

# Number of Children - Poisson Models with Polynomial Terms

February 8, 2012

First of all, the children data is loaded:

```
> library(catdata)
> data(children)
> attach(children)
```

A log-linear Poisson model with the number of children as dependent variable is fitted. Since one cannot expect that the metric predictors have linear effects, polynomial terms are included in the predictors.

```
> pois <- glm(child ~ age+I(age^2)+I(age^3)+I(age^4)+dur+I(dur^2)+nation+god+univ,
+             data = children, family = poisson(link=log))
> summary(pois)
```

Call:

```
glm(formula = child ~ age + I(age^2) + I(age^3) + I(age^4) +
     dur + I(dur^2) + nation + god + univ, family = poisson(link = log),
     data = children)
```

Deviance Residuals:

	Min	1Q	Median	3Q	Max
	-2.1514	-0.7559	0.0102	0.4832	3.6715

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )	
(Intercept)	-1.228e+01	1.484e+00	-8.277	< 2e-16	***
age	9.359e-01	1.239e-01	7.553	4.26e-14	***
I(age^2)	-2.490e-02	3.786e-03	-6.577	4.80e-11	***
I(age^3)	2.842e-04	4.915e-05	5.781	7.42e-09	***
I(age^4)	-1.180e-06	2.297e-07	-5.137	2.80e-07	***
dur	1.118e-01	6.652e-02	1.680	0.092904	.
I(dur^2)	-8.328e-03	2.997e-03	-2.779	0.005454	**
nation1	5.686e-02	1.386e-01	0.410	0.681599	
god2	-1.025e-01	5.903e-02	-1.736	0.082599	.
god3	-1.448e-01	6.780e-02	-2.136	0.032683	*
god4	-1.279e-01	7.088e-02	-1.805	0.071128	.
god5	-3.621e-02	6.695e-02	-0.541	0.588569	
god6	-9.241e-02	7.505e-02	-1.231	0.218239	

```

univ1      6.372e-01  1.729e-01  3.686 0.000228 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(Dispersion parameter for poisson family taken to be 1)

```

Null deviance: 2067.4 on 1760 degrees of freedom
Residual deviance: 1718.6 on 1747 degrees of freedom
AIC: 5196.8

```

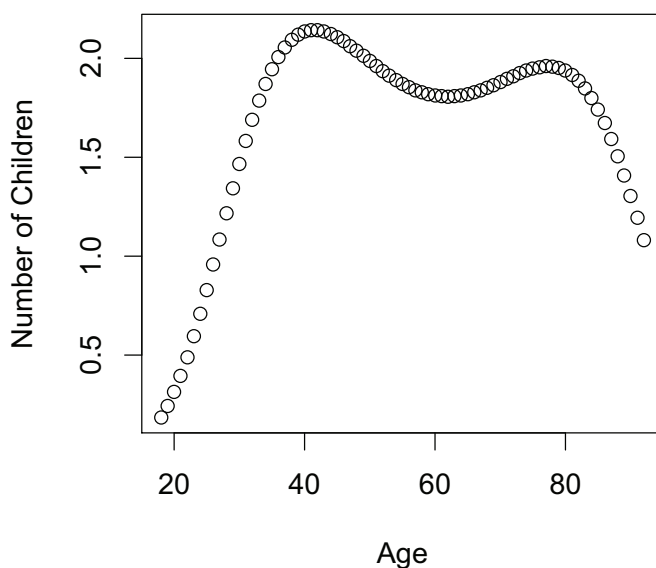
Number of Fisher Scoring iterations: 5

Visualizing the effect of age and duration for education.

```

> x <- min(age):max(age)
> y <- exp(pois$coef[1]+pois$coef["age"]*x+pois$coef["I(age^2)"]*x^2+
+   pois$coef["I(age^3)"]*x^3+pois$coef["I(age^4)"]*x^4+pois$coef["dur"]*10+
+   pois$coef["I(dur^2)"]*100)
> par(cex=1.4)
> plot(x, y, ylab="Number of Children", xlab="Age")

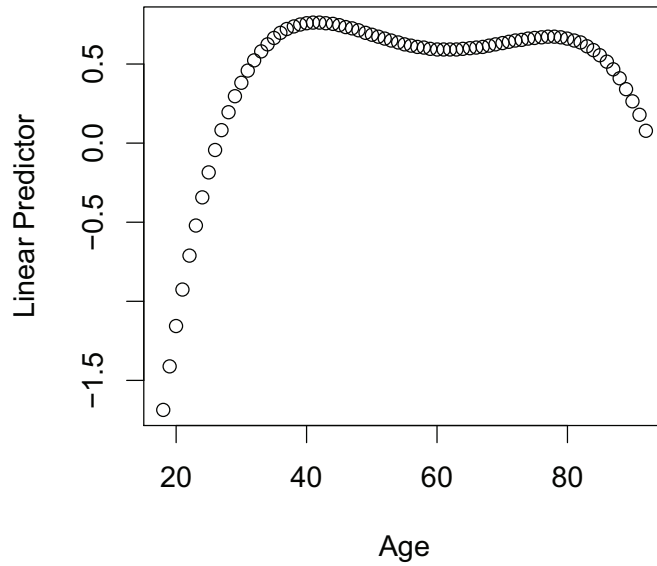
```



```

> y <- (pois$coef[1]+pois$coef["age"]*x+pois$coef["I(age^2)"]*x^2+
+   pois$coef["I(age^3)"]*x^3+pois$coef["I(age^4)"]*x^4+pois$coef["dur"]*10+
+   pois$coef["I(dur^2)"]*100)
> par(cex=1.4)
> plot(x, y, ylab="Linear Predictor", xlab="Age")

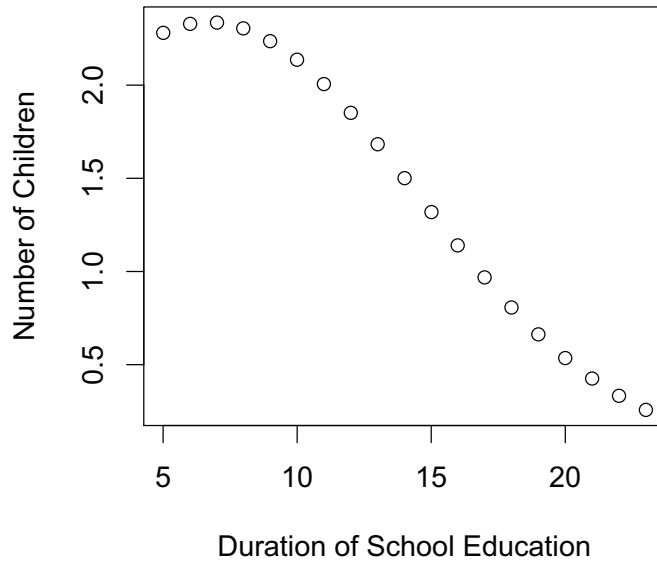
```



```

> x <- min(dur):max(dur)
> y <- exp(pois$coef[1]+pois$coef["age"]*40+pois$coef["I(age^2)"]*40^2+
+   pois$coef["I(age^3)"]*40^3+pois$coef["I(age^4)"]*40^4+pois$coef["dur"]*x+
+   pois$coef["I(dur^2)"]*x^2)
> par(cex=1.4)
> plot(x, y, ylab="Number of Children", xlab="Duration of School Education")

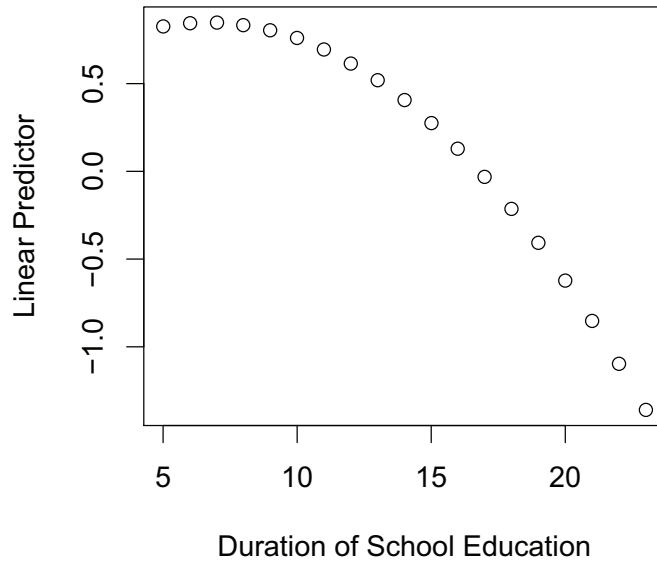
```



```

> y <- (pois$coef[1]+pois$coef["age"]*40+pois$coef["I(age^2)"]*40^2+
+   pois$coef["I(age^3)"]*40^3+pois$coef["I(age^4)"]*40^4+pois$coef["dur"]*x+
+   pois$coef["I(dur^2)"]*x^2)
> par(cex=1.4)
> plot(x, y, ylab="Linear Predictor", xlab="Duration of School Education")

```



Calculate the deviance of the Poisson model.

```
> anova(pois)
```

Analysis of Deviance Table

Model: poisson, link: log

Response: child

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev
NULL			1760	2067.4
age	1	93.596	1759	1973.8
I(age^2)	1	108.618	1758	1865.2
I(age^3)	1	68.198	1757	1797.0
I(age^4)	1	26.290	1756	1770.7
dur	1	30.730	1755	1740.0
I(dur^2)	1	0.682	1754	1739.3
nation	1	0.459	1753	1738.8
god	5	6.729	1748	1732.1
univ	1	13.489	1747	1718.6