Knee Data - Random Effects Logit Models

December 4, 2025

First the knee dataset is loaded:

```
library(catdata)
data(knee)
```

For the following models the data set is transformed into long format what can be done by the function "reshape".

In addition the dichotomized response variables "RD" is created. The groups are constructed by pain level up to level 2 und pain level higher than level 2.

```
knee <- reshape(knee, direction="long", varying=list(5:8), v.names="R",timevar="Time")

knee$RD <- rep(0, length(knee$R))
knee$RD[knee$R>2] <- 1
```

For better interpretability the variable "Age" is centered around 30 , the variable "Age2" is created as quadratic effect of "Age".

```
knee$Age <- knee$Age - 30
knee$Age2 <- knee$Age^2
```

Since only the measurements 2, 3 and 4 are used for the models, measurement 1 can be eliminated.

```
knee <- knee[knee$Time!=1,]
```

The first model will be fitted by Gauss–Hermite–Quadrature with 20 quadrature points by using function "glmmML" from library "glmmML".

```
library(glmmML)
```

Now the random intercept model with Gauss–Hermite–Quadrature is fitted, the option "method" has to be set on "ghq", the number of quadrature points is set by "n.points".

```
kneeGHQ <- glmmML(RD ~ as.factor(Th) + as.factor(Sex) + Age + Age2, data=knee,
family=binomial(), method="ghq", n.points=20, cluster=id)
summary(kneeGHQ)
```

The random intercept model with Penalized Quasi–Likelihood is fitted by use of "glmmPQL" from the library "MASS".

```
kneePQL <- glmmPQL(RD ~ as.factor(Th) + as.factor(Sex) + Age + Age2, data=knee,
random = ~ 1|id, family=binomial())
summary(kneePQL)
```

The library "gee" is needed for fitting of the marginal model.

```
library(gee)
```

For the marginal model the data set has to be arranged according to the variable "id" so that measurements from the same individual are arranged one after the other.

```
knee <- knee[order(knee$id),]
kneeGEE <- gee(RD ~ as.factor(Th) + as.factor(Sex) + Age + Age2, data=knee,
family=binomial(), id=id, corstr="exchangeable")
summary(kneeGEE)
```