1884

BIOST 518

HW01

12 January 2015

1. Among censored individuals, the minimum observation time was 1,480 days or >4 years. Consequently, there was no censoring prior to 4 years so it is valid to dichotomize the data at that point.

2. Method: The data was stratified based on outcome of interest, death within 4 years of study enrollment. The mean, standard deviation, minimum, and maximum were calculated for continuous variables and the proportion for the binary variables.

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| **Variable** | **Death within 4 years****N=495** | **Death after 4 years****N=4,505** |
|  | **Mean (SD)** | **(Min, Max)** | **Mean (SD)** | **(Min, Max)** |
| Age (years) | 76.29 (6.71) | (65, 100) | 72.45 (5.33) | (65, 98) |
| CRP level (mg/mL) | 5.40 (8.08) | (0, 55) | 3.47 (5.85) | (0, 108) |
| BMI | 26.31 (4.97) | (14.8, 48.1) | 26.71 (4.71) | (14.7, 58.8) |
| Cholesterol (mg/dL) | 204.07 (41.37) | (73, 396) | 212.52 (38.97) | (78, 430) |
|  | **%** |  | **%** |  |
| Smoker | 14.34 |  | 11.85 |  |
| Male | 60.40 |  | 39.89 |  |
| Prior CVD  | 41.41 |  | 20.95 |  |
|  |  |  |  |  |

Inference: The descriptive statistics suggest that there may be a true difference in the distribution of C reactive protein (CRP) levels among those who died within 4 years of study enrollment and those who did not with higher levels found among those who died within 4 years. Individuals who died within 4 years of study enrollment were more likely to have prior cardiovascular disease (CVD), be male, and tended to be older and smoke.

3. Methods: The CRP values were stratified based on vital status at four years and the mean CRP values were compared. Difference in the means was tested using a t-test in which equal variance was not assumed. Equal variance was also not assumed for the calculation of the 95% confidence interval.

Inference: The mean CRP level for individuals who survived more than 4 years after study enrollment was 3.42 mg/L compared to a mean of 5.37 mg/L among those who did not survive past 4 years following study enrollment. The point estimate for the difference in mean CRP value between those who died by year 4 of enrollment and those who survived past was 1.95. Given a two-sided p-value <.001 we reject the null-hypothesis that there is no difference in the mean CRP value between those who were and were not alive 4 years after study enrollment. We are 95% confident that the true difference in means is between 1.21 and 2.68 mg/L. We conclude that a lower CRP level is associate with survival past 4 years.

4. Methods: The CRP values were stratified based on vital status at four years and the geometric mean CRP values were compared. The CRP values were log transformed and the difference of the means was tested using a t-test in which equal variance was not assumed. Equal variance was also not assumed for the calculation of the 95% confidence interval. CRP levels that were reported as zero were assumed to be below the threshold of detection and were replaced with .5 mg/L or one-half the non-zero minimum reported, 1 mg/L. The geometric means of the log transformed data were back transformed for reporting

Inference: The geometric mean CRP level for individuals who survived more than 4 years after study enrollment was 2.53 mg/L compared to a mean of 2.97 mg/L among those who died within 4 years following study enrollment. The point estimate for the difference in mean CRP value between those who died by year 4 of enrollment and those who survived past was 1.46. Given a two-sided p-value <.001 we reject the null-hypothesis that there is no difference in the geometric mean CRP value between those who were and were not alive 4 years after study enrollment. We are 95% confident that the true difference in means is between 1.33 and 1.61 mg/L. We conclude that a lower CRP level is associate with survival past 4 years.

5. Methods: Individuals were stratified based on vital status at four years and the proportion of individual with high (>3mg/L) CRP compared. Pearson’s chi squared test was used to assess difference in probability of death within 4 years of study enrollment. 95% confidence intervals were calculate via Wald methods.

Inference: Among those who died within 4 years of study enrollment, the proportion of individuals with a high CRP was 15.6% compared to 8.00% among those who survived beyond 4 years. The point estimate for the difference in proportion of individuals with a high CRP value between those who died by year 4 of enrollment and those who survived past was 7.61%. Given a two-sided p-value <.001 we reject the null-hypothesis that there is no difference in the mean CRP value between those who were and were not alive 4 years after study enrollment. We are 95% confident that the true difference in proportions is between 5.41% and 9.81%. We conclude that a high CRP level is associate with death within 4 years of study enrollment.

6. Methods: Individuals were stratified based on vital status at four years and the odds of individual with high (>3mg/L) CRP compared. Fisher’s exact was used to assess the odds ratio and 95% confidence interval.

Inference: Among those who died within 4 years of study enrollment, the odds of having a high CRP was .185 compared to .0871 among those who survived beyond 4 years. The point estimate for the odds ratio was 2.12. Given a two-sided p-value <.001 we reject the null-hypothesis that there is no difference in the odds of having a high CRP value between those who were and were not alive 4 years after study enrollment. We are 95% confident that the true difference in proportions is between 1.74 and 2.59. We conclude that those who died within 4 years of study enrollment were more likely to have a high CRP value

7. Methods: Kaplan-Meier survival curves were generated for low and high (>3mg/L) CRP levels. Cox proportional hazards were used to calculate the hazard ratio and a 95% confidence interval. The logrank test was used to test average survival times between individuals with low and high CRP levels.

 Inference: Cox proportional hazards gives a hazard ratio of 1.66 and we are 95% confident that the true value of the hazards ratio is between 1.47 and 1.89/ The log rank test gave a two-sided p-value <.001, so we reject the null hypothesis that there is no difference in average survival between those with high vs. low CRP levels. We conclude that having a low CRP level is associated with longer survival.



8. I would prefer to do a comparison of geometric means of CRP levels between those who died within 4 years and those who did not (aka problem 4). Not dichotomizing CRP levels is more efficient and gives more precise results. Looking at log transformed data is often best for biochemical variables, as protein levels are usually exponential. T-tests of means are generally well understood and interpreted by people, unlike odds ratios.