

## Examine\_results

I tested the 4 model variants on real ALSFRS data. Here I summarise some of the fit statistics for each model in turn. In each case the same data was used in long or wide format as needed. The data had 834 individuals, with a total of 3,311 longitudinal timepoints of 12 questions each. All models were run across 4 chains on 4 separate cores with the default warm-up and sampling iterations.

To recap the models were: - Model 1 - Multiple latent dimensions - Model 2 - Modeling questions separately - multivariate - Model 3 - Using continuation ratio - Model 4 - Using a custom family

Each model had the following numbers of parameters:

```
## [1] "Model 1: 11387"
## [1] "Model 2: 10543"
## [1] "Model 3: 10521"
## [1] "Model 4: 10520"
```

and the following numbers of divergences:

```
## [1] "Model 1: 0"
## [1] "Model 2: 0"
## [1] "Model 3: 0"
## [1] "Model 4: 0"
```

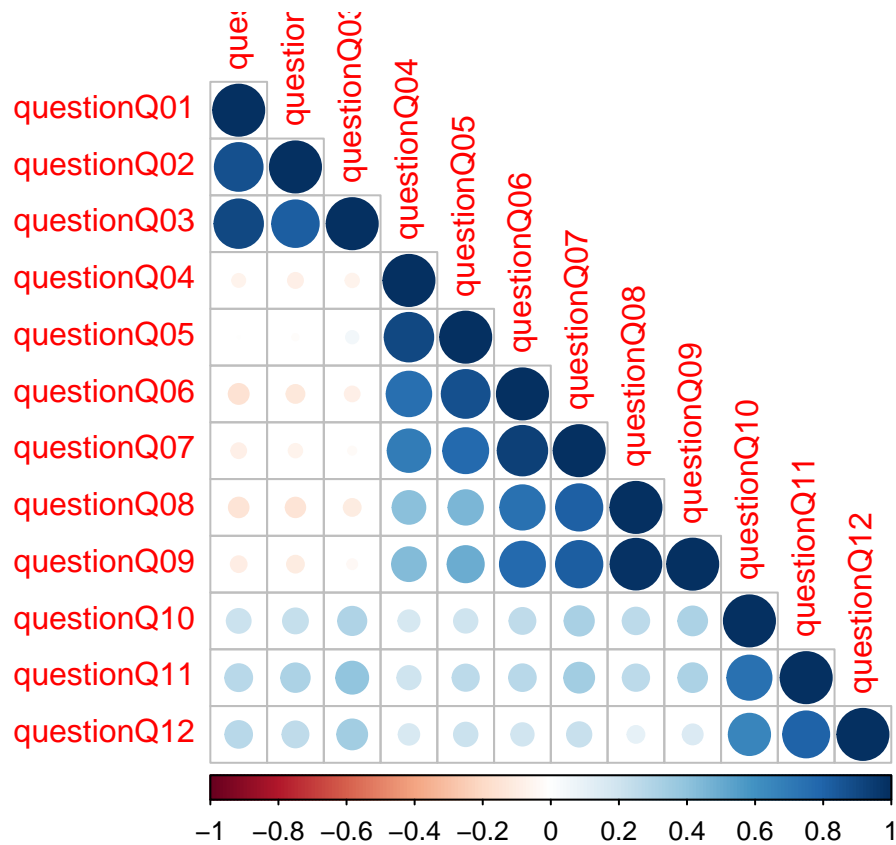
The times for warmup and sampling for each chain of the models were:

```
## [1] "Model 1:"
##           warmup  sample
## chain:1  9811.56 9092.76
## chain:2 11060.30 7159.92
## chain:3 10605.00 8934.94
## chain:4 10828.40 4621.79
## [1] "Model 2:"
##           warmup  sample
## chain:1 16890.50 3953.60
## chain:2 17234.10 41025.00
## chain:3 17194.00 4473.53
## chain:4  8102.01 5472.32
## [1] "Model 3:"
##           warmup  sample
## chain:1 21175.8 8673.85
## chain:2 30186.8 7764.63
## chain:3 53974.3 8212.70
## chain:4 22542.9 4482.03
## [1] "Model 4:"
```

```
##          warmup  sample
## chain:1 34091.0 14273.6
## chain:2 32847.6 14386.7
## chain:3 34468.0 14270.0
## chain:4 35844.6 14236.9
```

Model 1 correlation matrix

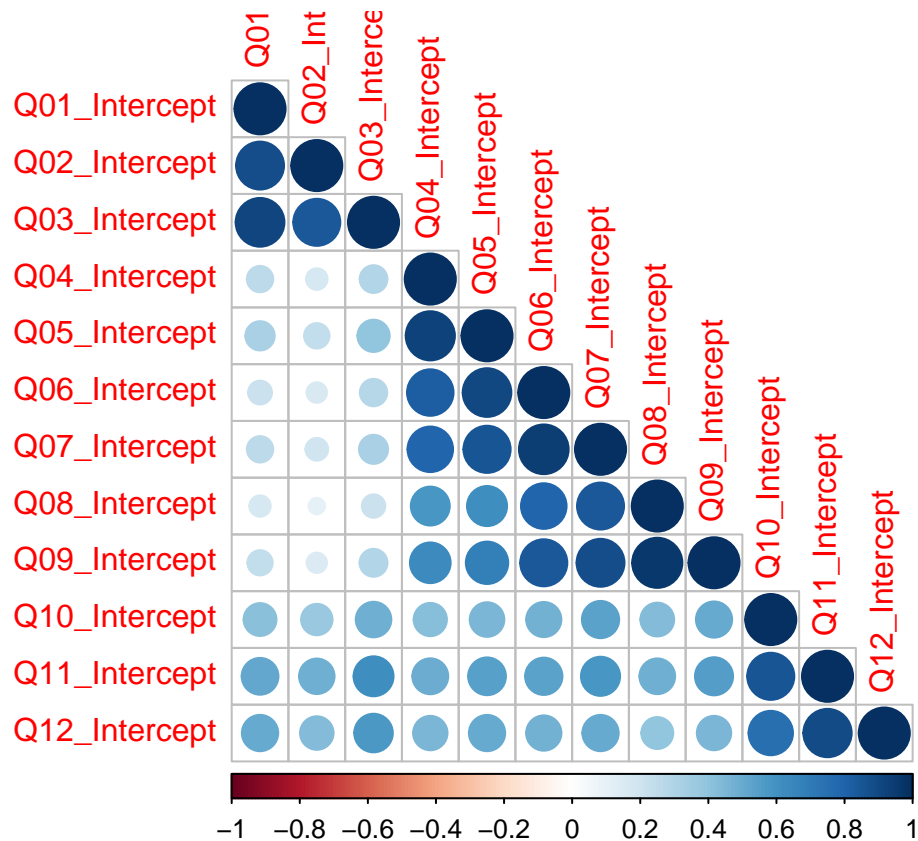
```
##          questionQ01 questionQ02 questionQ03 questionQ04 questionQ05
## questionQ01 " 1.0000" " 0.8733" " 0.9001" "-0.0639" "-0.0012"
## questionQ02 " 0.8733" " 1.0000" " 0.8292" "-0.0861" "-0.0148"
## questionQ03 " 0.9001" " 0.8292" " 1.0000" "-0.0689" " 0.0585"
## questionQ04 "-0.0639" "-0.0861" "-0.0689" " 1.0000" " 0.9025"
## questionQ05 "-0.0012" "-0.0148" " 0.0585" " 0.9025" " 1.0000"
## questionQ06 "-0.1517" "-0.1219" "-0.0832" " 0.7585" " 0.8752"
## questionQ07 "-0.0836" "-0.0690" "-0.0246" " 0.6917" " 0.7741"
## questionQ08 "-0.1469" "-0.1447" "-0.1086" " 0.4104" " 0.4526"
## questionQ09 "-0.0949" "-0.1077" "-0.0373" " 0.4368" " 0.4997"
## questionQ10 " 0.2175" " 0.2371" " 0.3038" " 0.1705" " 0.2095"
## questionQ11 " 0.2763" " 0.3102" " 0.3910" " 0.2061" " 0.2629"
## questionQ12 " 0.2724" " 0.2568" " 0.3418" " 0.1613" " 0.2104"
##          questionQ06 questionQ07 questionQ08 questionQ09 questionQ10
## questionQ01 "-0.1517" "-0.0836" "-0.1469" "-0.0949" " 0.2175"
## questionQ02 "-0.1219" "-0.0690" "-0.1447" "-0.1077" " 0.2371"
## questionQ03 "-0.0832" "-0.0246" "-0.1086" "-0.0373" " 0.3038"
## questionQ04 " 0.7585" " 0.6917" " 0.4104" " 0.4368" " 0.1705"
## questionQ05 " 0.8752" " 0.7741" " 0.4526" " 0.4997" " 0.2095"
## questionQ06 " 1.0000" " 0.9383" " 0.7499" " 0.7750" " 0.2564"
## questionQ07 " 0.9383" " 1.0000" " 0.8188" " 0.8217" " 0.3277"
## questionQ08 " 0.7499" " 0.8188" " 1.0000" " 0.9840" " 0.2687"
## questionQ09 " 0.7750" " 0.8217" " 0.9840" " 1.0000" " 0.3174"
## questionQ10 " 0.2564" " 0.3277" " 0.2687" " 0.3174" " 1.0000"
## questionQ11 " 0.2716" " 0.3418" " 0.2659" " 0.3149" " 0.7459"
## questionQ12 " 0.1907" " 0.2257" " 0.1088" " 0.1520" " 0.6523"
##          questionQ11 questionQ12
## questionQ01 " 0.2763" " 0.2724"
## questionQ02 " 0.3102" " 0.2568"
## questionQ03 " 0.3910" " 0.3418"
## questionQ04 " 0.2061" " 0.1613"
## questionQ05 " 0.2629" " 0.2104"
## questionQ06 " 0.2716" " 0.1907"
## questionQ07 " 0.3418" " 0.2257"
## questionQ08 " 0.2659" " 0.1088"
## questionQ09 " 0.3149" " 0.1520"
## questionQ10 " 0.7459" " 0.6523"
## questionQ11 " 1.0000" " 0.8099"
## questionQ12 " 0.8099" " 1.0000"
```



Model 2 correlation matrix

##	Q01_Intercept	Q02_Intercept	Q03_Intercept	Q04_Intercept
## Q01_Intercept	"1.000"	"0.881"	"0.911"	"0.267"
## Q02_Intercept	"0.881"	"1.000"	"0.848"	"0.179"
## Q03_Intercept	"0.911"	"0.848"	"1.000"	"0.295"
## Q04_Intercept	"0.267"	"0.179"	"0.295"	"1.000"
## Q05_Intercept	"0.329"	"0.248"	"0.399"	"0.927"
## Q06_Intercept	"0.219"	"0.161"	"0.288"	"0.829"
## Q07_Intercept	"0.267"	"0.199"	"0.324"	"0.794"
## Q08_Intercept	"0.175"	"0.104"	"0.210"	"0.581"
## Q09_Intercept	"0.245"	"0.159"	"0.300"	"0.634"
## Q10_Intercept	"0.415"	"0.378"	"0.485"	"0.424"
## Q11_Intercept	"0.519"	"0.483"	"0.612"	"0.494"
## Q12_Intercept	"0.506"	"0.431"	"0.570"	"0.454"
##	Q05_Intercept	Q06_Intercept	Q07_Intercept	Q08_Intercept
## Q01_Intercept	"0.329"	"0.219"	"0.267"	"0.175"
## Q02_Intercept	"0.248"	"0.161"	"0.199"	"0.104"
## Q03_Intercept	"0.399"	"0.288"	"0.324"	"0.210"
## Q04_Intercept	"0.927"	"0.829"	"0.794"	"0.581"
## Q05_Intercept	"1.000"	"0.908"	"0.852"	"0.616"
## Q06_Intercept	"0.908"	"1.000"	"0.946"	"0.797"
## Q07_Intercept	"0.852"	"0.946"	"1.000"	"0.847"
## Q08_Intercept	"0.616"	"0.797"	"0.847"	"1.000"
## Q09_Intercept	"0.689"	"0.848"	"0.880"	"0.964"
## Q10_Intercept	"0.459"	"0.474"	"0.532"	"0.437"
## Q11_Intercept	"0.547"	"0.534"	"0.587"	"0.489"
## Q12_Intercept	"0.505"	"0.477"	"0.506"	"0.392"

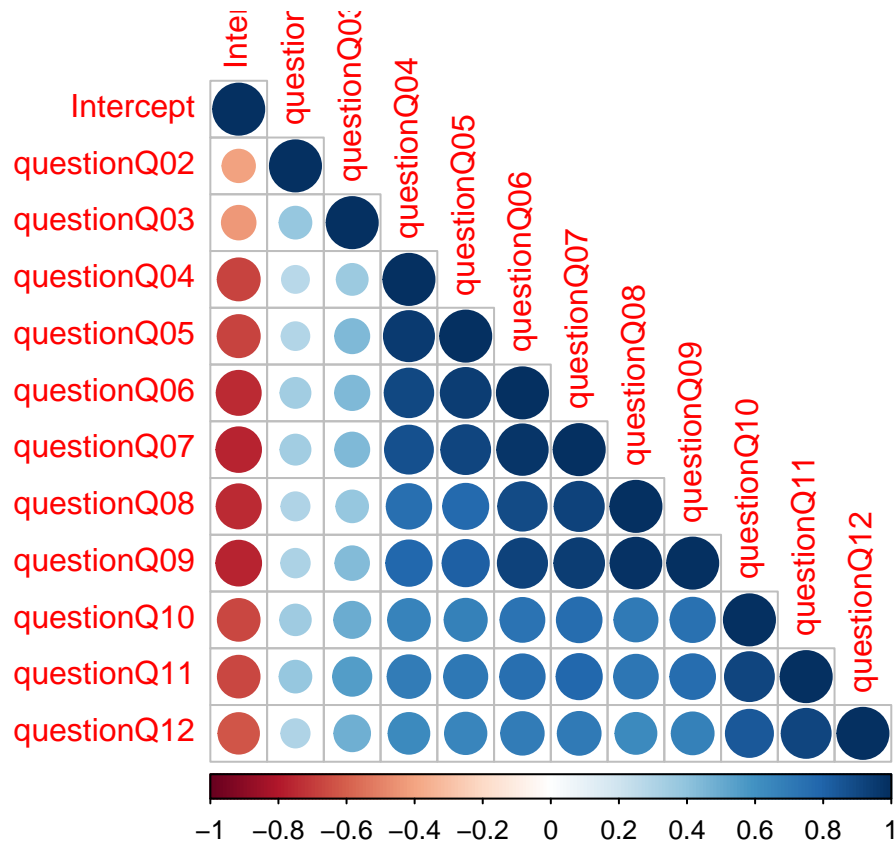
```
##          Q09_Intercept Q10_Intercept Q11_Intercept Q12_Intercept
## Q01_Intercept "0.245"      "0.415"      "0.519"      "0.506"
## Q02_Intercept "0.159"      "0.378"      "0.483"      "0.431"
## Q03_Intercept "0.300"      "0.485"      "0.612"      "0.570"
## Q04_Intercept "0.634"      "0.424"      "0.494"      "0.454"
## Q05_Intercept "0.689"      "0.459"      "0.547"      "0.505"
## Q06_Intercept "0.848"      "0.474"      "0.534"      "0.477"
## Q07_Intercept "0.880"      "0.532"      "0.587"      "0.506"
## Q08_Intercept "0.964"      "0.437"      "0.489"      "0.392"
## Q09_Intercept "1.000"      "0.503"      "0.557"      "0.453"
## Q10_Intercept "0.503"      "1.000"      "0.851"      "0.756"
## Q11_Intercept "0.557"      "0.851"      "1.000"      "0.896"
## Q12_Intercept "0.453"      "0.756"      "0.896"      "1.000"
```



Model 3 correlation matrix

```
##          Intercept questionQ02 questionQ03 questionQ04 questionQ05
## Intercept  " 1.000"  "-0.402"  "-0.432"  "-0.674"  "-0.676"
## questionQ02 "-0.402"  " 1.000"   " 0.387"   " 0.277"   " 0.293"
## questionQ03 "-0.432"  " 0.387"   " 1.000"   " 0.365"   " 0.444"
## questionQ04 "-0.674"  " 0.277"   " 0.365"   " 1.000"   " 0.959"
## questionQ05 "-0.676"  " 0.293"   " 0.444"   " 0.959"   " 1.000"
## questionQ06 "-0.741"  " 0.342"   " 0.448"   " 0.901"   " 0.949"
## questionQ07 "-0.761"  " 0.344"   " 0.444"   " 0.879"   " 0.912"
## questionQ08 "-0.744"  " 0.301"   " 0.384"   " 0.756"   " 0.778"
## questionQ09 "-0.767"  " 0.311"   " 0.431"   " 0.787"   " 0.817"
## questionQ10 "-0.666"  " 0.357"   " 0.498"   " 0.668"   " 0.679"
## questionQ11 "-0.665"  " 0.385"   " 0.558"   " 0.695"   " 0.712"
```

```
## questionQ12 "-0.628" " 0.304" " 0.488" " 0.634" " 0.654"
##               questionQ06 questionQ07 questionQ08 questionQ09 questionQ10
## Intercept   "-0.741"   "-0.761"   "-0.744"   "-0.767"   "-0.666"
## questionQ02 " 0.342"   " 0.344"   " 0.301"   " 0.311"   " 0.357"
## questionQ03 " 0.448"   " 0.444"   " 0.384"   " 0.431"   " 0.498"
## questionQ04 " 0.901"   " 0.879"   " 0.756"   " 0.787"   " 0.668"
## questionQ05 " 0.949"   " 0.912"   " 0.778"   " 0.817"   " 0.679"
## questionQ06 " 1.000"   " 0.975"   " 0.897"   " 0.925"   " 0.735"
## questionQ07 " 0.975"   " 1.000"   " 0.925"   " 0.945"   " 0.763"
## questionQ08 " 0.897"   " 0.925"   " 1.000"   " 0.984"   " 0.710"
## questionQ09 " 0.925"   " 0.945"   " 0.984"   " 1.000"   " 0.749"
## questionQ10 " 0.735"   " 0.763"   " 0.710"   " 0.749"   " 1.000"
## questionQ11 " 0.755"   " 0.781"   " 0.729"   " 0.763"   " 0.915"
## questionQ12 " 0.691"   " 0.702"   " 0.640"   " 0.670"   " 0.849"
##               questionQ11 questionQ12
## Intercept   "-0.665"   "-0.628"
## questionQ02 " 0.385"   " 0.304"
## questionQ03 " 0.558"   " 0.488"
## questionQ04 " 0.695"   " 0.634"
## questionQ05 " 0.712"   " 0.654"
## questionQ06 " 0.755"   " 0.691"
## questionQ07 " 0.781"   " 0.702"
## questionQ08 " 0.729"   " 0.640"
## questionQ09 " 0.763"   " 0.670"
## questionQ10 " 0.915"   " 0.849"
## questionQ11 " 1.000"   " 0.918"
## questionQ12 " 0.918"   " 1.000"
```



# Model 4 correlation matrix

```
##      Intercept questionQ02 questionQ03 questionQ04 questionQ05
## Intercept " 1.000" "-0.407" "-0.408" "-0.660" "-0.653"
## questionQ02 "-0.407" " 1.000" " 0.385" " 0.281" " 0.291"
## questionQ03 "-0.408" " 0.385" " 1.000" " 0.360" " 0.438"
## questionQ04 "-0.660" " 0.281" " 0.360" " 1.000" " 0.954"
## questionQ05 "-0.653" " 0.291" " 0.438" " 0.954" " 1.000"
## questionQ06 "-0.726" " 0.341" " 0.433" " 0.897" " 0.944"
## questionQ07 "-0.744" " 0.341" " 0.429" " 0.876" " 0.906"
## questionQ08 "-0.732" " 0.307" " 0.369" " 0.754" " 0.769"
## questionQ09 "-0.750" " 0.309" " 0.416" " 0.783" " 0.808"
## questionQ10 "-0.651" " 0.360" " 0.483" " 0.666" " 0.672"
## questionQ11 "-0.640" " 0.388" " 0.540" " 0.682" " 0.696"
## questionQ12 "-0.605" " 0.305" " 0.473" " 0.625" " 0.640"
##      questionQ06 questionQ07 questionQ08 questionQ09 questionQ10
## Intercept "-0.726" "-0.744" "-0.732" "-0.750" "-0.651"
## questionQ02 " 0.341" " 0.341" " 0.307" " 0.309" " 0.360"
## questionQ03 " 0.433" " 0.429" " 0.369" " 0.416" " 0.483"
## questionQ04 " 0.897" " 0.876" " 0.754" " 0.783" " 0.666"
## questionQ05 " 0.944" " 0.906" " 0.769" " 0.808" " 0.672"
## questionQ06 " 1.000" " 0.973" " 0.894" " 0.922" " 0.732"
## questionQ07 " 0.973" " 1.000" " 0.923" " 0.940" " 0.760"
## questionQ08 " 0.894" " 0.923" " 1.000" " 0.984" " 0.710"
## questionQ09 " 0.922" " 0.940" " 0.984" " 1.000" " 0.744"
## questionQ10 " 0.732" " 0.760" " 0.710" " 0.744" " 1.000"
## questionQ11 " 0.743" " 0.767" " 0.719" " 0.751" " 0.910"
## questionQ12 " 0.678" " 0.690" " 0.629" " 0.658" " 0.840"
##      questionQ11 questionQ12
## Intercept "-0.640" "-0.605"
## questionQ02 " 0.388" " 0.305"
## questionQ03 " 0.540" " 0.473"
## questionQ04 " 0.682" " 0.625"
## questionQ05 " 0.696" " 0.640"
## questionQ06 " 0.743" " 0.678"
## questionQ07 " 0.767" " 0.690"
## questionQ08 " 0.719" " 0.629"
## questionQ09 " 0.751" " 0.658"
## questionQ10 " 0.910" " 0.840"
## questionQ11 " 1.000" " 0.920"
## questionQ12 " 0.920" " 1.000"
```

