Problem Set 8

## Surgery

Sore throats can be a common side effect following surgery that required general anesthesia. Doctors are interested in the following research question:

RQ: Do type of device used to secure the airway, and/or the duration of the surgery have an impact on whether patients will experience a sore throat upon waking? If yes, then quantify this effect.

Data is found in the excel spreadsheet “sore throat.xlsx” and a description of the variables is included below:

Variable Name Description

Y Patient had a sore throat upon waking (1 – Yes, 0 – No)

D Duration of the surgery in minutes

T Type of device used to secure the airway ( 1 – tracheal tube, 0 – laryngeal mask airway)

Part I – preliminary analysis

1. Run a chi-square test for independence between Y (patient did or did not have a sore throat) and T (type of device). Report sore throat rates for each device, the p-value for the chi-square test, and state your preliminary conclusion regarding the impact of type of device on sore throats.
2. Fit a logistic regression model to predict sore throats using duration of surgery only. Your results should include:

* The fitted logit model and the p-value for the Wald Chi-Square test for duration.
* For a surgery that will last an extra 10 minutes, compute the change in the odds of the patient waking up with a sore throat.
* Predicted probabilities for sore throats given duration of surgery is 15 minutes versus 45 minutes.
* AIC and BIC values
* Interpret the p-value for the Hosmer and Lemeshow test in the context of this problem.
* Percent concordant
* Classification table using , along with sensitivity, specificity and the overall classification rate.
* ROC curve

* Plot of predicted probability of sore throat versus duration of surgery. “Eyeball” the duration at which it is “50-50” on a sore throat.
* Preliminary conclusions regarding the impact of duration of surgery on the probability of sore throats.

Part II

1. Write out (in mathematical form with Greek letters) a logistic regression model that includes the main effects for D(duration) and T(type of device). Provide an interpretation of each mathematical term (variable or parameter, not including the intercept) included in your model.
2. Fit the model in #1 above and summarize the results. Your results should include:

* The fitted logit model and the p-values for the Wald Chi-Square tests for both and duration type of device.
* For a surgery that will last an extra 10 minutes, compute the change in the odds of the patient waking up with a sore throat.
* Compute the change in the odds of a sore throat for a surgery that uses a tracheal tube instead of a laryngeal mask airway.
* Predicted probabilities for sore throats given duration of surgery is 15 minutes and a tracheal tube was used versus 45 minutes and a laryngeal mask airway was used.
* AIC and BIC values
* Interpret the p-value for the Hosmer and Lemeshow test in the context of this problem.
* Percent concordant
* Classification table using , along with sensitivity, specificity and the overall classification rate.
* ROC curve
* Plot of predicted probability of sore throat versus duration of surgery by type of device. “Eyeball” the duration at which it is “50-50” on a sore

1. Run a likelihood ratio test comparing the model with duration only versus the model that includes both duration and type of device.
2. Construct a table which includes values for AIC, BIC, percent concordant, sensitivity, specificity, and classification rate for both models. Use this information along with the result in #3 to choose a final model.
3. Answer the research question using the analysis in Part II. Do your conclusions differ from those after the preliminary analysis?