Comparison Between Two Coronary Artery Surgical Treatments

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## **Abstract**

Two surgical treatment A and B are popular therapies for patients with coronary artery disease. 300 patients were divided into 4 groups based on the initial disease status, with similar demographic characteristics in each group, and assigned a treatment randomly. The length of hospital stay over 5 years was used to evaluate the efficacy of those two treatments. By studying the efficacy of treatment, it is not significantly associated with the length of hospital stay, while the probability of patients with more than 1 week but within 1 month stay corresponding to patients with no hospital stay in treatment A is larger than in treatment B. However, cumulative model shows treatment B performs better. By studying the efficacy of treatment and status, patients with mild disease status or severe disease status have better performance of the hospitalization days in treatment B, after adjusting for the baseline characteristics.

Keyword: coronary artery disease treatment, efficacy, cumulative logistic model

## **Introduction**

Coronary artery disease and its main complication, congestive heart failure, stroke or myocardial infarction, are leading causes of death and disability worldwide. Surgeries are common methods to treat coronary artery disease, while treatment A and B are two popular surgical therapies. But the efficacy of treatments may be influenced by various factors. In general, patients with severe disease status would have longer length of hospital stay, because of complications after the treatment. Besides, demographic characteristics, such as age, the history of diabetes and history of smoking, would have impacts on the performance of treatments.

In this study, 300 patients are recruited and divide into 4 groups based on their initial disease status, including mild, moderate, severe and very severe. In order to compare the efficacy of two treatments, treatment A and B are assigned to patients in each group randomly. The length of hospital stay over 5 years after the treatment is recorded as outcome, the efficacy of two treatments. And it is clinical meaningful to examine hospital stay in terms of no hospital stay (0 day), within 1 week stay (1-7 days), more than 1 week but within 1 month stay (8-30 days) and more than 1 month stay (31 or more days). Demographic characteristics are also recorded as the factors that may influence the treatments’ performance, including status, age, history of diabetes, history of hypertension, gender, race, history of congestive heart failure, history of myocardial infarction, history of smoking and ejection fraction.

This study reports the comparison between the efficacy of surgical treatment A and B for the patients with coronary artery disease, by using the length of hospital stay over 5 years. And the differences of hospital stay between two treatments across patients with different initial disease status, after adjusting for the baseline characteristics, are also considered to describe the impact of the relationship between treatments and disease status on the hospitalization of days.

## **Methodology**

1. Baseline characteristics of patients in two treatment groups are compared to determine whether the characteristics in treatment groups are in balance (Table I). Because two treatments are randomly assigned to the patients, the proportion of each category should be similar in treatment A and B.

2. Patients are divided by 4 groups based on hospital stay. Treatment, status, baseline characteristics of patients in each group are compared to determine whether these variables are associated with the efficacy of treatment, the length of hospital stay (Table II). The chi-square or fisher’s exact test is used to identify the significant differences of categorical variables, and t test or kruskal-wallis test is used to determine the relationship of continuous variables. Categorical variables are presented as N (%), while continuous variables are presented as mean (sd). All tests are two-sided and are considered as significant when the p-value is less than 0.05 significance level. All missing values are assumed to be missing at random.

3. To determine the differences of the hospitalization days over 5 years in two treatment groups, generalized logistic model is used, where the length of hospital stay is the outcome and treatment is the factors. The relative probabilities and 95% confidence interval of hospitalization days are provided with the p-value of treatment (Table III), in order to compare the efficacy of treatment A and B. The test is two-sided, while the significance level is 0.05.

4. Because the outcome, the length of hospital stay, is an ordinal categorical variable, cumulative logistic model is used to determine the relationship between hospitalization days and treatments. Score test for proportional odds assumption is used to identify whether the model is a proportional logistic model. Odds ratio is provided with 95% confidence interval to check the different efficacy of two treatments (Table IV). The test is two-sided with 0.05 significance level, and goodness of fit of the model should be tested.

5. To determine whether the differences of hospital stay between two treatments are the same across patients with different initial disease status, three-way contingency table is created with treatment, disease status and the length of hospital stay (Table V). The chi-square or fisher’s exact test is used to identify the significant differences of treatment in each status group. The tests are two-sided with 0.05 significance level.

6. Because demographic characteristics, such as age, history of hypertension, and history of diabetes, would cause symptoms that require hospitalization during the follow-up period or influence the efficacy of the treatments, the cumulative logistic model is used with demographic characteristics as covariates, where the length of hospital stay is the outcome, treatment, status, the interaction term of treatment and status are the factors. Cumulative logistic model is more appropriate for the ordinal variable and helpful to avoid 0 cells in the contingency table. The odds ratios with 95% confidence interval of two treatments in different initial disease status in both univariate model and multivariate model are provided to determine the differences of hospital stay between two treatments across patients with different disease status (Table VI), and goodness of fit of the model should be tested.

All analyses are done by using SAS 9.4.

## **Results**

The baseline characteristics of patients in two treatments are listed in Table I. When comparing the difference features of patients in treatment A and B, it can be seen that more similarities than difference of the baseline characteristics in two treatments. For example, the proportion of patients with diabetes in treatment A (22.5%) is almost the same as the proportion in treatment B (23.5%); the average age in treatment A (61.8) is nearly equal to the average age in treatment B (61.4). Therefore, the patients in different treatments are in balance of all baseline characteristics.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table I**  Baseline Characteristics of Patients in Two Treatment Groups | | | |
|  | A (N=151) | B (N=149) | p value |
| **AGE** | 61.8 (10.3) | 61.4 (9.8) | **0.7512** |
| **EJECFRAC+** | 60.2 (11.6) | 62.2 (12.0) | **0.1564** |
| **STATUS** |  |  | **0.9476** |
| mild | 55 (36.4%) | 54 (36.2%) |  |
| moderate | 62 (41.1%) | 61 (40.9%) |  |
| severe | 6 (4.0%) | 8 (5.4%) |  |
| very severe | 28 (18.5%) | 26 (17.4%) |  |
| **DIAB yes** |  |  | **0.8412** |
| no | 117 (77.5%) | 114 (76.5%) |  |
| yes | 34 (22.5%) | 35 (23.5%) |  |
| **HYPER** |  |  | **0.4889** |
| no | 72 (47.7%) | 77 (51.7%) |  |
| yes | 79 (52.3%) | 72 (48.3%) |  |
| **SEX** |  |  | **0.7415** |
| Female | 40 (26.5%) | 42 (28.2%) |  |
| Male | 111 (73.5%) | 107 (71.8%) |  |
| **RACE** |  |  | **0.5515** |
| White | 139 (92.1%) | 140 (94.0%) |  |
| Asian | 1 (0.7%) | 0 (0.0%) |  |
| Black | 11 (7.3%) | 9 (6.0%) |  |
| **CHF** |  |  | **0.7198** |
| no | 147 (97.4%) | 144 (96.6%) |  |
| yes | 4 (2.6%) | 5 (3.4%) |  |
| **MI** |  |  | **0.7945** |
| no | 90 (59.6%) | 91 (61.1%) |  |
| yes | 61 (40.4%) | 58 (38.9%) |  |
| **HXSMK** |  |  | **0.8827** |
| no | 58 (38.4%) | 56 (37.6%) |  |
| yes | 93 (61.6%) | 93 (62.4%) |  |
| +Few missing values are presented and mean (sd) are calculated based on available data | | | |

Treatment, status, and baseline characteristics of patients in each hospital stay group are listed in Table II. By comparing the p-values of variables and the 0.05 significance level, age is related to the hospital stay that older patients are more likely to have symptoms which require hospitalization during the follow-up period after the treatment. Besides, the history of hypertension is associated with the hospital stay. Patients with hypertension have higher probabilities to stay longer in hospital, which indicates that history of hypertension may influence the efficacy of treatments. However, treatment is not significantly associated with the length of hospital stay at 0.05 significance level, which indicates that hospital stay over 5-year period can be seen the same between patients received treatment A and B.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table II** Characteristics of Patients in Four Hospital Stay Groups | | | | | |
|  | more than 1 month stay (N=39) | more than 1 week but within 1 month stay (N=117) | within 1 week stay (N=95) | no hospital stay (N=49) | p value |
| **AGE** | 63.7 (11.6) | 62.8 (10.4) | 59.8 (8.9) | 60.6 (9.5) | **0.0286** |
| **EJECFRAC+** | 63.1 (11.2) | 61.3 (11.6) | 60.9 (12.6) | 60.2 (11.4) | **0.8574** |
| **TREAT** |  |  |  |  | **0.0692** |
| A | 20 (51.3%) | 67 (57.3%) | 47 (49.5%) | 17 (34.7%) |  |
| B | 19 (48.7%) | 50 (42.7%) | 48 (50.5%) | 32 (65.3%) |  |
| **STATUS** |  |  |  |  | **0.6323** |
| mild | 14 (35.9%) | 41 (35.0%) | 41 (43.2%) | 13 (26.5%) |  |
| moderate | 16 (41.0%) | 46 (39.3%) | 36 (37.9%) | 25 (51.0%) |  |
| severe | 3 (7.7%) | 7 (6.0%) | 2 (2.1%) | 2 (4.1%) |  |
| very severe | 6 (15.4%) | 23 (19.7%) | 16 (16.8%) | 9 (18.4%) |  |
| **DIAB** |  |  |  |  | **0.0775** |
| no | 26 (66.7%) | 86 (73.5%) | 81 (85.3%) | 38 (77.6%) |  |
| yes | 13 (33.3%) | 31 (26.5%) | 14 (14.7%) | 11 (22.4%) |  |
| **HYPER** |  |  |  |  | **0.003** |
| no | 10 (25.6%) | 55 (47.0%) | 54 (56.8%) | 30 (61.2%) |  |
| yes | 29 (74.4%) | 62 (53.0%) | 41 (43.2%) | 19 (38.8%) |  |
| **SEX** |  |  |  |  | **0.2581** |
| Female | 14 (35.9%) | 36 (30.8%) | 21 (22.1%) | 11 (22.4%) |  |
| Male | 25 (64.1%) | 81 (69.2%) | 74 (77.9%) | 38 (77.6%) |  |
| **RACE** |  |  |  |  | **0.3669** |
| White | 34 (87.2%) | 109 (93.2%) | 91 (95.8%) | 45 (91.8%) |  |
| Asian | 0 (0.0%) | 0 (0.0%) | 1 (1.1%) | 0 (0.0%) |  |
| Black | 5 (12.8%) | 8 (6.8%) | 3 (3.2%) | 4 (8.2%) |  |
| **CHF** |  |  |  |  | **0.3647** |
| no | 39 (100.0%) | 113 (96.6%) | 93 (97.9%) | 46 (93.9%) |  |
| yes | 0 (0.0%) | 4 (3.4%) | 2 (2.1%) | 3 (6.1%) |  |
| **MI** |  |  |  |  | **0.457** |
| no | 27 (69.2%) | 65 (55.6%) | 58 (61.1%) | 31 (63.3%) |  |
| yes | 12 (30.8%) | 52 (44.4%) | 37 (38.9%) | 18 (36.7%) |  |
| **HXSMK** |  |  |  |  | **0.5384** |
| no | 17 (43.6%) | 48 (41.0%) | 31 (32.6%) | 18 (36.7%) |  |
| yes | 22 (56.4%) | 69 (59.0%) | 64 (67.4%) | 31 (63.3%) |  |
| +Few missing values are presented and mean (sd) are calculated based on available data | | | | | |

Although chi-square shows there is no relationship between treatment and hospital stay, generalized logistic model can be used to identify the differences of relative probability of various hospital stay in two treatment groups, which are listed in Table III. It can be seen that the relative probability of more than 1 week but within 1 month stay and no hospital stay in treatment A is 2.522 (1.261, 5.044) times larger than the relative probability in treatment B, which indicates that more patients in treatment A are required to stay in hospital longer, corresponding to no hospital stay, than patients in treatment B. But the other two relative probabilities are not significantly different between treatment A and B. The overall test of generalized logistic model shows that treatment is not significantly associated with hospital stay with p-value 0.075 at 0.05 significance level.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table III** Relative Probability of Hospital Stay vs. No Hospital Stay | | | | |
| **Treatment** | Relative Probability of within 1 week stay vs. no hospital stay (95% CI) | Relative Probability of more than 1 week but within 1 month stay vs. no hospital stay (95% CI) | Relative Probability of more than 1 month stay vs. no hospital stay (95% CI) | P-value |
| A | 1.843 (0.904, 3.759) | 2.522 (1.261, 5.044) | 1.981 (0.838, 4.684) | 0.075 |
| B | reference | reference | reference |  |

Because hospital stay is an ordinal variable, cumulative logistic model is also appropriate to determine the difference of two treatments. Score test for proportional odds assumption with p-value 0.2415 indicates that the it is a proportional odds model. From the goodness of fit test, the proportional odds model is appropriate for this data set, though the p-value is not so high. The relative probability with 95% confidence interval are listed in Table IV. The relative probability of more than 1 week stay to less than 1 week stay of patients who received treatment A is 1.554 (1.026, 2.355) times more than the relative probability of patients received treatment B, which may indicate that treatment B would perform better than treatment A.

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| --- | --- | --- | --- |
| **Table IV** Proportional Odds Ratio | | | |
|  |  | Proportional Odds Ratio (95% CI) | P-value |
| **Treatment** | |  |  |
|  | A | 1.554 (1.026, 2.355) | 0.0376 |
|  | B | reference |  |
| Goodness of Fit Test Deviance p-value is 0.2432  Goodness of Fit Test Pearson p-value is 0.2425 | | | |

The efficacy of treatments in the length of hospital stay may be influenced by patients’ initial disease status, therefore, a three-way contingency table is created to determine the relationship between the treatments and hospital stay based on difference disease status. The results are listed in Table V. Although there are homogeneous relative probabilities in different disease status, it can be seen that the p-value of fisher exact test for the mild status is significant, which indicates that a significant difference is detected in two treatments of patients with mild disease status.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table V** Three-Way Contingency Table of Status, Treatment and Hospital Stay | | | | | | |
| **Status** | **Treatment** | Days of no hospital stay n/N(%) | Days of within 1 week stay n/N(%) | Days of more than 1 week but within 1 month stay n/N(%) | Days of more than 1 month stay n/N(%) | P-value |
| mild | A | 2/55 (3.64%) | 19/55(34.55%) | 26/55(47.27%) | 8/55 (14.55%) | 0.0187 |
|  | B | 11/54(20.37%) | 22/54(40.74%) | 15/54(27.78%) | 6/54(11.11%) | |
| moderate | A | 12/62(19.35%) | 20/62(32.26%) | 22/62(35.48%) | 8/62(12.9%) | 0.9038 |
|  | B | 13/61(21.31%) | 16/61(26.63%) | 24/61(39.34%) | 8/61(13.11%) | |
| severe | A | 0/6(0%) | 0/6(0%) | 4/6(66.67%) | 2/6(33.33%) | 0.366 |
|  | B | 2/8(25%) | 2/8(25%) | 3/8(37.5%) | 1/8(12.5%) | |
| very severe | A | 3/28(10.71%) | 8/28(28.57%) | 15/28(53.57%) | 2/28(7.14%) | 0.3186 |
|  | B | 6/26(23.08%) | 8/26(30.77%) | 8/26(30.77%) | 4/26(15.38%) | |
| P-values of Cochran-Mantel-Haenszel Statistics are all not significant, indicating homogeneity of Odds ratio | | | | | | |

Since the baseline demographic characteristics may have impacts on the hospital stay, which can be considered as the efficacy of two treatments, cumulative model is used with all baseline characteristics as covariates. In order to determine the influence of treatment and status on the length of hospital stay, interaction term of these two variable is considered as a covariate. Score test for proportional odds assumption with p-value 0.5354 indicates that the it is a proportional odds model. From the goodness of fit test, the proportional odds model is appropriate for this data set, though the p-value of Pearson test is not so high. The odds ratios with 95% confidence interval of different hospital stay with reference “no hospital stay” are listed in Table VI. It indicates that the interaction term of treatment and status is not significantly associated with the hospital stay. That is, the efficacy of treatment on the hospital stay does not depend on patients’ initial disease status. However, by comparing the relative probabilities of treatment based on different disease status, it can be seen that relative probabilities with 95% confidence intervals of mild status and severe status are greater than 1, that illustrates treatment B would perform better than A in patients who are evaluated as mild or severe status. For example, the relative probability of more than 1 week stay to less than 1 week stay of patients who received treatment A with mild status is 2.536 (1.242, 5.177) times more than the relative probability of patients received treatment B in mild status. Therefore, the efficacy of treatment A and B are significantly different in patients with mild status or severe status, while the efficacy of treatment A and B in patients with moderate status or very severe status can be considered as the same.

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| --- | --- | --- | --- | --- | --- |
| **Table VI** Proportional Odds Ratio of Univariate Model and Multivariate Model | | | | | |
|  |  | Univariate Proportional Odds Ratio (95% CI) | P-value | Multivariate Proportional Odds Ratio (95% CI) | P-value |
| **Treatment** | |  |  |  |  |
|  | A | 1.554 (1.026, 2.355) | 0.0376 | 1.584 (1.033, 2.428) | 0.0351 |
|  | B | reference |  | reference |  |
| **Status** | **Treatment** | |  |  |  |
| mild | A vs.B | 2.334(1.167, 4.668) | 0.1244 | 2.536(1.242, 5.177) | 0.0759 |
| moderate | A vs.B | 0.932(0.489, 1.776) | | 0.883(0.452, 1.727) | |
| severe | A vs.B | 6.63(0.916, 48.006) | | 7.804(1.002, 60.774) | |
| very severe | A vs.B | 1.503(0.566, 3.99) | | 1.387(0.512, 3.755) | |
| α significant level is 0.05  Goodness of Fit Test Deviance p-value for Multivariate Model is 0.9998  Goodness of Fit Test Pearson p-value for Multivariate Model is 0.3709 | | | | | |

## **Discussion**

Because of the high morbidity of coronary artery disease with its complications, it is important to determine the efficacy of these two surgical treatment A and B, which is beneficial for patients with coronary artery disease to receive healthy life. While patients’ initial disease status may influence the efficacy of the treatments, it is also necessary to determine the relationship between the treatments and length of hospital stay based on different initial disease status.

The baseline characteristics by treatments describes the similarity of patients’ features between two treatment groups. Patients’ age, history of diabetes, gender and so on are almost the same in treatment A and treatment B, which would increase the reliability when testing the difference of the two treatments.

The factors, such as treatment, initial disease status and baseline demographic characteristics, by the length of hospital stay indicates the relationship between factors and efficacy of treatments, which is measured as the hospital stay. There are many more similarities than difference, only age and history of hypertension show significant differences among hospital stay levels. Older patients are more likely to have symptoms that require longer hospitalization stay. Patients with hypertension are more likely to be in hospital longer over 5-year follow-up period than patients without hypertension. However, the treatment is not significantly associated with the length of hospital days, which indicates that the efficacy of treatment A and B can be seen as the same by two-way contingency table.

In the generalized logistic model to determine the relationship between treatments and hospital stay, no significant difference between treatments is detected, but it is helpful to check the relative probability of various hospital stay levels between treatment A and B, where treatment B may be more efficient with the smaller relative probability of patients having more than 1 week but within 1 month stay corresponding to patients having no hospital stay.

By further considering the length of hospital stay as ordinal variable, it is natural to fit the cumulative logistic model. The constant relative probability describes the efficacy of two treatments in different hospital stay separations can be seen the same, while the relative probability of hospital stay based on treatment A is 1.554 times larger than in treatment B. In other words, patients who receive treatment B have larger chances to be healthier, without severe symptoms.

In order to further analyze the efficacy of treatments, initial disease status is considered as a stratum to determine whether the differences of hospital stay between two treatments are the same across patients with different initial disease status. Although the test shows the conditional relationships of treatment and hospital stay based on disease status are the same, the efficacy of two treatments is different in patients with mild disease status.

Improving the analysis with adjusting for the demographic characteristics and adding the interaction term of treatments and status, by using cumulative logistic model, the overall relationship between treatments and hospital stay does not depend on initial disease status. However, the relative probabilities of hospital stay based on treatments in different status describe that the difference of efficacy in treatment A and B is the largest in patients with severe disease status, while the difference of efficacy in treatment A and B is the second largest in patients with mild disease status. And the hospital stay between two treatments is the same in patients with moderate disease status or very severe disease status.

In conclusion, treatment B may be a better therapy than treatment A, especially in patients with mild initial disease status or severe disease status. But in this study, the number of patients with severe initial disease status is small, which may decrease the reliability of tests’ results based on the subset of patients with severe disease status.

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## **Appendices**

1. Cochran-Mantel-Haenszel Statistics to test the relationship between treatments and the length of hospital stay.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cochran-Mantel-Haenszel Statistics (Based on Table Scores) | | | | |
| Statistic | Alternative Hypothesis | DF | Value | Prob |
| 1 | Nonzero Correlation | 1 | 0.8027 | 0.3703 |
| 2 | Row Mean Scores Differ | 1 | 0.8027 | 0.3703 |
| 3 | General Association | 3 | 7.0615 | 0.0700 |

2. The overall effect of treatment tested in the generalized logistic model with the length of hospital stay and treatments.

|  |  |  |  |
| --- | --- | --- | --- |
| Type 3 Analysis of Effects | | | |
| Effect | DF | Wald Chi-Square | Pr > ChiSq |
| TREAT | 3 | 6.9053 | 0.0750 |

3. The relative probabilities of hospital stay with 95% confidence interval between different treatments in the generalized logistic model with the length of hospital stay and treatments.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Odds Ratio Estimates | | | | |
| Effect | DAYS | Point Estimate | 95% Wald Confidence Limits | |
| TREAT A vs B | more than 1 month stay | 1.981 | 0.838 | 4.684 |
| TREAT A vs B | more than 1 week but within 1 month stay | 2.522 | 1.261 | 5.044 |
| TREAT A vs B | within 1 week stay | 1.843 | 0.904 | 3.759 |

4. Score test for the proportional odds assumption in the cumulative logistic model with the length of hospital stay and treatments.

|  |  |  |
| --- | --- | --- |
| Score Test for the Proportional Odds Assumption | | |
| Chi-Square | DF | Pr > ChiSq |
| 2.8419 | 2 | 0.2415 |

5. Goodness of fit test in the cumulative logistic model with the length of hospital stay and treatments.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deviance and Pearson Goodness-of-Fit Statistics | | | | |
| Criterion | Value | DF | Value/DF | Pr > ChiSq |
| Deviance | 2.8278 | 2 | 1.4139 | 0.2432 |
| Pearson | 2.8333 | 2 | 1.4166 | 0.2425 |

6. The overall effect of treatment tested in the cumulative logistic model with the length of hospital stay and treatments.

|  |  |  |  |
| --- | --- | --- | --- |
| Type 3 Analysis of Effects | | | |
| Effect | DF | Wald Chi-Square | Pr > ChiSq |
| TREAT | 1 | 4.3232 | 0.0376 |

7. The relative probabilities of hospital stay with 95% confidence interval in the cumulative logistic model with the length of hospital stay and treatments.

|  |  |  |  |
| --- | --- | --- | --- |
| Odds Ratio Estimates | | | |
| Effect | Point Estimate | 95% Wald Confidence Limits | |
| TREAT A vs B | 1.554 | 1.026 | 2.355 |

8. Cochran-Mantel-Haenszel Statistics to test the relationship between treatments and the length of hospital stay with initial disease status as stratum.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cochran-Mantel-Haenszel Statistics (Based on Table Scores) | | | | |
| Statistic | Alternative Hypothesis | DF | Value | Prob |
| 1 | Nonzero Correlation | 1 | 0.8814 | 0.3478 |
| 2 | Row Mean Scores Differ | 1 | 0.8814 | 0.3478 |
| 3 | General Association | 3 | 7.1446 | 0.0674 |

9. The relative probabilities of hospital stay with 95% confidence interval based on different disease status in the cumulative logistic model with the length of hospital stay and treatments, status, the interaction term of treatments and status.

|  |  |  |  |
| --- | --- | --- | --- |
| Odds Ratio Estimates and Wald Confidence Intervals | | | |
| Odds Ratio | Estimate | 95% Confidence Limits | |
| TREAT A vs B at STATUS=mild | 2.334 | 1.167 | 4.668 |
| TREAT A vs B at STATUS=moderate | 0.932 | 0.489 | 1.776 |
| TREAT A vs B at STATUS=severe | 6.630 | 0.916 | 48.006 |
| TREAT A vs B at STATUS=very severe | 1.503 | 0.566 | 3.990 |

10. Score test for the proportional odds assumption in the cumulative logistic model with the length of hospital stay and treatments, status, the interaction term of treatments and status with all demographic characteristics as covariates (multivariate model).

|  |  |  |
| --- | --- | --- |
| Score Test for the Proportional Odds Assumption | | |
| Chi-Square | DF | Pr > ChiSq |
| 32.6158 | 34 | 0.5354 |

11. Goodness of fit test in the cumulative logistic model with the length of hospital stay and treatments, status, the interaction term of treatments and status with all demographic characteristics as covariates (multivariate model).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deviance and Pearson Goodness-of-Fit Statistics | | | | |
| Criterion | Value | DF | Value/DF | Pr > ChiSq |
| Deviance | 723.5873 | 862 | 0.8394 | 0.9998 |
| Pearson | 875.0754 | 862 | 1.0152 | 0.3709 |

12. The overall effect of interaction term tested in the cumulative logistic model with the length of hospital stay and treatments, status, the interaction term of treatments and status with all demographic characteristics as covariates (multivariate model).

|  |  |  |  |
| --- | --- | --- | --- |
| Joint Tests | | | |
| Effect | DF | Wald Chi-Square | Pr > ChiSq |
| STATUS\*TREAT | 3 | 6.8778 | 0.0759 |

13. The relative probabilities of hospital stay with 95% confidence interval based on different disease status in the cumulative logistic model with the length of hospital stay and treatments, status, and status with all demographic characteristics as covariates (multivariate model for treatment).

|  |  |  |  |
| --- | --- | --- | --- |
| Odds Ratio Estimates and Wald Confidence Intervals | | | |
| Odds Ratio | Estimate | 95% Confidence Limits | |
| TREAT A vs B | 1.584 | 1.033 | 2.428 |

14. The relative probabilities of hospital stay with 95% confidence interval based on different disease status in the cumulative logistic model with the length of hospital stay and treatments, status, the interaction term of treatments and status with all demographic characteristics as covariates (multivariate model).

|  |  |  |  |
| --- | --- | --- | --- |
| Odds Ratio Estimates and Wald Confidence Intervals | | | |
| Odds Ratio | Estimate | 95% Confidence Limits | |
| TREAT A vs B at STATUS=mild | 2.536 | 1.242 | 5.177 |
| TREAT A vs B at STATUS=moderate | 0.883 | 0.452 | 1.727 |
| TREAT A vs B at STATUS=severe | 7.804 | 1.002 | 60.774 |
| TREAT A vs B at STATUS=very severe | 1.387 | 0.512 | 3.755 |