Poisson regression

- At this point, we are ready to perform our Poisson model analysis using the `glm` function.
- We fit the model and store it in the object `model1` and get a summary of the model.

Poisson Regression with R

```
model1 <- glm(num_awards ~ prog + math,
family="poisson", data=p)

summary(model1)
```

Poisson Regression with R

```
Call:
glm(formula = num_awards ~ prog + math, family = "poi
Deviance Residuals:
Min       1Q   Median       3Q      Max
-2.204  -0.844  -0.511    0.256    2.680
```

Poisson Regression with R

```
Coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept)     -5.2471     0.6585   -7.97  1.6e-15 *
progAcademic     1.0839     0.3583    3.03   0.0025 *
progVocational   0.3698     0.4411    0.84   0.4018
math             0.0702     0.0106    6.62  3.6e-11 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.'
```

Poisson Regression with R

```
(Dispersion parameter for poisson family taken to be

Null deviance: 287.67  on 199  degrees of freedom
Residual deviance: 189.45  on 196  degrees of freedom
AIC: 373.5

Number of Fisher Scoring iterations: 6
```

Poisson Regression with R

- It is recommended using robust standard errors for the parameter estimates to control for mild violation of the distribution assumption that the variance equals the mean.
- The R package **sandwich** can be used to obtain the robust standard errors and calculated the p-values accordingly.
- Together with the p-values, we have also calculated the 95% confidence interval using the parameter estimates and their robust standard errors.

Poisson Regression with R

sandwich R Package

- Robust Covariance Matrix Estimators
- Model-robust standard error estimators for cross-sectional, time series, and longitudinal data.

Poisson Regression with R

Robust Standard Errors

```
cov.model1 <- vcovHC(model1, type="HC0")
std.err <- sqrt(diag(cov.model1))

r.est <- cbind(Estimate= coef(model1),
"Robust SE" = std.err,
"Pr(>|z|)" = 2 * pnorm(abs(coef(model1)/std.err),
lower.tail=FALSE),
LL = coef(model1) - 1.96 * std.err,
UL = coef(model1) + 1.96 * std.err)
```

Poisson Regression with R

```
r.est

Estimate Robust SE  Pr(>|z|)       LL       UL
(Intercept)    -5.24712   0.64600 4.567e-16 -6.5133 -3.
progAcademic    1.08386   0.32105 7.355e-04  0.4546  1.
progVocational  0.36981   0.40042 3.557e-01 -0.4150  1.
math            0.07015   0.01044 1.784e-11  0.0497  0.
```