Knee Injuries - Comparison of Link Functions

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At the beginning the knee dataset is loaded:

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

In the following the variable Age is centered around 30 years and the quadratic variable Age2 is created.

```
> Age <- Age - 30
> Age2 <- Age^2
```

For the cumulative maximum extreme value (Gumbel) model that will be fitted later, the response has to be transformed so that afterwards the ordering of the response categories is reversed.

```
> k <- length(unique(R4))
> R4rev <- k + 1 - R4
```

The response pain (R4 or R4rev) is an ordered factor, the covariates therapy (Th) and sex (Sex) need to be factors.

```
> R4 <- as.ordered(R4)
> R4rev <- as.ordered(R4rev)
> Th <- as.factor(Th)
> Sex <- as.factor(Sex)
```

With the "vglm"–function from the "VGAM"–library both cumulative and sequential models can be fitted.

```
> library(VGAM)
```

To compare the performance of cumulative models with different link functions one can use the deviances of the respective models. At first four models with four different link functions (Logit, Probit, Gumbel, Gompertz) are fitted.

Cumulative Logit model:

```
> clogit <- vglm(R4 ~ Th + Sex + Age +Age2, family = cumulative (link="logit",
+ parallel=TRUE))
```

Cumulative Probit model:

```
> cprobit <- vglm(R4 ~ Th + Sex + Age +Age2, family = cumulative (link="probit",
+ parallel=TRUE))
```

Cumulative Gumbel model:

```
> cgumbel <- vglm(R4rev ~ Th + Sex + Age +Age2, family = cumulative(link="cloglog",
+ parallel=TRUE))
```

Cumulative Gompertz model:

```
> cgompertz <- vglm(R4 ~ Th + Sex + Age +Age2, family = cumulative(link="cloglog",
+ parallel=TRUE))
```

Now the four deviances can be recalled by the following command:

```
> deviance(clogit)
```

```
[1] 363
```

```
> deviance(cprobit)
```

```
[1] 364
```

```
> deviance(cgumbel)
```

```
[1] 369
```

```
> deviance(cgompertz)
```

```
[1] 361
```

For comparison the four corresponding sequential models are fitted.

Sequential Logit model:

```
> slogit <- vglm(R4 ~ Th + Sex + Age +Age2, family = sratio (link="logit",
+ parallel=TRUE))
```

Sequential Probit model:

```
> sprobit <- vglm(R4 ~ Th + Sex + Age +Age2, family = sratio (link="probit",
+ parallel=TRUE))
```

Sequential Gumbel model:

```
> sgumbel <- vglm(R4rev ~ Th + Sex + Age +Age2, family = sratio (link="cloglog",
+ parallel=TRUE))
```

Sequential Gompertz model:

```
> sgompertz <- vglm(R4 ~ Th + Sex + Age +Age2, family = sratio (link="cloglog",
+ parallel=TRUE))
```

Now the deviances of the sequential models are recalled:

```
> deviance(slogit)
```

```
[1] 360

> deviance(sprobit)

[1] 361

> deviance(sgumbel)

[1] 369

> deviance(sgompertz)

[1] 361
```