

R version 2.14.1 (2011-12-22)

```
> # aids counts, tampere slides
> belg.aids = data.frame(cases=c(12,14,33,50,67,74,123,141,165,204,253,246,240),year=1:
> belg.aids
```

```
  cases year
1     12   1
2     14   2
3     33   3
4     50   4
5     67   5
6     74   6
7    123   7
8    141   8
9    165   9
10   204  10
11   253  11
12   246  12
13   240  13
```

```
# slide for Poisson link function (log)
```

```
> am1 = glm(cases ~ year,data=belg.aids, family=poisson(link=log))
> summary(am1)
```

Call:

```
glm(formula = cases ~ year, family = poisson(link = log), data = belg.aids)
```

Deviance Residuals:

```
    Min       1Q   Median       3Q      Max
-4.6784 -1.5013 -0.2636  2.1760  2.7306
```

Coefficients:

```
            Estimate Std. Error z value Pr(>|z|)
(Intercept) 3.140590   0.078247  40.14  <2e-16 ***
year         0.202121   0.007771  26.01  <2e-16 ***
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(Dispersion parameter for poisson family taken to be 1)

```
Null deviance: 872.206 on 12 degrees of freedom
Residual deviance: 80.686 on 11 degrees of freedom
AIC: 166.37
```

Number of Fisher Scoring iterations: 4

```
> plot(am1) # gives you the set of diagnostic plots--resids vs fitted etc
```

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```
# try quadratic in year
```

```
> am2 = glm(cases ~ year+I(year^2),data=belg.aids, family=poisson(link=log))
```

```
> summary(am2)
```

Call:

```
glm(formula = cases ~ year + I(year^2), family = poisson(link = log),
    data = belg.aids)
```

Deviance Residuals:

```

      Min       1Q   Median       3Q      Max
-1.45903 -0.64491  0.08927  0.67117  1.54596

```

Coefficients:

```

      Estimate Std. Error z value Pr(>|z|)
(Intercept)  1.901459   0.186877  10.175 < 2e-16 ***
year          0.556003   0.045780  12.145 < 2e-16 ***
I(year^2)    -0.021346   0.002659  -8.029 9.82e-16 ***

```

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(Dispersion parameter for poisson family taken to be 1)

```

Null deviance: 872.2058 on 12 degrees of freedom
Residual deviance: 9.2402 on 10 degrees of freedom
AIC: 96.924

```

Number of Fisher Scoring iterations: 4

```

> anova(am1,am2) # compare nested models
Analysis of Deviance Table

```

```

Model 1: cases ~ year
Model 2: cases ~ year + I(year^2)
  Resid. Df Resid. Dev Df Deviance
1         11      80.686
2         10       9.240  1   71.446

```

```

> anova(am1,am2, test = "Chisq")
Analysis of Deviance Table

```

```

Model 1: cases ~ year
Model 2: cases ~ year + I(year^2)
  Resid. Df Resid. Dev Df Deviance Pr(>Chi)
1         11      80.686
2         10       9.240  1   71.446 < 2.2e-16 ***

```

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

> AIC(am1,am2)
  df      AIC
am1  2 166.36982
am2  3  96.92358

```

```

> # cubic doesn't help

```

```

> year = seq(1,13,length=100)

```

```

> fv = predict(am2,newdata=data.frame(year=year),se=TRUE)

```

```

> length(fv)

```

```

[1] 3

```

```

> fv

```

```

$fit

```

```

      1      2      3      4      5      6      7      8      9
2.436116 2.498021 2.559300 2.619951 2.679975 2.739372 2.798142 2.856284 2.913799 2.9706
      14     15     16     17     18     19     20     21     22
3.191966 3.245717 3.298842 3.351339 3.403208 3.454451 3.505066 3.555054 3.604415 3.6531
      27     28     29     30     31     32     33     34     35
3.841810 3.887407 3.932377 3.976720 4.020435 4.063523 4.105984 4.147818 4.189025 4.2296
      40     41     42     43     44     45     46     47     48
4.385648 4.423091 4.459907 4.496095 4.531656 4.566590 4.600897 4.634576 4.667628 4.7000
      53     54     55     56     57     58     59     60     61
4.823480 4.852768 4.881430 4.909464 4.936871 4.963650 4.989803 5.015328 5.040225 5.0644
      66     67     68     69     70     71     72     73     74
5.155306 5.176440 5.196947 5.216827 5.236079 5.254705 5.272703 5.290073 5.306817 5.3229

```

```
      79      80      81      82      83      84      85      86      87
5.381125 5.394105 5.406458 5.418184 5.429282 5.439753 5.449596 5.458813 5.467402 5.4753
      92      93      94      95      96      97      98      99     100
5.500939 5.505765 5.509963 5.513534 5.516478 5.518795 5.520484 5.521546 5.521981
```

```
$se.fit
```

```
      1      2      3      4      5      6      7      8
0.14611046 0.14156784 0.13711311 0.13274683 0.12846963 0.12428216 0.12018513 0.11617927
      12      13      14      15      16      17      18      19
0.10108429 0.09754730 0.09410706 0.09076469 0.08752138 0.08437834 0.08133687 0.07839827
      23      24      25      26      27      28      29      30
0.06769975 0.06529583 0.06300274 0.06082157 0.05875328 0.05679860 0.05495800 0.05323164
      34      35      36      37      38      39      40      41
0.04745686 0.04628848 0.04522524 0.04426357 0.04339926 0.04262751 0.04194297 0.04133980
      45      46      47      48      49      50      51      52
0.03961166 0.03931673 0.03906286 0.03884334 0.03865165 0.03848157 0.03832718 0.03818295
      56      57      58      59      60      61      62      63
0.03761037 0.03744764 0.03727027 0.03707561 0.03686141 0.03662583 0.03636748 0.03608537
      67      68      69      70      71      72      73      74
0.03471529 0.03431549 0.03389585 0.03345893 0.03300794 0.03254681 0.03208026 0.03161386
      78      79      80      81      82      83      84      85
0.02989456 0.02954646 0.02925269 0.02902564 0.02887832 0.02882404 0.02887603 0.02904699
      89      90      91      92      93      94      95      96
0.03112945 0.03203575 0.03310329 0.03433198 0.03572007 0.03726451 0.03896127 0.04080574
      100
0.04956070
```

```
$residual.scale
```

```
[1] 1
```

```
> year
```

```
 [1] 1.000000  1.121212  1.242424  1.363636  1.484848  1.606061  1.727273  1.848485
 [12] 2.333333  2.454545  2.575758  2.696970  2.818182  2.939394  3.060606  3.181818
 [23] 3.666667  3.787879  3.909091  4.030303  4.151515  4.272727  4.393939  4.515152
 [34] 5.000000  5.121212  5.242424  5.363636  5.484848  5.606061  5.727273  5.848485
 [45] 6.333333  6.454545  6.575758  6.696970  6.818182  6.939394  7.060606  7.181818
 [56] 7.666667  7.787879  7.909091  8.030303  8.151515  8.272727  8.393939  8.515152
 [67] 9.000000  9.121212  9.242424  9.363636  9.484848  9.606061  9.727273  9.848485
 [78] 10.333333 10.454545 10.575758 10.696970 10.818182 10.939394 11.060606 11.181818 1
 [89] 11.666667 11.787879 11.909091 12.030303 12.151515 12.272727 12.393939 12.515152 1
 [100] 13.000000
```

```
> plot(belg.aids$year+1980,belg.aids$cases) # data
```

```
> lines(year+1980,exp(fv$fit),col=2) # fit
```

```
> lines(year+1980,exp(fv$fit+2*fv$se),col=3) # upper c.l.
```

```
> lines(year+1980,exp(fv$fit-2*fv$se),col=3) # lower c.l.
```

```
> # produces nice final plot, note the overlay of fit and CI bands (2*se)
```