

Exam II – Take Home

Bone Mass Density Screening

The data for your project comes from a study conducted in Youngstown, OH from 1997-2000. Health Professions professors and students screened anyone interested in obtaining an estimate of their bone mass density at health and county fairs. Subjects placed their ankle in a portable scanning machine to determine if they were at risk for osteoporosis. Over the course of the study, a total of 1792 subjects were screened. Your data set contains only a portion (250 observations) of the total data set. The file **osteo4.xls** 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:

| | |
|------------------|---|
| subjectno | An identifying number to keep track of subjects |
| sex | 1=Female, 2=Male |
| age | Age in years |
| weight | Pounds |
| height | Inches |
| bmd | Bone Mass Density |
| tscore | Calculation of Risk for Osteoporosis |
| fracture | 0=No, 1=Yes |
| osteo | 0=No, 1=Yes at risk for Osteoporosis |
| calcium | 0=No, 1=Yes |
| treat | 0=No, 1=Yes |
| count | Column of 1's |

The variable **bmd** indicates whether a subject is at risk for osteoporosis. The lower the **bmd**, the greater the chance of having osteoporosis. The variable **osteo** indicates whether a subject was identified as being at risk for osteoporosis. A subject with osteoporosis is at high risk for fractures, especially fractures of the wrist, hip, and spine. A fall that leads to a fracture can be devastating for an elderly subject. The variable above **treat** indicates whether a subject is currently taking a medication such as estrogen, Fosxamax, Miacalcin, or Didronel which have all shown in clinical trials to increase bone mass density, or at least slow its deterioration. After screening, letters were sent to a subject's primary care physician if their T-score indicated they might have osteoporosis.

Begin your report by providing a summary for the discrete variables of **sex**, **fracture**, **osteo**, and **treat**, (raw numbers and percents). Treat the variables of **age**, and **bmd**, as continuous variables and create a summary of these variables (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 **osteo** vs. **fracture**. Let A be the event of having osteoporosis, B be the event of reporting having a fracture occur. Determine the following (Be careful of missing values):

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

Consider having osteoporosis (**osteo=1**) as the risk factor and having a fracture occur (**fracture=1**) as the disease, calculate the relative risk and interpret its meaning.

Many physicians and people themselves believe that osteoporosis only affects women. Investigate that claim with the following.

Create a 2x2 contingency table of **gender** vs. **osteo**. Let A be the event of having being a woman, B be the event of having osteoporosis. Determine the following (Be careful of missing values):

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

Consider being a woman as the risk factor and having osteoporosis as the disease, calculate the relative risk and interpret its meaning. What does this result indicate?

Write a summary paragraph that describes what results were surprising or interesting to you. Remember that is not a random sample of data since people voluntarily attend a health fair and then voluntarily put their ankle in the machine. You might want to comment on the value of the data despite not being random. This paragraph should be at least 6 sentences in length.

Answers for Test

| Sum of COUNT | |
|--------------------|------------|
| SEX | Total |
| 1 | 193 |
| 2 | 56 |
| (blank) | 1 |
| Grand Total | 250 |

| Sum of COUNT | |
|--------------------|------------|
| FRACTURE | Total |
| 0 | 189 |
| 1 | 61 |
| Grand Total | 250 |

| Sum of COUNT | |
|--------------------|------------|
| OSTEO | Total |
| 0 | 138 |
| 1 | 112 |
| Grand Total | 250 |

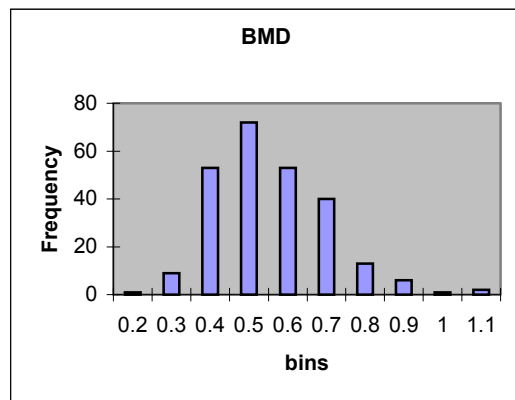
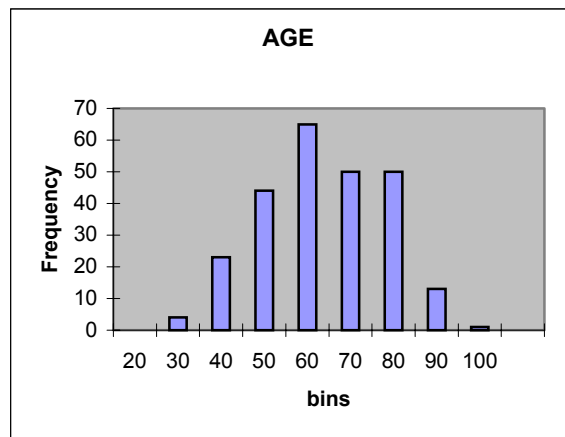
| Sum of COUNT | |
|--------------------|------------|
| TREAT | Total |
| 0 | 193 |
| 1 | 57 |
| Grand Total | 250 |

AGE

| | |
|--------------------|----------|
| Mean | 58.82 |
| Standard Error | 0.876987 |
| Median | 58 |
| Mode | 53 |
| Standard Deviation | 13.86639 |
| Sample Variance | 192.2767 |
| Kurtosis | -0.76668 |
| Skewness | -0.07273 |
| Range | 66 |
| Minimum | 25 |
| Maximum | 91 |
| Sum | 14705 |
| Count | 250 |

BMD

| | |
|--------------------|----------|
| Mean | 0.506308 |
| Standard Error | 0.009238 |
| Median | 0.49 |
| Mode | 0.5 |
| Standard Deviation | 0.146066 |
| Sample Variance | 0.021335 |
| Kurtosis | 0.998471 |
| Skewness | 0.761406 |
| Range | 0.884 |
| Minimum | 0.194 |
| Maximum | 1.078 |
| Sum | 126.5771 |
| Count | 250 |



| | | | | |
|-------------|---|-----|----|-------------|
| OSTEO | | 0 | 1 | Grand Total |
| | 0 | 111 | 27 | 138 |
| | 1 | 78 | 34 | 112 |
| Grand Total | | 189 | 61 | 250 |

| | | | | |
|--------------|-------|-----|-----|-------------|
| Sum of COUNT | OSTEO | | | |
| SEX | | 0 | 1 | Grand Total |
| | 1 | 104 | 89 | 193 |
| | 2 | 34 | 22 | 56 |
| (blank) | | | 1 | 1 |
| Grand Total | | 138 | 112 | 250 |