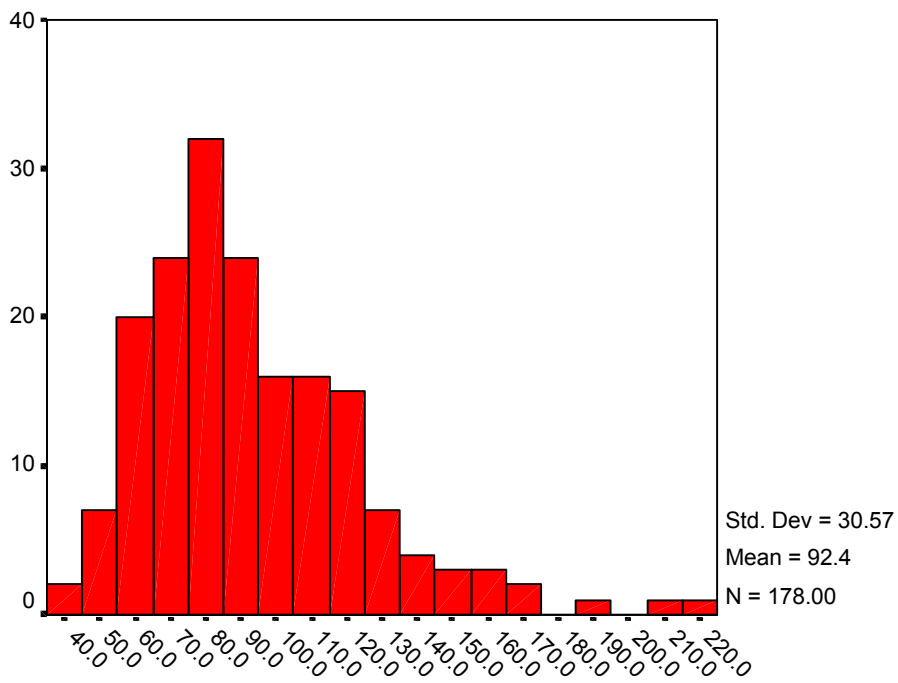
**Descriptive Statistics**

	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



Alkaline Phos.

**Sex \* HIGHALP Crosstabulation**

Count

		HIGHALP		Total
		No	Yes	
Sex	Male	81	10	91
	Female	63	24	87
Total		144	34	178

**OVER80 \* HIGHALP Crosstabulation**

			HIGHALP		Total
			No	Yes	
OVER80	No	Count	131	33	164
		% within OVER80	79.9%	20.1%	100.0%
	Yes	Count	13	1	14
		% within OVER80	92.9%	7.1%	100.0%
Total		Count	144	34	178
		% within OVER80	80.9%	19.1%	100.0%