Birth Data - Bivariate Binary Regression

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First the Birth data are loaded from package "catdata".

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

Now the original variable "Intensive" is converted into the binary variable "Intensive" indicating whether the child spent time in intensive care or not.

```
> intensive <- rep(0,length(Intensive))
> intensive[Intensive>0] <- 1
> Intensive <- intensive
```

Now "Previous" is reduced to 3 categories by merging two and more previous pregnancies to level "2".

```
> previous <- Previous
> previous[previous>1] <- 2
> Previous <- previous

> library(VGAM)
```

The data set "Birth" is built as data set containing the variables for the model but without missing values.

```
> Birth <- as.data.frame(na.omit(cbind(Intensive, Cesarean, Sex, Weight, Previous,
+ AgeMother)))
> detach(birth)
```

With that data set the model can be fitted. The option "binom2.or" is needed to fit a bivariate binary model.

```
> bivarlogit <- vglm(cbind(Intensive , Cesarean) ~ as.factor(Sex) + Weight +
+ as.factor(Previous) + AgeMother, binom2.or(zero=NULL), data=Birth)
> summary(bivarlogit)

Call:
vglm(formula = cbind(Intensive, Cesarean) ~ as.factor(Sex) +
    Weight + as.factor(Previous) + AgeMother, family = binom2.or(zero = NULL),
    data = Birth)
```

```
Pearson residuals:
                    Min       1Q  Median      3Q    Max
logitlink(mu1)  -1.189 -0.33932 -0.2490 -0.1636 10.813
logitlink(mu2)  -1.382 -0.52340 -0.4178 -0.2481  5.913
loglink(oratio) -4.188  0.03249  0.1034  0.1670 47.924

Coefficients:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept):1           3.6521826  1.0370175   3.522 0.000429 ***
(Intercept):2          -1.0586965  0.8053249  -1.315 0.188638
(Intercept):3           6.1059585  2.8496769   2.143 0.032138 *
as.factor(Sex)2:1      -0.1650560  0.2478618  -0.666 0.505463
as.factor(Sex)2:2      -0.2608484  0.1901733  -1.372 0.170177
as.factor(Sex)2:3       0.2873172  0.5991993   0.480 0.631582
Weight:1               -0.0019044  0.0002149  -8.864  < 2e-16 ***
Weight:2               -0.0006908  0.0001550  -4.457  8.3e-06 ***
Weight:3               -0.0005166  0.0005696  -0.907 0.364447
as.factor(Previous)1:1 -0.6114638  0.3770418  -1.622 0.104859
as.factor(Previous)1:2 -0.5923288  0.2556927  -2.317 0.020527 *
as.factor(Previous)1:3  1.3983837  0.9064236   1.543 0.122892
as.factor(Previous)2:1  0.5135426  0.4938780   1.040 0.298425
as.factor(Previous)2:2 -2.2237403  0.7802474  -2.850 0.004371 **
as.factor(Previous)2:3  4.1368132  2.1476298   1.926 0.054077 .
AgeMother:1             0.0118064  0.0289937   0.407 0.683857
AgeMother:2             0.0795597  0.0231137   3.442 0.000577 ***
AgeMother:3            -0.1718012  0.0760511  -2.259 0.023882 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Names of linear predictors: logitlink(mu1), logitlink(mu2), loglink(oratio)

Residual deviance: 1165.207 on 2304 degrees of freedom

Log-likelihood: -582.6032 on 2304 degrees of freedom

Number of Fisher scoring iterations: 10

Warning: Hauck-Donner effect detected in the following estimate(s):
'Weight:1'
```