

# Addiction - Multinomial Model with Hierarchically Structured Response

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First the "addiction" data are loaded and attached.

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

For the Multinomial Model with hierarchically structured response we use simple Logit Models. For the first model, which models the effect of categories 0 and 1 versus 2, a new response "ill01" is created. In addition the variable "age2" for the squared effect of age is created.

```
> ill01 <- ill
> ill01[ill==0] <- 1
> ill01[ill==2] <- 0
> age2 <- age^2
```

Now the model for categories 0 and 1 versus 2 is fitted.

```
> m01vs2 <- glm(ill01 ~ as.factor(gender) + as.factor(university) + age + age2,
+ family=binomial())
> summary(m01vs2)
```

Call:

```
glm(formula = ill01 ~ as.factor(gender) + as.factor(university) +
    age + age2, family = binomial())
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.9573	0.5416	0.6492	0.7702	1.0774

Coefficients:

	Estimate	Std. Error	z value
(Intercept)	2.1788569	0.5145020	4.235
as.factor(gender)1	-0.0171594	0.1828231	-0.094
as.factor(university)1	0.0894869	0.2067492	0.433
age	-0.0342091	0.0255108	-1.341
age2	0.0001307	0.0002881	0.454

Pr(>|z|)

```

(Intercept)          2.29e-05 ***
as.factor(gender)1    0.925
as.factor(university)1 0.665
age                   0.180
age2                  0.650

```

---

Signif. codes:

```

0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(Dispersion parameter for binomial family taken to be 1)

```

Null deviance: 756.98 on 681 degrees of freedom
Residual deviance: 736.74 on 677 degrees of freedom
(30 observations deleted due to missingness)
AIC: 746.74

```

Number of Fisher Scoring iterations: 4

For the next model the data set has to be reduced, only observations with response categories 0 or 1 are needed. Then the variable "age2" is built.

```

> detach(addiction)
> addiction2 <- addiction[addiction$ill!=2,]
> attach(addiction2)
> age2 <- age^2

```

Finally the model for categories 0 versus 1 is fitted.

```

> m0vs1 <- glm(ill ~ as.factor(gender) + as.factor(university) + age + age2,
+ family=binomial())
> summary(m0vs1)

```

Call:

```

glm(formula = ill ~ as.factor(gender) + as.factor(university) +
    age + age2, family = binomial())

```

Deviance Residuals:

```

      Min       1Q   Median       3Q      Max
-2.3539  -0.9427   0.5316   0.8918   1.9496

```

Coefficients:

```

              Estimate Std. Error z value
(Intercept)    -3.5468017  0.5443388  -6.516
as.factor(gender)1  0.5433231  0.2054682   2.644
as.factor(university)1 1.4655504  0.2600787   5.635
age              0.1719897  0.0283914   6.058
age2            -0.0017344  0.0003341  -5.191
              Pr(>|z|)
(Intercept)    7.23e-11 ***
as.factor(gender)1  0.00819 **
as.factor(university)1 1.75e-08 ***

```

```
age          1.38e-09 ***
age2         2.10e-07 ***
```

```
---
```

```
Signif. codes:
```

```
0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(Dispersion parameter for binomial family taken to be 1)
```

```
Null deviance: 689.93 on 515 degrees of freedom
```

```
Residual deviance: 583.94 on 511 degrees of freedom
```

```
(27 observations deleted due to missingness)
```

```
AIC: 593.94
```

```
Number of Fisher Scoring iterations: 4
```