Use of Logistic Regression to Predict the Need for Admission Among Emergency Department Patients: a Model to Predict Patient Suitability for a Rapid Assessment Zone

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Introduction

In order to facilitate the flow of patients who are likely to be treated in the emergency department and discharged, a new rapid assessment zone (RAZ) was introduced to the emergency department at the University of Alberta Hospital. The goal of this study was to create an admission rule based on logistic regression to predict which patients are unlikely to require admission to the hospital and are thus suitable for inclusion in the rapid assessment zone. A logistic regression model was fitted with the null hypothesis of all coefficients equal to 0 tested against the alternative hypothesis that some coefficients do not equal 0.

Methods

In this retrospective cohort study, data from one week of emergency department visits was obtained from the emergency department information system. This data included the patient's age, gender, triage score using the Canadian triage assessment score (CTAS), pulse, respiratory rate, Glasgow coma scale, systolic blood pressure, and arrival by ambulance or not. The observations were used to fit a generalized linear model using a binomial random component and the logit link. (Figure 1) Goodness of fit was assessed by the Hosmer-Lemshow statistic, and model adequacy was assessed using the generalized coefficient of determination (R-squared)

Results

Data was available for 2486 emergency department visits. Only age, sex, CTAS, respiratory rate, and ambulance arrival had confidence intervals for the coefficients that did not cross 0. Pulse, GCS, and systolic blood pressure coefficients crossed zero. The final model was fit with only the age, sex, CTAS, respiratory rate, and ambulance arrival terms. The Hosmer-Lemshow statistic was 13.0 (p=0.11) and good model fit was obtained. (Figure 2). The generalized coefficient of determination (R-squared) was 0.306.

Conclusions

The present study suggests that the factors of age, gender, triage score, respiratory rate, and arrival by ambulance are the most important for predicting need for eventual admission. Although, the Hosmer-Lemshow statistic did not reveal statistically significant lack of fit, the generalized coefficient of determination was relatively low indicating that the model could explain only 30% of the variation in admission rate

Figure 1

```
Call:
glm(formula = Admitted ~ Age + Sex + CTAS + Pulse + Resp
+ GCS +
    Systolic + Ambulance, family = binomial(link =
"logit"),
    data = na.omit(admit))

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.8464  -0.6494  -0.3966  -0.2054   2.7613

Coefficients:
             Estimate Std. Error z value  Pr(>|z|)
(Intercept) -1.362313   1.881715  -0.724  0.46908
Age          0.029226   0.005678   5.147 2.65e-07 ***
SexM         0.539982   0.233519   2.312  0.02076 *
CTAS        -0.470511   0.174033  -2.704  0.00686 **
Pulse        0.003543   0.006536   0.542  0.58778
Resp         0.079825   0.032836   2.431  0.01506 *
GCS         -0.133719   0.109911  -1.217  0.22375
Systolic    -0.005160   0.005627  -0.917  0.35915
Ambulance1   1.239053   0.246058   5.036 4.76e-07 ***
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
' ' 1
(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 617.2  on 565  degrees of freedom
Residual deviance: 485.6  on 557  degrees of freedom
AIC: 503.6

Number of Fisher Scoring iterations: 5
```
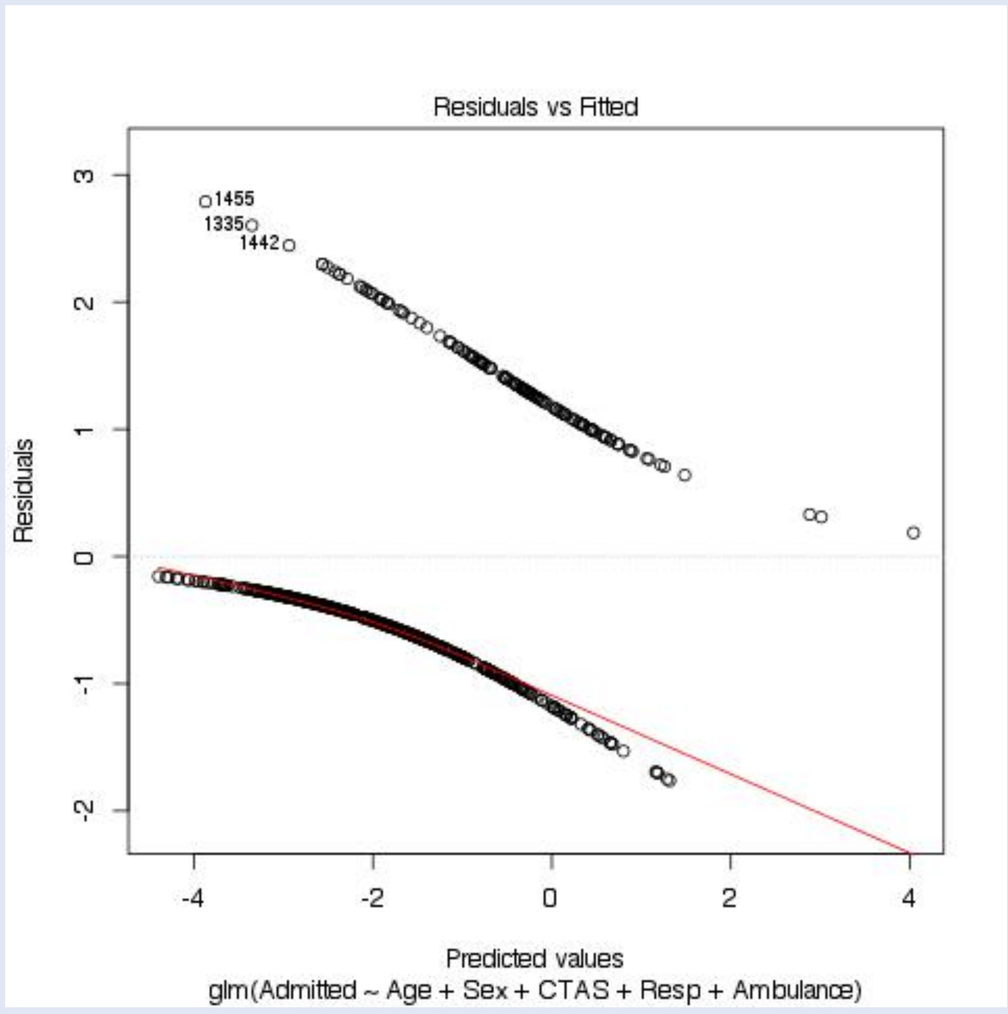

Figure 2



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