Main Analysis

Group C

Data Description

The UCLA Nurse Blood Pressure Study collected information from registered nurses in the Los Angeles area between 24 and 50 years of age on blood pressure (BP) and potential factors that contribute to hypertension. This information includes family history, and whether the subject had one or two hypertensive parents, as well as a wide range of measures of the physical and emotional condition of each nurse throughout the day. Researchers sought to study the links between BP and family history, personality, mood changes, working status, and menstrual phase. The first BP measurement was taken half an hour before the subject's normal start of work, and BP was then measured approximately every 20 minutes for the rest of the day. At each BP reading, the nurses also rate their mood on several dimensions, including how stressed they feel at the moment the BP is taken. In addition, the activity of each subject during the 10 minutes before each reading was measured using an actigraph worn on the waist.

Research Question

What are the factors that are associated with higher systolic blood pressure?

Load necessary packages

```
library(here)
library(tidyverse)
library(mice)
library(lme4)
library(lmerTest)
library(ggplot2)
```

Data Inspection and Manipulation

```
# Load data
nursebp <- read.csv(here("Data/nursebp.csv"), header = TRUE)

# Check structure
str(nursebp)
```

```
## 'data.frame':    9573 obs. of  16 variables:
##  $ SNUM    : int  1002 1002 1002 1002 1002 1002 1002 1002 1002 1002 ...
##  $ SYS     : int  136 114 130 120 117 143 118 117 91 102 ...
##  $ DIA     : int  76 63 72 68 57 64 79 79 75 65 ...
```

```
##  $ HRT     : int  77 83 80 86 85 84 79 82 75 76 ...
##  $ MNACT5  : num  NA 230 189 229 213 ...
##  $ PHASE   : chr  "L" "L" "L" "L" ...
##  $ DAY     : chr  "W" "W" "W" "W" ...
##  $ POSTURE : chr  "SIT" "STAND" "STAND" "STAND" ...
##  $ STR     : int  1 2 1 1 1 1 2 1 2 1 ...
##  $ HAP     : int  5 4 5 5 5 5 5 5 4 5 ...
##  $ TIR     : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ AGE     : int  49 49 49 49 49 49 49 49 49 49 ...
##  $ FH123   : chr  "YES" "YES" "YES" "YES" ...
##  $ time    : int  427 450 468 489 506 527 531 549 565 569 ...
##  $ timept  : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ timepass: int  0 23 41 62 79 100 104 122 138 142 ...
```

```
# Summary of key variables
summary(nursebp)
```

```
##       SNUM           SYS              DIA              HRT
##  Min.   :1002   Min.   : 75.0   Min.   : 40.00   Min.   : 35.00
##  1st Qu.:1091   1st Qu.:108.0   1st Qu.: 63.00   1st Qu.: 71.00
##  Median :1154   Median :117.0   Median : 71.00   Median : 80.00
##  Mean   :1156   Mean   :118.2   Mean   : 71.38   Mean   : 80.03
##  3rd Qu.:1231   3rd Qu.:127.0   3rd Qu.: 79.00   3rd Qu.: 88.00
##  Max.   :1307   Max.   :200.0   Max.   :120.00   Max.   :144.00
##
##      MNACT5         PHASE               DAY              POSTURE
##  Min.   :  0.0   Length:9573        Length:9573        Length:9573
##  1st Qu.:160.2   Class :character   Class :character   Class :character
##  Median :207.0   Mode  :character   Mode  :character   Mode  :character
##  Mean   :190.4
##  3rd Qu.:236.4
##  Max.   :359.4
##  NA's   :985
##       STR             HAP              TIR              AGE
##  Min.   :1.00   Min.   :1.000   Min.   :1.000   Min.   :24.00
##  1st Qu.:1.00   1st Qu.:2.000   1st Qu.:1.000   1st Qu.:33.00
##  Median :1.00   Median :3.000   Median :2.000   Median :38.00
##  Mean   :1.51   Mean   :3.099   Mean   :1.954   Mean   :37.82
##  3rd Qu.:2.00   3rd Qu.:4.000   3rd Qu.:3.000   3rd Qu.:43.00
##  Max.   :5.00   Max.   :5.000   Max.   :5.000   Max.   :50.00
##  NA's   :754    NA's   :755     NA's   :755
##     FH123                time           timept          timepass
##  Length:9573        Min.   : 300   Min.   : 1.00   Min.   :   0
##  Class :character   1st Qu.: 665   1st Qu.:12.00   1st Qu.: 217
##  Mode  :character   Median : 891   Median :24.00   Median : 443
##                     Mean   : 890   Mean   :24.41   Mean   : 447
##                     3rd Qu.:1118   3rd Qu.:36.00   3rd Qu.: 671
##                     Max.   :1439   Max.   :60.00   Max.   :1450
##
```

```
# Count missingness
colSums(is.na(nursebp))
```

```
##     SNUM      SYS      DIA      HRT   MNACT5    PHASE      DAY  POSTURE
```

```
##         0         0         0         0       985         0         0         0
##       STR       HAP       TIR       AGE    FH123      time   timept timepass
##       754       755       755         0         0         0         0         0
```

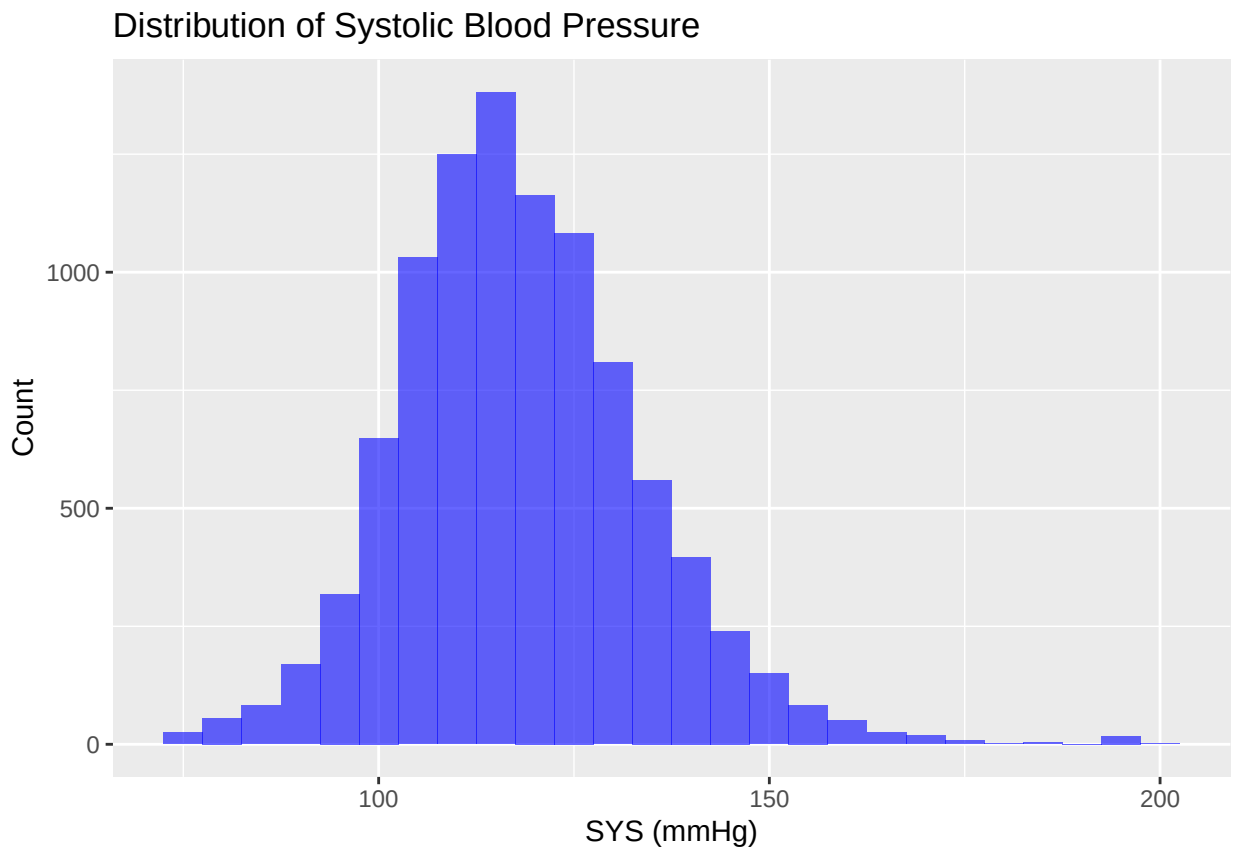
```
# Number of unique subjects
length(unique(nursebp$SNUM))
```

```
## [1] 203
```

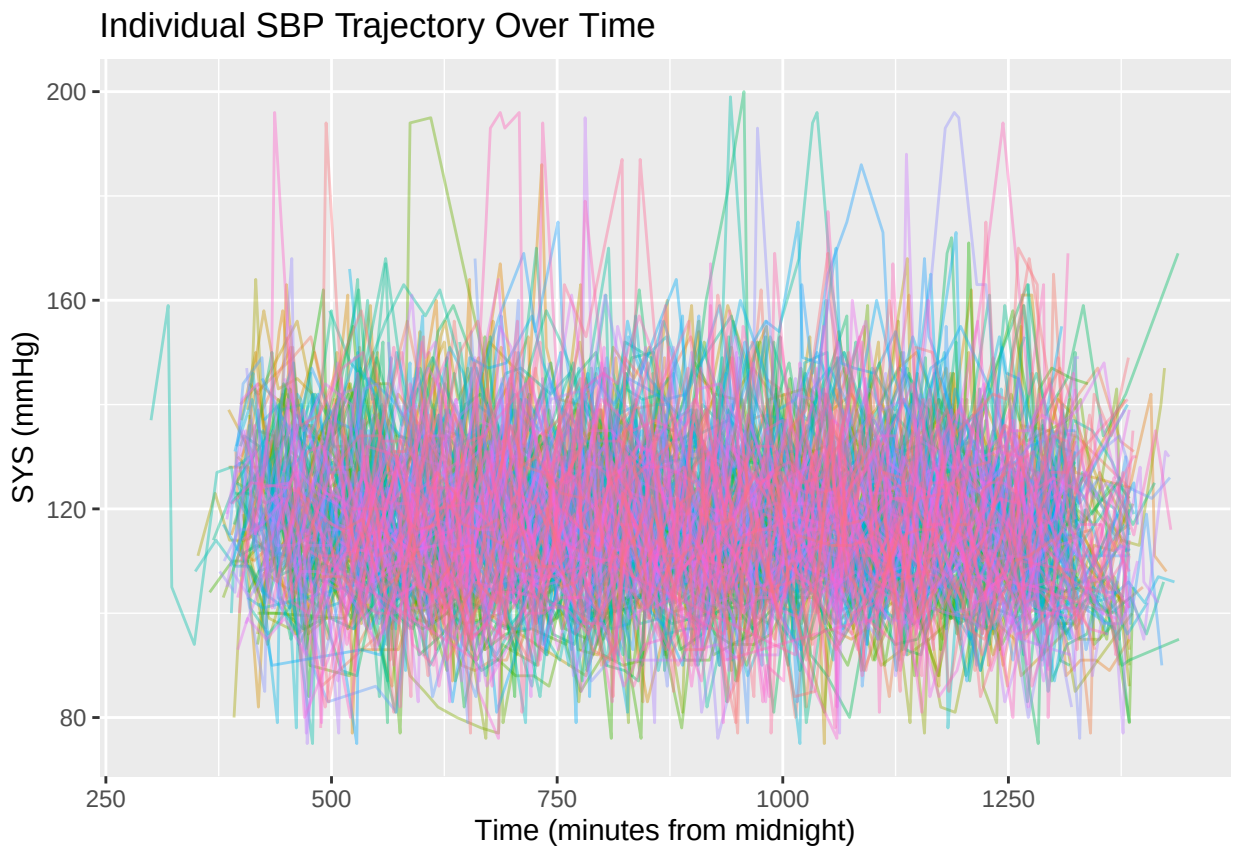
```
nursebp <- nursebp %>%
  mutate(
    DAY = as.factor(DAY),
    FH123 = as.factor(FH123),
    PHASE = as.factor(PHASE),
    POSTURE = as.factor(POSTURE),
    SNUM = as.factor(SNUM)
  )
```

Exploratory Analysis

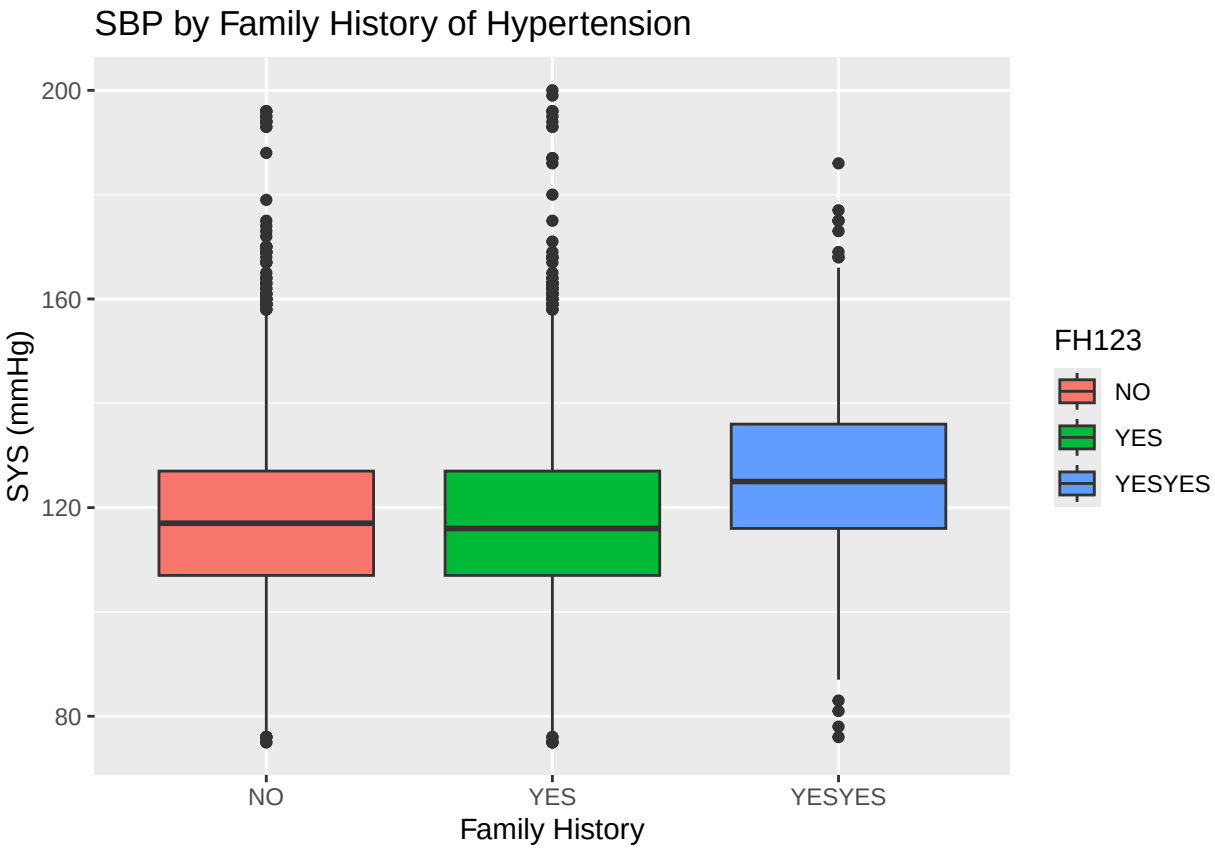
```
ggplot(nursebp, aes(x = SYS)) +
  geom_histogram(binwidth = 5, fill = "blue", alpha = 0.6) +
  labs(title = "Distribution of Systolic Blood Pressure",
       x = "SYS (mmHg)", y = "Count")
```



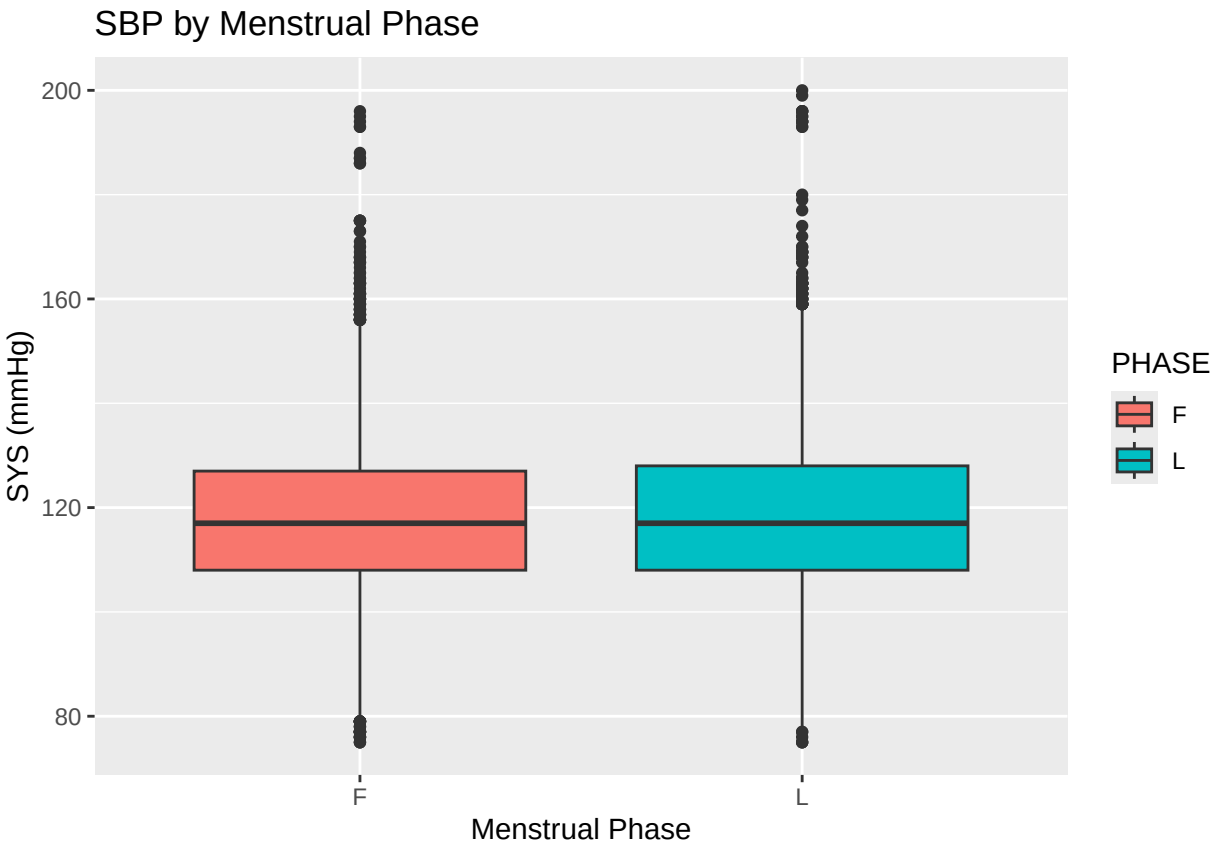
```
ggplot(nursebp, aes(x = time, y = SYS, group = SNUM, color = SNUM)) +
  geom_line(alpha = 0.4) +
  labs(title = "Individual SBP Trajectory Over Time",
       x = "Time (minutes from midnight)", y = "SYS (mmHg)") +
  theme(legend.position = "none")
```



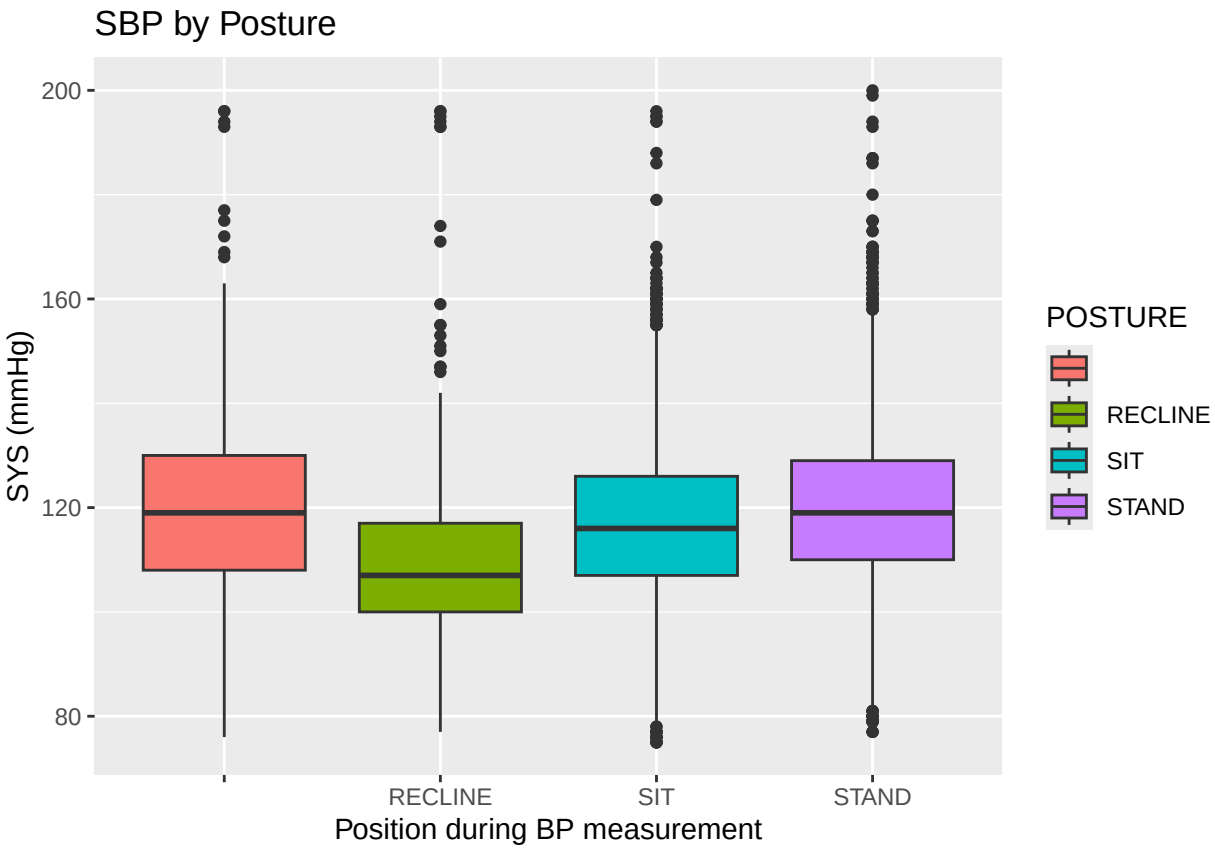

```
ggplot(nursebp, aes(x = FH123, y = SYS, fill = FH123)) +
  geom_boxplot() +
  labs(title = "SBP by Family History of Hypertension",
       x = "Family History", y = "SYS (mmHg)")
```




```
ggplot(nursebp, aes(x = PHASE, y = SYS, fill = PHASE)) +
  geom_boxplot() +
  labs(title = "SBP by Menstrual Phase",
       x = "Menstrual Phase", y = "SYS (mmHg)")
```

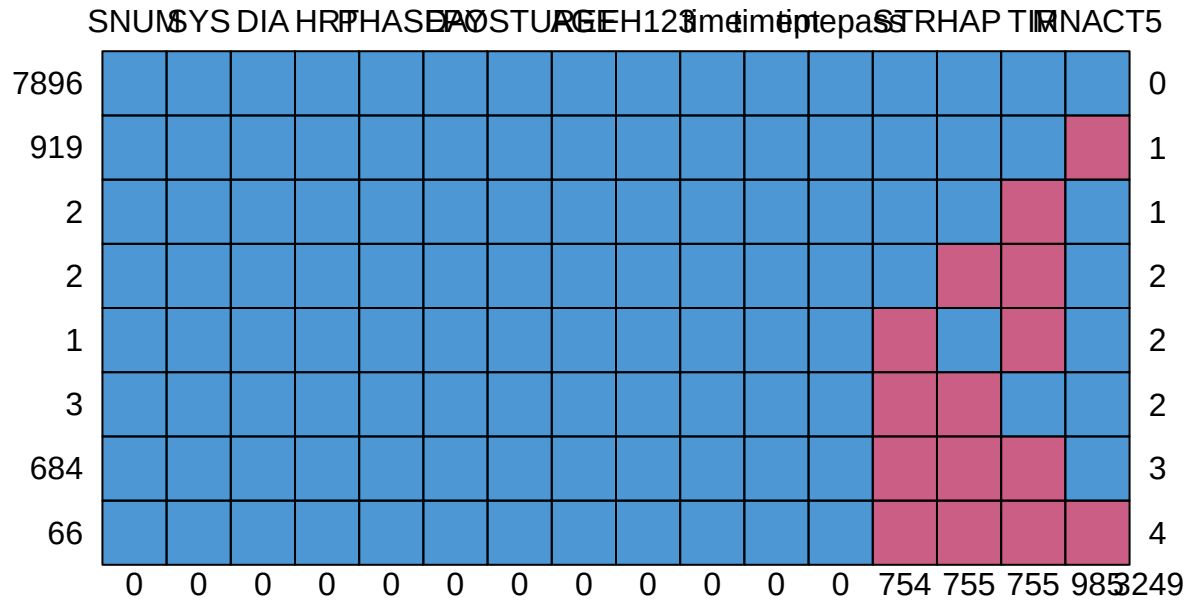



```
ggplot(nursebp, aes(x = POSTURE, y = SYS, fill = POSTURE)) +
  geom_boxplot() +
  labs(title = "SBP by Posture",
       x = "Position during BP measurement", y = "SYS (mmHg)")
```



Modelling

```
md.pattern(nursebp)
```




```
##      SNUM SYS DIA HRT PHASE DAY POSTURE AGE FH123 time timept timepass STR HAP
## 7896    1   1   1   1     1   1       1   1     1    1      1        1   1   1
## 919     1   1   1   1     1   1       1   1     1    1      1        1   1   1
## 2       1   1   1   1     1   1       1   1     1    1      1        1   1   1
## 2       1   1   1   1     1   1       1   1     1    1      1        1   1   0
## 1       1   1   1   1     1   1       1   1     1    1      1        1   0   1
## 3       1   1   1   1     1   1       1   1     1    1      1        1   0   0
## 684     1   1   1   1     1   1       1   1     1    1      1        1   0   0
## 66      1   1   1   1     1   1       1   1     1    1      1        1   0   0
##        0   0   0   0     0   0       0   0     0    0      0        0 754 755
##      TIR MNACT5
## 7896   1      1    0
## 919    1      0    1
## 2      0      1    1
## 2      0      1    2
## 1      0      1    2
## 3      1      1    2
## 684    0      1    3
## 66     0      0    4
##      755    985 3249
```

Diagnostics

Results and Interpretation

Visualization