Macular Degeneration Analysis

```r
library(tidyverse)
```

```
-- Attaching core tidyverse packages ---------------------- tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.3     v tidyr     1.3.1
v purrr     1.0.2
-- Conflicts ------------------------------------- tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom
```

```r
library(vroom)
```

```
Attaching package: 'vroom'

The following objects are masked from 'package:readr':

    as.col_spec, col_character, col_date, col_datetime, col_double,
    col_factor, col_guess, col_integer, col_logical, col_number,
    col_skip, col_time, cols, cols_condense, cols_only, date_names,
    date_names_lang, date_names_langs, default_locale, fwf_cols,
    fwf_empty, fwf_positions, fwf_widths, locale, output_column,
    problems, spec
```

```r
library(nlme)
```

```
Attaching package: 'nlme'

The following object is masked from 'package:dplyr':

    collapse
```

```r
library(multcomp)
```

```
Loading required package: mvtnorm
Loading required package: survival
Loading required package: TH.data
Loading required package: MASS

Attaching package: 'MASS'

The following object is masked from 'package:dplyr':

    select


Attaching package: 'TH.data'

The following object is masked from 'package:MASS':

    geyser
```

```r
armd <- vroom('ARMD.txt')
```

```
Rows: 200 Columns: 5
-- Column specification ---------------------------------------------------------
Delimiter: " "
dbl (5): Subject, Time, Trt, Baseline, Vision

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```
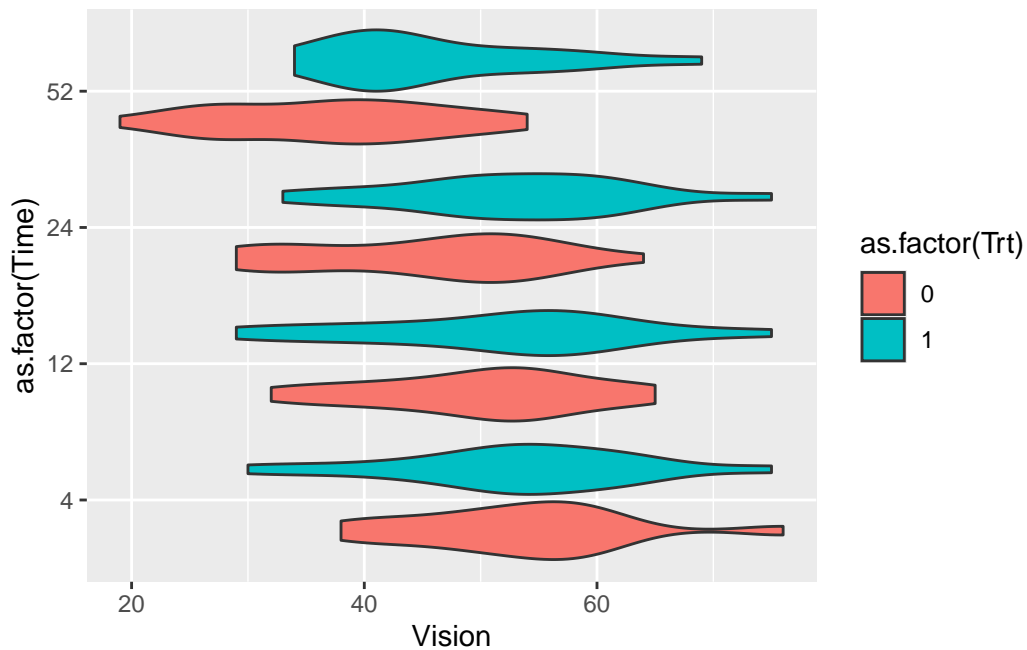
EDA

Violin Plot

It looks like the treatment is effective, but mostly just over longer periods of time.

```
ggplot(data = armd, aes(x=Vision, y=as.factor(Time), fill=as.factor(Trt))) +
  geom_violin()
```
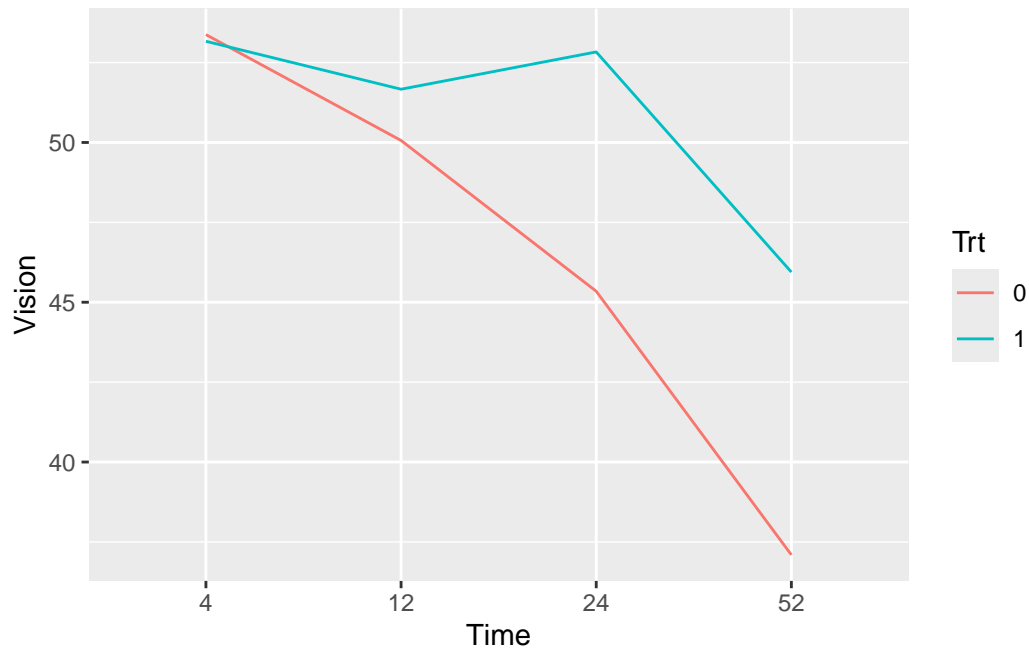

Line Plot

Vision appears to be worsening much faster without treatment than it is with treatment.

```
armd %>%
  mutate(Time = as.factor(Time),
         Trt = as.factor(Trt)) %>%
  group_by(Trt, Time) %>%
  summarize(Vision = mean(Vision)) %>%
  ggplot(data=., aes(x=Time, y=Vision, color=Trt, group=Trt)) +
  geom_line()
```

`summarise()` has grouped output by 'Trt'. You can override using the `.groups`
argument.

Correlation within Subject

```
ind.lm <- lm(Vision~. -Subject, data=armd)
ind_resids <- matrix(data=ind.lm$residuals, ncol=4, byrow = TRUE)
cor(ind_resids)
```

```
              [,1]        [,2]        [,3]         [,4]
[1,]  1.000000000  0.5428410  0.06037822 -0.007528103
[2,]  0.542840988  1.0000000  0.48044468   0.259607820
[3,]  0.060378221  0.4804447  1.00000000   0.487273324
[4,] -0.007528103  0.2596078  0.48727332   1.000000000
```

Box Regression Model

```
armd.gls <- gls(Vision~., data=armd,
            correlation=corSymm(form=~4|Subject))

coef(armd.gls) # beta-hat
```

```
(Intercept)      Subject         Time          Trt     Baseline
13.75417438   0.06585348  -0.27271312   3.52180940   0.70095783
```

```
sigma(armd.gls) # sigma-hat
```

```
[1] 7.106728
```

```
armd.gls$modelStruct$corStruct #correlation parameters
```

```
Correlation structure of class corSymm representing
 Correlation:
   1       2       3
2  0.686
3  0.081   0.421
4 -0.006   0.187   0.413
```