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BIOS 6623-Project Two

**Introduction**

The primary aim of this research project is to calculate the expected death rate (as well as a measure of variation in this estimate) of heart surgery patients at 44 different VA hospitals. The VA does a review of hospitals every six months in order to identify hospitals that have an unexpectedly high or low death rate for these patients. It is important to compare each hospital’s actual death rate to their expected death rate, which can account for the overall health of the population of patients.

Secondary aims of this project are to investigate the relationship between albumin and death rate, to see if it is a measurement that should be used in prediction of death rates.

The data used for analysis contains 26520 individuals who had either valve or CABG heart surgery from 44 different veterans’ hospitals. Data from the current six month time period (period 39) was available, as well as data from the past five six month periods. Comorbidities (BMI, ASA score, albumin levels) were recorded for each patient, along with their 30 day mortality.

**Methods**

RStudio version 3.4.2 was used for all statistical analysis

The initial dataset contained 26520 individuals. Two people in that cohort did not have the valve or CABG heart surgery, so they were removed from the study. For modeling purposes, only those individuals with complete cases could be used, which was a cohort of 21346. The expected death rate for period 39 was made on the 3478 individuals from period 39 who had complete cases. Hospital 30 did not have any complete cases for period 39, which made it impossible to find an expected death rate.

Weight was measured in kilograms instead of pounds by hospital 1 through 16 during the 39-month period. These values were converted to pounds and BMI was recalculated for all individuals using the corrected weight values and height. Due to small sample sizes, ASA scores of 1,2, or 3 were collapsed into one group, while ASA scores of 4 and 5 were collapsed into another group.

It is important to note that albumin is missing due to ASA score. Those who were not missing albumin only had an ASA score of 4 or 5. Those who were missing albumin only had ASA scores of 1,2,3, or 4. Due to the large percentage of the study missing albumin (~62% of the population), it was not included in the primary analysis model.

Categorical data was presented using percents and group sizes. Numerical variables were presented using means and standard deviations.

Logistic regression was performed with 30 day mortality as the outcome, and BMI, ASA, and procedure type used as covariates. From this model, estimates of the expected death rate for each individual in period 39 were calculated. These estimates were then averaged across hospitals in order to get an expected death rate for each hospital.

Bootstrapping was performed (sample = 10000) in order to get an estimate of the variation associated with each death rate.

Results

Conclusions

Tables and Graphs

|  |  |  |  |
| --- | --- | --- | --- |
| **Table One: Comorbidities** | | | |
| **Variable** | **All Periods** | **Current Period** | **Past Periods** |
| **N** | 26518 | 4424 | 22094 |
| **Procedure**\* |  |  |  |
| Valve Surgery | 18.42 (4884) | 17.90 (792) | 18.52 (4092) |
| CABG Surgery | 75.90 (20126) | 76.40 (3380) | 75.79 (16746) |
| Missing | 5.69 (1508) | 5.70 (252) | 5.68 (1256) |
| **ASA**\* |  |  |  |
| 0 (1,2,3) | 22.44 (5950) | 22.81 (1009) | 22.36 (4941) |
| 1 (4 or 5) | 69.42 (18408) | 69.60 (3079) | 69.38 (15329) |
| Missing | 8.15 (2160) | 7.59 (336) | 8.26 (1824) |
| **Weight**+ | 174.84 ± 26.91 (Missing = 1855) | 174.86 ± 27.37 (Missing = 418) | 174.84 ± 26.83 (Missing = 1437) |
| **Height**+ | 65.49 ± 2.56 (Missing = 1855) | 65.52 ± 2.61 (Missing = 418) | 65.48 ± 2.54 (Missing = 1437) |
| **BMI**+ | 28.61 ± 3.8 (Missing = 1855) | 28.58 ± 3.83 (Missing = 418) | 28.62 ± 3.79 (Missing = 1437) |
| **Albumin**+ | 3.89 ± 0.5 (Missing = 16496) | 3.89 ± 0.50 (Missing = 2695) | 3.9 ± 0.49 (Missing = 13801) |
| **30 day mortality**\* | 3.27 (868) | 3.28 (145) | 3.27 (723) |

\*Variables are described using % (n)

+Variables are described using mean ± sd

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table Two: Death Rates by Hospital | | | | | | | |
| Hospital | **Number**  **Died** | **Number**  **Seen** | **Actual**  **Death Rate** | **Expected**  **Death Rate** | **95% CI of**  **Exp. Death Rate** | **Act./Exp.**  **Death Rate** | **High or Low**  **Ratio?** |
| 1 | 1 | 87 | 1.15 | 3.22 | (2.98, 3.47) | 0.36 | ≤ 0.80 |
| 2 | 1 | 106 | 0.94 | 3.43 | (3.17, 3.7) | 0.27 | ≤ 0.80 |
| 3 | 4 | 100 | 4.00 | 3.34 | (3.1, 3.60) | 1.20 | ≥ 1.20 |
| 4 | 4 | 94 | 4.26 | 3.17 | (2.94, 3.41) | 1.34 | ≥ 1.20 |
| 5 | 1 | 115 | 0.87 | 3.35 | (3.11, 3.61) | 0.26 | ≤ 0.80 |
| 6 | 2 | 104 | 1.92 | 3.07 | (2.85, 3.30) | 0.63 | ≤ 0.80 |
| 7 | 7 | 105 | 6.67 | 3.12 | (2.89, 3.35) | 2.14 | ≥ 1.20 |
| 8 | 4 | 120 | 3.33 | 3.34 | (3.09, 3.59) | 1.00 | 0.8-1.2 |
| 9 | 0 | 105 | 0 | 3.17 | (2.94, 3.41) | 0 | ≤ 0.80 |
| 10 | 2 | 100 | 2.00 | 3.15 | (2.92, 3.39) | 0.63 | ≤ 0.80 |
| 11 | 1 | 90 | 1.11 | 3.04 | (2.81, 3.28) | 0.37 | ≤ 0.80 |
| 12 | 4 | 98 | 4.08 | 3.28 | (3.04, 3.53) | 1.24 | ≥ 1.20 |
| 13 | 4 | 84 | 4.76 | 3.28 | (3.04, 3.54) | 1.45 | ≥ 1.20 |
| 14 | 1 | 103 | 0.97 | 3.00 | (2.77, 3.23) | 0.32 | ≤ 0.80 |
| 15 | 3 | 105 | 2.86 | 3.17 | (2.94, 3.41) | 0.90 | 0.8-1.2 |
| 16 | 1 | 111 | 0.90 | 3.13 | (2.90, 3.38) | 0.29 | ≤ 0.80 |
| 17 | 13 | 93 | 13.98 | 3.48 | (3.22, 3.75) | 4.02 | ≥ 1.20 |
| 18 | 2 | 95 | 2.11 | 3.18 | (2.94, 3.42) | 0.66 | ≤ 0.80 |
| 19 | 0 | 113 | 0 | 3.13 | (2.89, 3.37) | 0 | ≤ 0.80 |
| 20 | 2 | 98 | 2.04 | 2.84 | (2.62, 3.06) | 0.72 | ≤ 0.80 |
| 21 | 5 | 92 | 5.43 | 3.20 | (2.96, 3.44) | 1.70 | ≥ 1.20 |
| 22 | 2 | 86 | 2.33 | 3.21 | (2.98, 3.45) | 0.73 | ≤ 0.80 |
| 23 | 6 | 97 | 6.19 | 3.05 | (2.83, 3.29) | 2.03 | ≥ 1.20 |
| 24 | 4 | 104 | 3.85 | 3.33 | (3.09, 3.59) | 1.16 | 0.8-1.2 |
| 25 | 3 | 95 | 3.16 | 3.16 | (2.93, 3.40) | 1.00 | 0.8-1.2 |
| 26 | 4 | 99 | 4.04 | 3.18 | (2.95, 3.42) | 1.27 | ≥ 1.20 |
| 27 | 2 | 99 | 2.02 | 3.26 | (3.02, 3.51) | 0.62 | ≤ 0.80 |
| 28 | 5 | 101 | 4.95 | 3.30 | (3.05, 3.55) | 1.50 | ≥ 1.20 |
| 29 | 2 | 105 | 1.90 | 3.16 | (2.92, 3.40) | 0.60 | ≤ 0.80 |
| 30 | 10 | 117 | 8.55 | NA | NA | NA | NA |
| 31 | 7 | 104 | 6.73 | 3.15 | (2.91, 3.39) | 2.14 | ≥ 1.20 |
| 32 | 0 | 93 | 0 | 3.19 | (2.96, 3.43) | 0 | ≤ 0.80 |
| 33 | 0 | 113 | 0 | 3.29 | (3.05, 3.54) | 0 | ≤ 0.80 |
| 34 | 14 | 99 | 14.14 | 3.17 | (2.93, 3.41) | 4.46 | ≥ 1.20 |
| 35 | 5 | 84 | 5.95 | 3.14 | (2.91, 3.38) | 1.89 | ≥ 1.20 |
| 36 | 1 | 99 | 1.01 | 2.98 | (2.74, 3.22) | 0.34 | ≤ 0.80 |
| 37 | 4 | 107 | 3.74 | 3.05 | (2.83, 3.29) | 1.23 | ≥ 1.20 |
| 38 | 1 | 113 | 0.88 | 3.02 | (2.79, 3.25) | 0.29 | ≤ 0.80 |
| 39 | 4 | 101 | 3.96 | 3.13 | (2.90, 3.37) | 1.27 | ≥ 1.20 |
| 40 | 2 | 86 | 2.33 | 3.12 | (2.89, 3.36) | 0.75 | ≤ 0.80 |
| 41 | 5 | 116 | 4.31 | 3.18 | (2.95, 3.43) | 1.36 | ≥ 1.20 |
| 42 | 0 | 107 | 0 | 2.97 | (2.74, 3.20) | 0 | ≤ 0.80 |
| 43 | 2 | 83 | 2.41 | 3.22 | (2.98, 3.46) | 0.75 | ≤ 0.80 |
| 44 | 0 | 98 | 0 | 3.20 | (2.97, 3.44) | 0 | ≤ 0.80 |

GetHub Link

Full Code to generate the above analysis can be found at:

https://github.com/BIOS6623-UCD/bios6623-elcotton

Check old report

Do powerpoint

Albumin

Which expected value to use

When calculating actual death rate-use whole population