"Reproducing, with diabetic data (n=935), the "Evolucio_FG" (pdf and html) document"

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Version 2.0

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1 Version History

Version	Effective Date	Changes
1	15-May-2022	Replicant el document “Evolucio FG.html” amb les = que em van enviar i que pentanyen als diabètics
2	25-Sep-2022	Adding categories to mixed models (IMC, Admissions, HTA, IECA/ARA, ARNI, Months of Evolution, HbA1c control, Baseline GF, Groups of Age/Sex)

Contents

2 Càrrega de packages, dades, funcions

```
rm(list=ls())
library(compareGroups)
library(tidyverse)
library(magrittr)
library(emmeans)
library(lme4)
library(multcomp)
library(lmerTest)
library(gdata)
library(Hmisc)

setwd("/Users/jvila/Dropbox/JLupon/FGdiabet/")

load("./dat/datpre.rda")
```

Creació de 2 funcions:

```
Mixed_models_FG <- function(x, y){
  #Model time continuous
  lmer(y ~ x + x:VISIT_YEARS + (1|id), data=dades) -> model_temps_num
  model_temps_num %>% cftest -> cftest_temps_num
  model_temps_num %>% anova -> anova_temps_num

  #Model time categorical
  lmer(y ~ x + x:VISIT_YEARS_Cat + (1|id), data=dades) -> model_temps_cat
  model_temps_cat %>% cftest -> cftest_temps_cat
  model_temps_cat %>% anova -> anova_temps_cat

  emmeans(model_temps_cat, ~ VISIT_YEARS_Cat*x) -> emmeans_model_temps_cat

  plot(emmeans_model_temps_cat) + coord_flip() -> plot_emmeans

  return(list(model_tnum = model_temps_num, anova_tnum = anova_temps_num, cftest_tnum = cftest_temps_num,
              model_tcat = model_temps_cat, anova_tcat = anova_temps_cat, cftest_tcat = cftest_temps_cat,
              emmeans_model_tcat = emmeans_model_temps_cat, plot_marginal_means = plot_emmeans))
}

logitudinal_plot <- function(dades_plot){
    dades_plot %>% as.data.frame -> dades_plot
    figura <- ggplot(data = dades_plot, aes(x =  VISIT_YEARS_Cat, y = emmean, group=x, fill=x)) +
      # geom_point(size=5, col=I("black")) +
      geom_line(aes(x = VISIT_YEARS_Cat, y = emmean, col=I("black")), lwd=1.3) +
      geom_ribbon(aes(ymin = asymp.LCL,ymax = asymp.UCL), lwd=1.5, width=0.5, alpha = 0.5) +
      theme_grey(base_size = 20) + xlab("Years") + ylab("...") + # facet_grid(x~.) +
      theme(axis.text.x=element_text(angle=90, hjust=1)) + theme(legend.title = element_blank())
  return(figura)
}
```

Elimino els que tenen seguiment >= 15anys, con es va fer a "Evolucio FG.html"

```
# registres eliminats
length(subset(datpre, VISIT_YEARS >=15)$id)
```

```
## [1] 95
```

```
# aquest registres s'eliminen en individus:
length(unique(subset(datpre, VISIT_YEARS >=15)$id))
```

```
## [1] 22
```

```
# es treballa amb registres:
dades <- subset(datpre, VISIT_YEARS < 15)
length(unique(dades$id))
```

```
## [1] 935
```

He detectat que amb la instrucció que hi ha a continuació hi havia dos errors (ja hi eren al sintaxis que em vàreu passar):

- Amb error: cut(dades$VISIT_YEARS, breaks = 0:19),
- Sense error: cut(dades$VISIT_YEARS, breaks = 0:15, include.lowest = TRUE)

breaks = 0:19, talla els valors de IMC d'un en un fins a19. Però com que s'eliminen els valors més grans de 15, la instrucció correcta és breaks = 0:15

include.lowest = TRUE, si no poses aquesta subinstrucció els valors de VISIT_YEARS = 0 es quedem coma missing

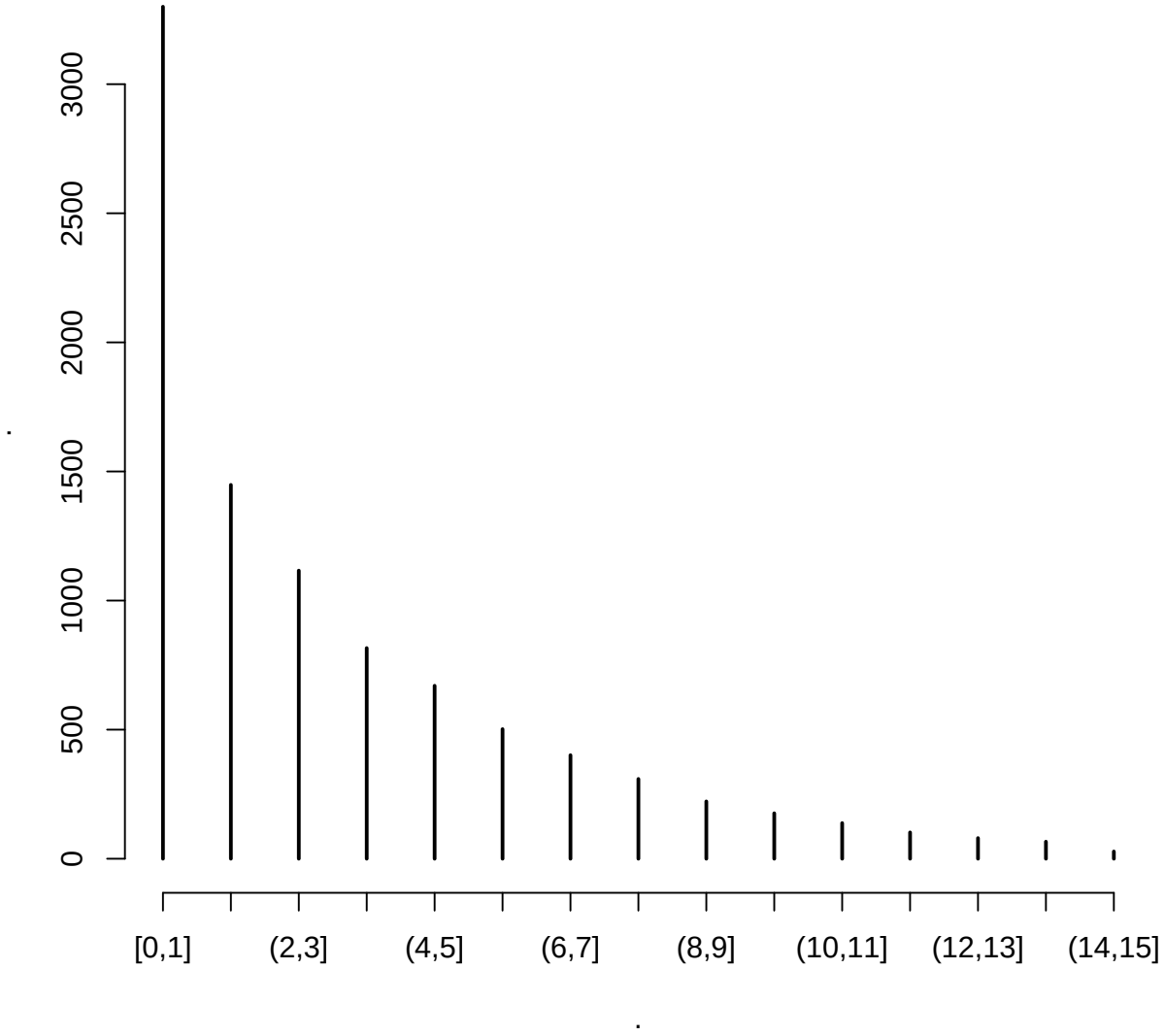
```
dades$VISIT_YEARS %>% summary
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   0.500   2.000   3.155   4.500  14.750
```

```
# dades£VISIT_YEARS_Cat <- cut(dades£VISIT_YEARS, breaks = 0:19)
dades$VISIT_YEARS_Cat <- cut(dades$VISIT_YEARS, breaks = 0:15, include.lowest = TRUE)
dades$VISIT_YEARS_Cat %>% table -> table_years_follow_up
table_years_follow_up
```

```
## .
##   [0,1]   (1,2]   (2,3]   (3,4]   (4,5]   (5,6]   (6,7]   (7,8]   (8,9]  (9,10]
##    3300    1448    1116     816     670     502     401     309     222     176
## (10,11] (11,12] (12,13] (13,14] (14,15]
##     138     102      80      66      28
```

```
table_years_follow_up %>% plot
```

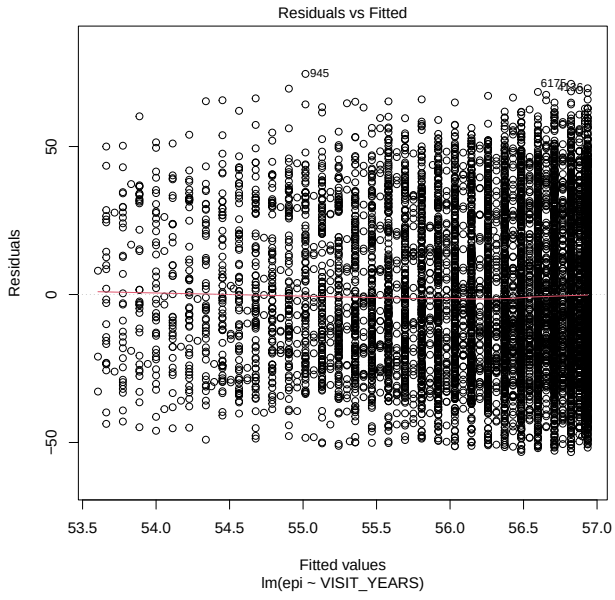

0
500
1000
1500
2000
2500
3000
[0,1]
(2,3]
(4,5]
(6,7]
(8,9]
(10,11]
(12,13]
(14,15]

3 Simple time model

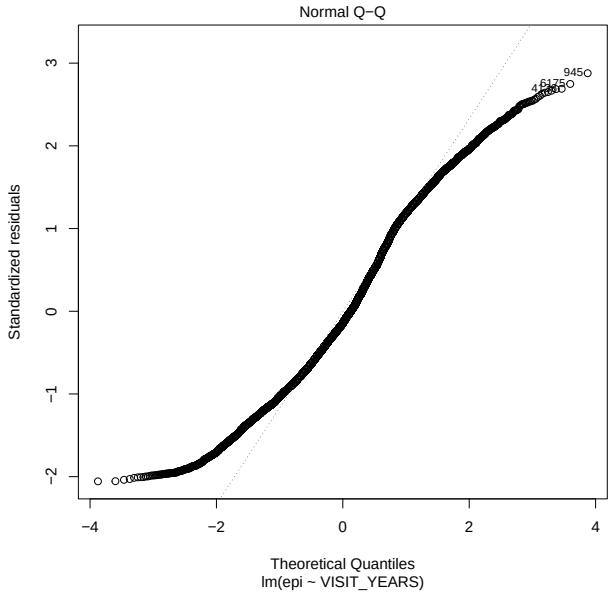
El que hi ha en aquesta secció, no veig que serveixi per res

3.1 Using VISIT_YEARS as numeric

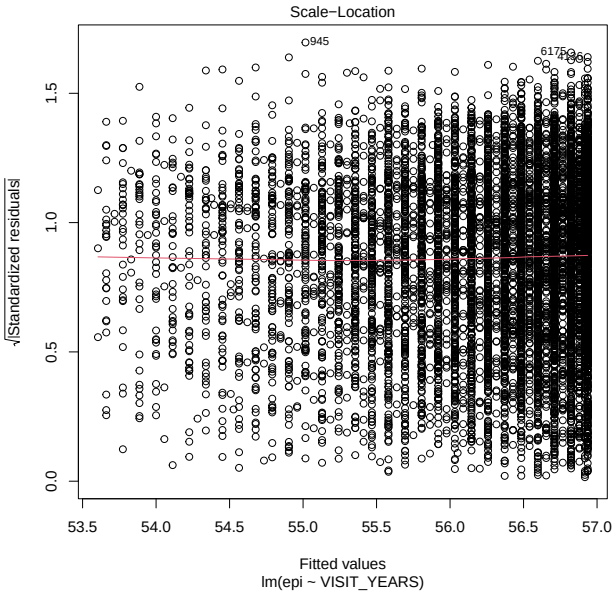
```
library(sjlabelled)
xdades <- dades[, c("epi", "VISIT_YEARS")]
model_1 <- lm(epi ~ VISIT_YEARS, data=zap_labels(dades[, c("epi", "VISIT_YEARS")]))
model_1 %>% summary

##
## Call:
## lm(formula = epi ~ VISIT_YEARS, data = zap_labels(dades[, c("epi",
##     "VISIT_YEARS")]))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -53.254 -20.415  -3.709  20.296  74.538
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 56.93633    0.37779 150.710  < 2e-16 ***
## VISIT_YEARS -0.22588    0.08455  -2.672  0.00756 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 25.9 on 9372 degrees of freedom
## Multiple R-squared:  0.000761,       Adjusted R-squared:  0.0006544
## F-statistic: 7.138 on 1 and 9372 DF,  p-value: 0.00756


model_1 %>% plot(c(1))
```



```
model_1 %>% plot(c(2))
```




```
model_1 %>% plot(c(3))
```

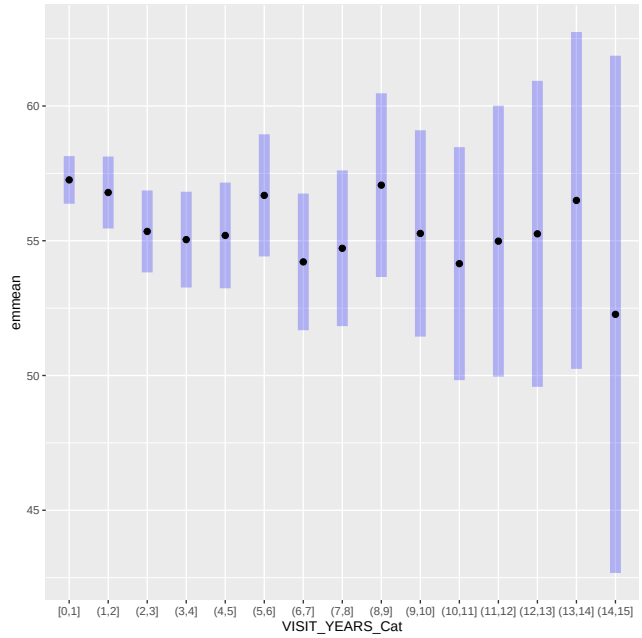


3.2 Using VISIT_YEARS as categories

```
tapply(dades$epi, dades$VISIT_YEARS_Cat, mean)

##    [0,1]    (1,2]    (2,3]    (3,4]    (4,5]    (5,6]    (6,7]    (7,8]
## 57.25805 56.79033 55.34612 55.04201 55.19698 56.68379 54.21536 54.71985
##    (8,9]   (9,10]  (10,11]  (11,12]  (12,13]  (13,14]  (14,15]
## 57.06360 55.27159 54.15029 54.98474 55.25662 56.49650 52.26909


model_2 <- lm(epi ~ VISIT_YEARS_Cat, data=dades)
emmeans(model_2, ~ VISIT_YEARS_Cat)
```

```
##  VISIT_YEARS_Cat emmean    SE   df lower.CL upper.CL
##  [0,1]              57.3 0.451 9359     56.4     58.1
##  (1,2]              56.8 0.681 9359     55.5     58.1
##  (2,3]              55.3 0.775 9359     53.8     56.9
##  (3,4]              55.0 0.907 9359     53.3     56.8
##  (4,5]              55.2 1.001 9359     53.2     57.2
##  (5,6]              56.7 1.156 9359     54.4     59.0
##  (6,7]              54.2 1.294 9359     51.7     56.8
##  (7,8]              54.7 1.474 9359     51.8     57.6
##  (8,9]              57.1 1.739 9359     53.7     60.5
##  (9,10]             55.3 1.953 9359     51.4     59.1
##  (10,11]            54.2 2.205 9359     49.8     58.5
##  (11,12]            55.0 2.565 9359     50.0     60.0
##  (12,13]            55.3 2.896 9359     49.6     60.9
##  (13,14]            56.5 3.189 9359     50.2     62.7
##  (14,15]            52.3 4.896 9359     42.7     61.9
##
## Confidence level used: 0.95
```

```
plot(emmeans(model_2, ~ VISIT_YEARS_Cat)) + coord_flip()
```



4 Mixed model

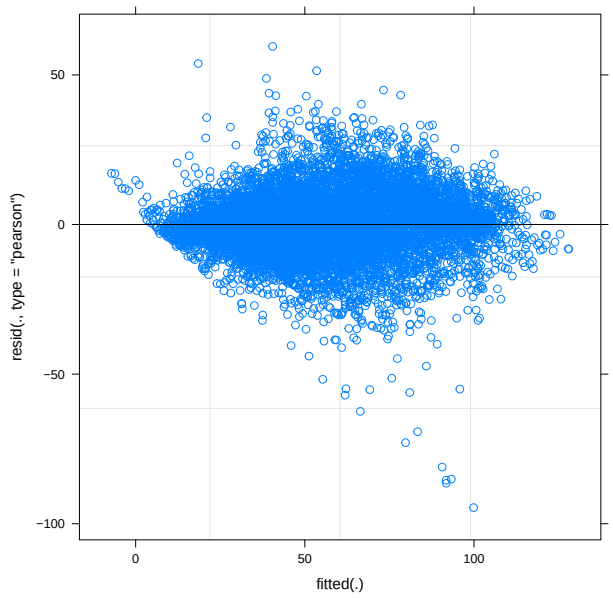
En aquesta secció s'analitza com canvia el epi al llarg dels anys, tenim en compte que un pacient té moltes mesures

4.1 Using VISIT_YEARS as numeric

```
model_3 <- lmer(epi ~ VISIT_YEARS + (1|id), data=dades)
model_3 %>% cftest
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = epi ~ VISIT_YEARS + (1 | id), data = dades)
##
## Linear Hypotheses:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0 57.95424    0.81145   71.42   <2e-16 ***
## VISIT_YEARS == 0 -2.04541    0.04794  -42.66   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_3 %>% plot
```



4.2 Using VISIT_YEARS as categories

```
model_4 <- lmer(epi ~ VISIT_YEARS_Cat + (1|id), data=dades)
model_4 %>% cftest
```

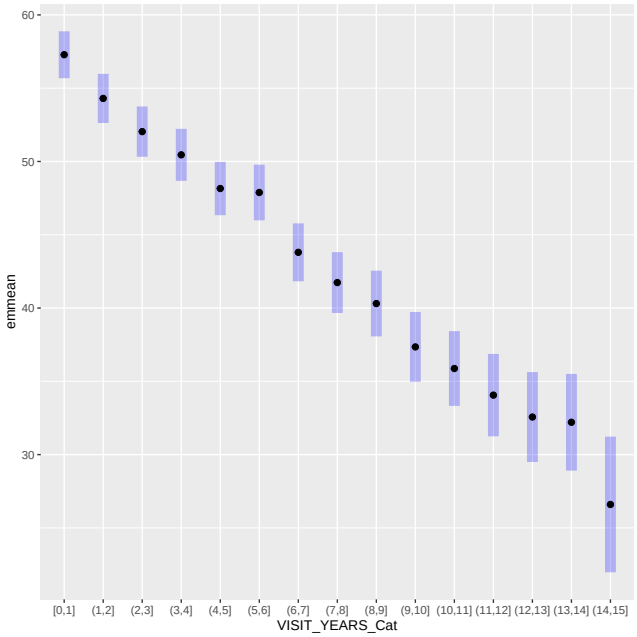
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
```

```
## Fit: lmer(formula = epi ~ VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0               57.2832     0.8162   70.18  < 2e-16 ***
## VISIT_YEARS_Cat(1,2] == 0      -2.9812     0.3798   -7.85 4.22e-15 ***
## VISIT_YEARS_Cat(2,3] == 0      -5.2461     0.4230  -12.40  < 2e-16 ***
## VISIT_YEARS_Cat(3,4] == 0      -6.8302     0.4802  -14.22  < 2e-16 ***
## VISIT_YEARS_Cat(4,5] == 0      -9.1285     0.5229  -17.46  < 2e-16 ***
## VISIT_YEARS_Cat(5,6] == 0      -9.3988     0.5909  -15.91  < 2e-16 ***
## VISIT_YEARS_Cat(6,7] == 0     -13.4817     0.6539  -20.62  < 2e-16 ***
## VISIT_YEARS_Cat(7,8] == 0     -15.5453     0.7306  -21.28  < 2e-16 ***
## VISIT_YEARS_Cat(8,9] == 0     -16.9763     0.8480  -20.02  < 2e-16 ***
## VISIT_YEARS_Cat(9,10] == 0    -19.9352     0.9407  -21.19  < 2e-16 ***
## VISIT_YEARS_Cat(10,11] == 0   -21.4092     1.0511  -20.37  < 2e-16 ***
## VISIT_YEARS_Cat(11,12] == 0   -23.2240     1.2108  -19.18  < 2e-16 ***
## VISIT_YEARS_Cat(12,13] == 0   -24.7191     1.3628  -18.14  < 2e-16 ***
## VISIT_YEARS_Cat(13,14] == 0   -25.0761     1.4988  -16.73  < 2e-16 ***
## VISIT_YEARS_Cat(14,15] == 0   -30.6854     2.2320  -13.75  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
emmeans_model_temps_cat <- emmeans(model_4, ~ VISIT_YEARS_Cat)

emmeans_model_temps_cat
```

```
##  VISIT_YEARS_Cat emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]             57.3 0.816 Inf      55.7      58.9
##  (1,2]             54.3 0.856 Inf      52.6      56.0
##  (2,3]             52.0 0.876 Inf      50.3      53.8
##  (3,4]             50.5 0.905 Inf      48.7      52.2
##  (4,5]             48.2 0.928 Inf      46.3      50.0
##  (5,6]             47.9 0.969 Inf      46.0      49.8
##  (6,7]             43.8 1.008 Inf      41.8      45.8
##  (7,8]             41.7 1.059 Inf      39.7      43.8
##  (8,9]             40.3 1.144 Inf      38.1      42.5
##  (9,10]            37.3 1.214 Inf      35.0      39.7
##  (10,11]           35.9 1.302 Inf      33.3      38.4
##  (11,12]           34.1 1.434 Inf      31.2      36.9
##  (12,13]           32.6 1.564 Inf      29.5      35.6
##  (13,14]           32.2 1.684 Inf      28.9      35.5
##  (14,15]           26.6 2.361 Inf      22.0      31.2
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
plot(emmeans_model_temps_cat) + coord_flip()
```


60
50
40
30
emmean
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
VISIT_YEARS_Cat

5 Mixed model adding SEX

En aquesta secció s'analitza com canvia el epi al llarg dels anys segons el SEX

```
model_sex <- Mixed_models_FG(dades$SEX, dades$epi)
model_sex$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                2992    2992     1  957.0  22.988  1.89e-06 ***
## x:VISIT_YEARS 239574  119787     2 8619.6 920.376 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_sex$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                    3198  3198.2     1  983.7  24.533 8.595e-07 ***
## x:VISIT_YEARS_Cat 241463  8623.7    28 8440.7  66.151 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_sex$cftest_tcat
```

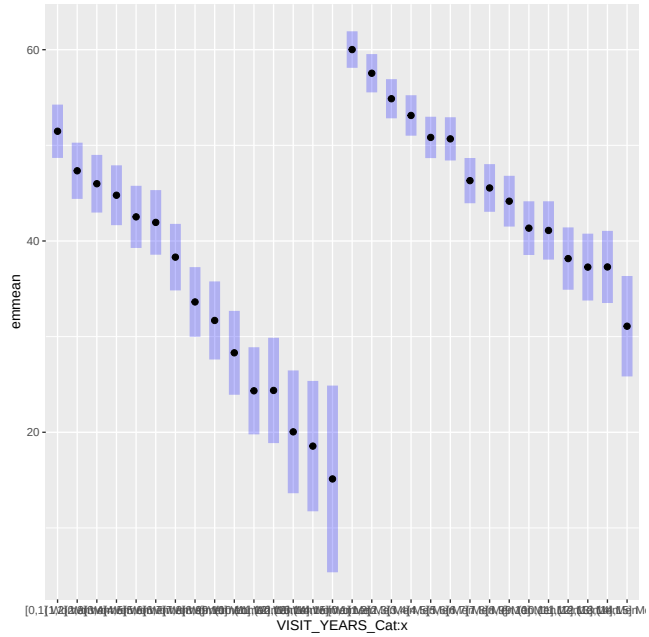
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                      51.4721     1.4224  36.187  < 2e-16 ***
## xMen == 0                              8.5412     1.7244   4.953 7.31e-07 ***
## xWomen:VISIT_YEARS_Cat(1,2] == 0      -4.1336     0.6853  -6.032 1.62e-09 ***
## xMen:VISIT_YEARS_Cat(1,2] == 0        -2.4749     0.4553  -5.436 5.46e-08 ***
## xWomen:VISIT_YEARS_Cat(2,3] == 0      -5.4865     0.7659  -7.164 7.84e-13 ***
## xMen:VISIT_YEARS_Cat(2,3] == 0        -5.1409     0.5063 -10.153  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(3,4] == 0      -6.6895     0.8781  -7.618 2.58e-14 ***
## xMen:VISIT_YEARS_Cat(3,4] == 0        -6.8891     0.5723 -12.037  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(4,5] == 0      -8.9516     0.9862  -9.077  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(4,5] == 0        -9.1859     0.6157 -14.919  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(5,6] == 0      -9.5295     1.0915  -8.731  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(5,6] == 0        -9.3371     0.7014 -13.313  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(6,7] == 0     -13.1625     1.1704 -11.246  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(6,7] == 0       -13.7025     0.7869 -17.412  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(7,8] == 0     -17.8470     1.2947 -13.785  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(7,8] == 0       -14.4702     0.8834 -16.380  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(8,9] == 0     -19.7811     1.5990 -12.371  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(8,9] == 0       -15.8530     0.9984 -15.878  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(9,10] == 0    -23.1643     1.7957 -12.900  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(9,10] == 0      -18.6713     1.1025 -16.936  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(10,11] == 0   -27.1364     1.9019 -14.268  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(10,11] == 0     -18.9113     1.2587 -15.025  < 2e-16 ***
```

```
## xWomen:VISIT_YEARS_Cat(11,12] == 0 -27.0978     2.4714 -10.964  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(11,12] == 0   -21.8535     1.3872 -15.754  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(12,13] == 0 -31.4275     2.9895 -10.513  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(12,13] == 0   -22.7431     1.5301 -14.864  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(13,14] == 0 -32.9189     3.2108 -10.252  < 2e-16 ***
## xMen:VISIT_YEARS_Cat(13,14] == 0   -22.7280     1.6927 -13.427  < 2e-16 ***
## xWomen:VISIT_YEARS_Cat(14,15] == 0 -36.3508     4.7973  -7.577 3.53e-14 ***
## xMen:VISIT_YEARS_Cat(14,15] == 0   -28.9244     2.5179 -11.488  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_sex$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x     emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           Women   51.5 1.422 Inf     48.68      54.3
##  (1,2]           Women   47.3 1.500 Inf     44.40      50.3
##  (2,3]           Women   46.0 1.538 Inf     42.97      49.0
##  (3,4]           Women   44.8 1.596 Inf     41.65      47.9
##  (4,5]           Women   42.5 1.658 Inf     39.27      45.8
##  (5,6]           Women   41.9 1.723 Inf     38.56      45.3
##  (6,7]           Women   38.3 1.775 Inf     34.83      41.8
##  (7,8]           Women   33.6 1.859 Inf     29.98      37.3
##  (8,9]           Women   31.7 2.082 Inf     27.61      35.8
##  (9,10]          Women   28.3 2.237 Inf     23.92      32.7
##  (10,11]         Women   24.3 2.324 Inf     19.78      28.9
##  (11,12]         Women   24.4 2.809 Inf     18.87      29.9
##  (12,13]         Women   20.0 3.275 Inf     13.63      26.5
##  (13,14]         Women   18.6 3.478 Inf     11.74      25.4
##  (14,15]         Women   15.1 4.980 Inf      5.36      24.9
##  [0,1]           Men     60.0 0.975 Inf     58.10      61.9
##  (1,2]           Men     57.5 1.022 Inf     55.54      59.5
##  (2,3]           Men     54.9 1.045 Inf     52.82      56.9
##  (3,4]           Men     53.1 1.079 Inf     51.01      55.2
##  (4,5]           Men     50.8 1.103 Inf     48.67      53.0
##  (5,6]           Men     50.7 1.153 Inf     48.42      52.9
##  (6,7]           Men     46.3 1.207 Inf     43.95      48.7
##  (7,8]           Men     45.5 1.272 Inf     43.05      48.0
##  (8,9]           Men     44.2 1.354 Inf     41.51      46.8
##  (9,10]          Men     41.3 1.433 Inf     38.53      44.2
##  (10,11]         Men     41.1 1.556 Inf     38.05      44.2
##  (11,12]         Men     38.2 1.662 Inf     34.90      41.4
##  (12,13]         Men     37.3 1.783 Inf     33.78      40.8
##  (13,14]         Men     37.3 1.925 Inf     33.51      41.1
##  (14,15]         Men     31.1 2.680 Inf     25.84      36.3
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_sex$plot_marginal_means
```



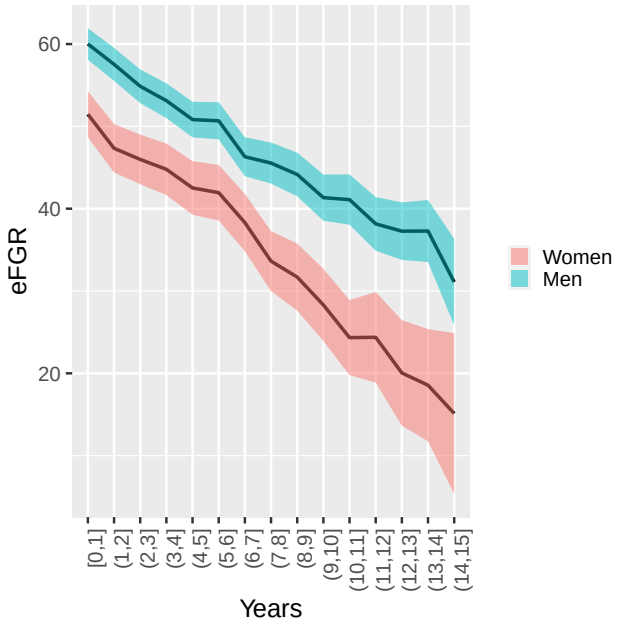

```
fiber.emt <- emtrends(model_sex$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x     VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  Women             -2.37 0.0915 Inf     -2.54     -2.19
##  Men               -1.92 0.0562 Inf     -2.03     -1.81
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast    estimate    SE  df z.ratio p.value
##  Women - Men   -0.441 0.107 Inf  -4.101  <.0001
##
## Degrees-of-freedom method: asymptotic
```

```
model_sex$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


60
40
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
Women
Men

6 Mixed model adding DIABET

Aquests models no els faig ja que precissament hem seleccionat diabetics

7 Mixed model adding FE (categories)

En aquesta secció s'analitza com canvia el epi al llarg dels anys segons categories de FE

```
dades$FE_cat <- cut(dades$FE, breaks = c(4,40,49,86))
dades$FE_cat_rec <- as.factor(dades$FE_cat)
levels(dades$FE_cat_rec) <- c('EF<=40%', 'EF 41-49%', 'EF>=50')
table(dades$FE_cat_rec, dades$FE_cat)
```

```
##
##              (4,40] (40,49] (49,86]
##   EF<=40%     7571       0       0
##   EF 41-49%      0     816       0
##   EF>=50         0       0     987
```

```
model_FE <- Mixed_models_FG(dades$FE_cat_rec, dades$epi)
model_FE$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                3063    1531     2  965.3   11.79 8.736e-06 ***
## x:VISIT_YEARS 242281   80760     3 8624.9  621.75 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_FE$cftest_tnum
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0               60.06823    0.91694  65.509  < 2e-16 ***
## xEF 41-49% == 0                -6.04518    2.65460  -2.277   0.0228 *
## xEF>=50 == 0                  -10.77636    2.36580  -4.555 5.24e-06 ***
## xEF<=40%:VISIT_YEARS == 0      -1.94634    0.05197 -37.452  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS == 0    -2.95915    0.17284 -17.121  < 2e-16 ***
## xEF>=50:VISIT_YEARS == 0       -2.26742    0.17419 -13.017  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_FE$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                    3251  1625.6     2  987.4  12.519 4.275e-06 ***
## x:VISIT_YEARS_Cat  247837  6044.8    41 8432.4  46.553 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

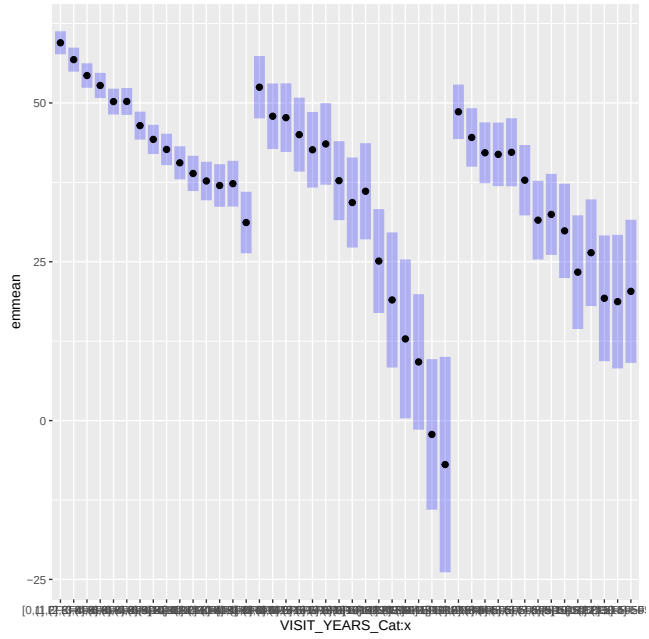
```
model_FE$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                          59.4715     0.9229  64.437  < 2e-16 ***
## xEF 41-49% == 0                           -6.9932     2.6683  -2.621 0.008772 **
## xEF>=50 == 0                             -10.8677     2.3749  -4.576 4.74e-06 ***
## xEF<=40%:VISIT_YEARS_Cat(1,2] == 0        -2.6529     0.4259  -6.229 4.70e-10 ***
## xEF 41-49%:VISIT_YEARS_Cat(1,2] == 0      -4.5692     1.1928  -3.831 0.000128 ***
## xEF>=50:VISIT_YEARS_Cat(1,2] == 0         -4.0379     1.1438  -3.530 0.000415 ***
## xEF<=40%:VISIT_YEARS_Cat(2,3] == 0        -5.1571     0.4674 -11.033  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(2,3] == 0      -4.7931     1.4367  -3.336 0.000850 ***
## xEF>=50:VISIT_YEARS_Cat(2,3] == 0         -6.4466     1.3329  -4.836 1.32e-06 ***
## xEF<=40%:VISIT_YEARS_Cat(3,4] == 0        -6.7192     0.5256 -12.783  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(3,4] == 0      -7.4693     1.8157  -4.114 3.89e-05 ***
## xEF>=50:VISIT_YEARS_Cat(3,4] == 0         -6.6963     1.5173  -4.413 1.02e-05 ***
## xEF<=40%:VISIT_YEARS_Cat(4,5] == 0        -9.2604     0.5684 -16.292  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(4,5] == 0      -9.8489     1.9219  -5.125 2.98e-07 ***
## xEF>=50:VISIT_YEARS_Cat(4,5] == 0         -6.3716     1.8026  -3.535 0.000408 ***
## xEF<=40%:VISIT_YEARS_Cat(5,6] == 0        -9.2362     0.6428 -14.369  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(5,6] == 0      -8.9315     2.2797  -3.918 8.94e-05 ***
## xEF>=50:VISIT_YEARS_Cat(5,6] == 0        -10.7632     1.9400  -5.548 2.89e-08 ***
## xEF<=40%:VISIT_YEARS_Cat(6,7] == 0       -13.0389     0.7151 -18.233  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(6,7] == 0     -14.7112     2.1244  -6.925 4.37e-12 ***
## xEF>=50:VISIT_YEARS_Cat(6,7] == 0        -17.0548     2.3994  -7.108 1.18e-12 ***
## xEF<=40%:VISIT_YEARS_Cat(7,8] == 0       -15.2098     0.7921 -19.201  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(7,8] == 0     -18.1543     2.7407  -6.624 3.50e-11 ***
## xEF>=50:VISIT_YEARS_Cat(7,8] == 0        -16.1499     2.5260  -6.394 1.62e-10 ***
## xEF<=40%:VISIT_YEARS_Cat(8,9] == 0       -16.7873     0.9156 -18.335  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(8,9] == 0     -16.3798     3.0635  -5.347 8.96e-08 ***
## xEF>=50:VISIT_YEARS_Cat(8,9] == 0        -18.7382     3.1849  -5.884 4.02e-09 ***
## xEF<=40%:VISIT_YEARS_Cat(9,10] == 0      -18.8961     1.0049 -18.804  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(9,10] == 0    -27.3654     3.4425  -7.949 1.78e-15 ***
## xEF>=50:VISIT_YEARS_Cat(9,10] == 0       -25.2390     4.0744  -6.195 5.85e-10 ***
## xEF<=40%:VISIT_YEARS_Cat(10,11] == 0     -20.5718     1.1206 -18.357  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(10,11] == 0   -33.4887     4.8851  -6.855 7.12e-12 ***
## xEF>=50:VISIT_YEARS_Cat(10,11] == 0      -22.1782     3.7565  -5.904 3.55e-09 ***
## xEF<=40%:VISIT_YEARS_Cat(11,12] == 0     -21.7569     1.2808 -16.987  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(11,12] == 0   -39.6226     5.9270  -6.685 2.31e-11 ***
## xEF>=50:VISIT_YEARS_Cat(11,12] == 0      -29.3503     4.6119  -6.364 1.97e-10 ***
## xEF<=40%:VISIT_YEARS_Cat(12,13] == 0     -22.4653     1.4755 -15.226  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(12,13] == 0   -43.2447     4.9027  -8.821  < 2e-16 ***
## xEF>=50:VISIT_YEARS_Cat(12,13] == 0      -29.8790     4.9570  -6.028 1.66e-09 ***
## xEF<=40%:VISIT_YEARS_Cat(13,14] == 0     -22.1768     1.6208 -13.683  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(13,14] == 0   -54.6537     5.5647  -9.822  < 2e-16 ***
## xEF>=50:VISIT_YEARS_Cat(13,14] == 0      -28.2609     5.3673  -5.265 1.40e-07 ***
## xEF<=40%:VISIT_YEARS_Cat(14,15] == 0     -28.2965     2.3114 -12.242  < 2e-16 ***
## xEF 41-49%:VISIT_YEARS_Cat(14,15] == 0   -59.4020     8.3208  -7.139 9.40e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_FE$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x          emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           EF<=40%     59.47 0.923 Inf    57.663     61.28
##  (1,2]           EF<=40%     56.82 0.965 Inf    54.926     58.71
##  (2,3]           EF<=40%     54.31 0.984 Inf    52.386     56.24
##  (3,4]           EF<=40%     52.75 1.013 Inf    50.766     54.74
##  (4,5]           EF<=40%     50.21 1.036 Inf    48.180     52.24
##  (5,6]           EF<=40%     50.24 1.079 Inf    48.121     52.35
##  (6,7]           EF<=40%     46.43 1.123 Inf    44.231     48.63
##  (7,8]           EF<=40%     44.26 1.174 Inf    41.961     46.56
##  (8,9]           EF<=40%     42.68 1.261 Inf    40.214     45.15
##  (9,10]          EF<=40%     40.58 1.327 Inf    37.975     43.18
##  (10,11]         EF<=40%     38.90 1.417 Inf    36.123     41.68
##  (11,12]         EF<=40%     37.71 1.547 Inf    34.683     40.75
##  (12,13]         EF<=40%     37.01 1.711 Inf    33.652     40.36
##  (13,14]         EF<=40%     37.29 1.838 Inf    33.692     40.90
##  (14,15]         EF<=40%     31.18 2.469 Inf    26.336     36.01
##  [0,1]           EF 41-49%   52.48 2.504 Inf    47.571     57.39
##  (1,2]           EF 41-49%   47.91 2.634 Inf    42.746     53.07
##  (2,3]           EF 41-49%   47.69 2.755 Inf    42.286     53.08
##  (3,4]           EF 41-49%   45.01 2.969 Inf    39.190     50.83
##  (4,5]           EF 41-49%   42.63 3.038 Inf    36.674     48.58
##  (5,6]           EF 41-49%   43.55 3.277 Inf    37.125     49.97
##  (6,7]           EF 41-49%   37.77 3.172 Inf    31.551     43.98
##  (7,8]           EF 41-49%   34.32 3.614 Inf    27.240     41.41
##  (8,9]           EF 41-49%   36.10 3.863 Inf    28.526     43.67
##  (9,10]          EF 41-49%   25.11 4.171 Inf    16.937     33.29
##  (10,11]         EF 41-49%   18.99 5.426 Inf     8.355     29.62
##  (11,12]         EF 41-49%   12.86 6.381 Inf     0.349     25.36
##  (12,13]         EF 41-49%    9.23 5.443 Inf    -1.434     19.90
##  (13,14]         EF 41-49%   -2.18 6.047 Inf   -14.028      9.68
##  (14,15]         EF 41-49%   -6.92 8.651 Inf   -23.879     10.03
##  [0,1]           EF>=50      48.60 2.188 Inf    44.315     52.89
##  (1,2]           EF>=50      44.57 2.347 Inf    39.965     49.17
##  (2,3]           EF>=50      42.16 2.446 Inf    37.364     46.95
##  (3,4]           EF>=50      41.91 2.551 Inf    36.907     46.91
##  (4,5]           EF>=50      42.23 2.732 Inf    36.878     47.59
##  (5,6]           EF>=50      37.84 2.826 Inf    32.301     43.38
##  (6,7]           EF>=50      31.55 3.159 Inf    25.357     37.74
##  (7,8]           EF>=50      32.45 3.255 Inf    26.074     38.83
##  (8,9]           EF>=50      29.87 3.790 Inf    22.437     37.29
##  (9,10]          EF>=50      23.36 4.565 Inf    14.418     32.31
##  (10,11]         EF>=50      26.43 4.283 Inf    18.031     34.82
##  (11,12]         EF>=50      19.25 5.049 Inf     9.357     29.15
##  (12,13]         EF>=50      18.72 5.366 Inf     8.208     29.24
##  (13,14]         EF>=50      20.34 5.747 Inf     9.078     31.61
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_FE$plot_marginal_means
```



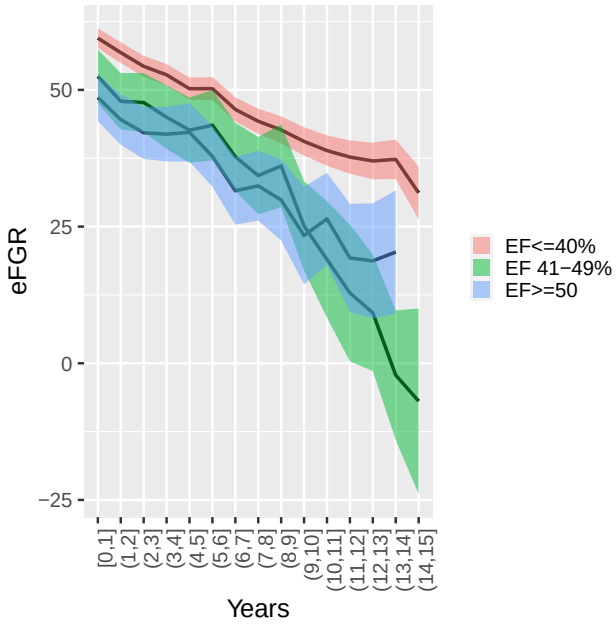

```
fiber.emt <- emtrends(model_FE$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x          VISIT_YEARS.trend    SE  df asymp.LCL asymp.UCL
##  EF<=40%                -1.95 0.052 Inf     -2.05     -1.84
##  EF 41-49%              -2.96 0.173 Inf     -3.30     -2.62
##  EF>=50                 -2.27 0.174 Inf     -2.61     -1.93
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast               estimate    SE  df z.ratio p.value
##  EF<=40% - (EF 41-49%)     1.013 0.180 Inf   5.612  <.0001
##  EF<=40% - EF>=50          0.321 0.182 Inf   1.766  0.1810
##  (EF 41-49%) - EF>=50     -0.692 0.245 Inf  -2.819  0.0134
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 3 estimates
```

```
model_FE$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


50
25
0
−25
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
EF<=40%
EF 41−49%
EF>=50

8 Mixed model adding Etiology

En aquesta secció s'analitza com canvia el epi al llarg dels anys segons categories de Etiology

```
dades$ETIOLOGIA_rec <- ifelse(dades$ETIOLOGIA == 1, 'Ischemic', 'Non ischemic')
model_ETIOLOGIA <- Mixed_models_FG(dades$ETIOLOGIA_rec, dades$epi)
model_ETIOLOGIA$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF  F value  Pr(>F)
## x                 628     628     1  955.4   4.8189 0.02839 *
## x:VISIT_YEARS  238450  119225     2 8611.9 915.1878 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_ETIOLOGIA$cftest_tnum
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                 56.43665    1.06529  52.978   <2e-16 ***
## xNon ischemic == 0                3.60121    1.64048   2.195   0.0281 *
## xIschemic:VISIT_YEARS == 0       -1.92428    0.06391 -30.109   <2e-16 ***
## xNon ischemic:VISIT_YEARS == 0 -2.20161    0.07243 -30.395   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_ETIOLOGIA$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## x                     439   439.0     1  982.9  3.3632 0.06697 .
## x:VISIT_YEARS_Cat  239843  8565.8    28 8440.9 65.6234 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_ETIOLOGIA$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                          56.0087     1.0719  52.253  < 2e-16
## xNon ischemic == 0                         3.0272     1.6507   1.834 0.066670
## xIschemic:VISIT_YEARS_Cat(1,2] == 0       -3.5526     0.5008  -7.094 1.30e-12
## xNon ischemic:VISIT_YEARS_Cat(1,2] == 0   -2.2110     0.5817  -3.801 0.000144
```

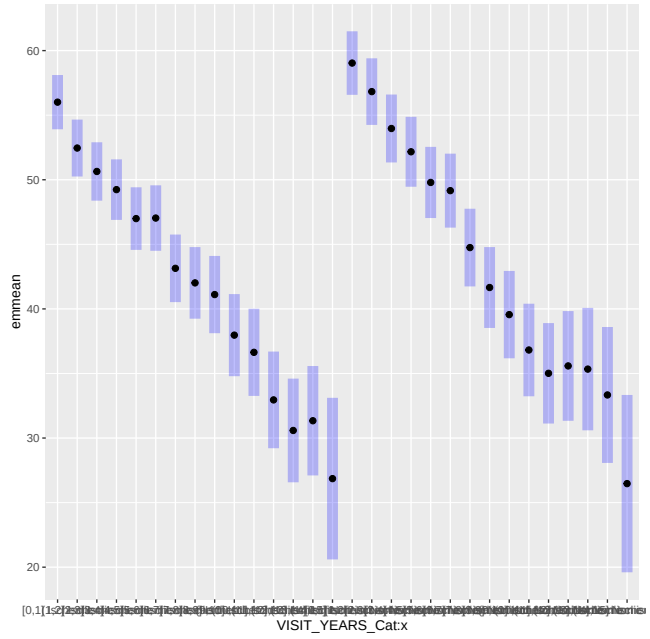
```
## xIschemic:VISIT_YEARS_Cat(2,3] == 0        -5.3670     0.5630  -9.533  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(2,3] == 0    -5.0667     0.6399  -7.918 2.44e-15
## xIschemic:VISIT_YEARS_Cat(3,4] == 0        -6.7726     0.6452 -10.498  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(3,4] == 0    -6.8702     0.7179  -9.570  < 2e-16
## xIschemic:VISIT_YEARS_Cat(4,5] == 0        -9.0157     0.7170 -12.574  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(4,5] == 0    -9.2442     0.7636 -12.106  < 2e-16
## xIschemic:VISIT_YEARS_Cat(5,6] == 0        -8.9748     0.8113 -11.062  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(5,6] == 0    -9.8790     0.8613 -11.470  < 2e-16
## xIschemic:VISIT_YEARS_Cat(6,7] == 0       -12.8670     0.8762 -14.686  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(6,7] == 0   -14.2879     0.9810 -14.565  < 2e-16
## xIschemic:VISIT_YEARS_Cat(7,8] == 0       -13.9951     0.9929 -14.095  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(7,8] == 0   -17.3798     1.0776 -16.129  < 2e-16
## xIschemic:VISIT_YEARS_Cat(8,9] == 0       -14.8984     1.1458 -13.002  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(8,9] == 0   -19.4789     1.2593 -15.468  < 2e-16
## xIschemic:VISIT_YEARS_Cat(9,10] == 0      -18.0402     1.2708 -14.196  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(9,10] == 0  -22.2187     1.3971 -15.903  < 2e-16
## xIschemic:VISIT_YEARS_Cat(10,11] == 0     -19.3717     1.3961 -13.876  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(10,11] == 0 -24.0237     1.5945 -15.067  < 2e-16
## xIschemic:VISIT_YEARS_Cat(11,12] == 0     -23.0556     1.6218 -14.216  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(11,12] == 0 -23.4519     1.8173 -12.905  < 2e-16
## xIschemic:VISIT_YEARS_Cat(12,13] == 0     -25.4220     1.7830 -14.258  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(12,13] == 0 -23.6975     2.1101 -11.231  < 2e-16
## xIschemic:VISIT_YEARS_Cat(13,14] == 0     -24.6689     1.9116 -12.905  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(13,14] == 0 -25.7001     2.4110 -10.660  < 2e-16
## xIschemic:VISIT_YEARS_Cat(14,15] == 0     -29.1511     3.0286  -9.625  < 2e-16
## xNon ischemic:VISIT_YEARS_Cat(14,15] == 0 -32.5654     3.2974  -9.876  < 2e-16
##
## (Intercept) == 0                          ***
## xNon ischemic == 0                        .
## xIschemic:VISIT_YEARS_Cat(1,2] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(1,2] == 0   ***
## xIschemic:VISIT_YEARS_Cat(2,3] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(2,3] == 0   ***
## xIschemic:VISIT_YEARS_Cat(3,4] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(3,4] == 0   ***
## xIschemic:VISIT_YEARS_Cat(4,5] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(4,5] == 0   ***
## xIschemic:VISIT_YEARS_Cat(5,6] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(5,6] == 0   ***
## xIschemic:VISIT_YEARS_Cat(6,7] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(6,7] == 0   ***
## xIschemic:VISIT_YEARS_Cat(7,8] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(7,8] == 0   ***
## xIschemic:VISIT_YEARS_Cat(8,9] == 0       ***
## xNon ischemic:VISIT_YEARS_Cat(8,9] == 0   ***
## xIschemic:VISIT_YEARS_Cat(9,10] == 0      ***
## xNon ischemic:VISIT_YEARS_Cat(9,10] == 0  ***
## xIschemic:VISIT_YEARS_Cat(10,11] == 0     ***
## xNon ischemic:VISIT_YEARS_Cat(10,11] == 0 ***
## xIschemic:VISIT_YEARS_Cat(11,12] == 0     ***
## xNon ischemic:VISIT_YEARS_Cat(11,12] == 0 ***
## xIschemic:VISIT_YEARS_Cat(12,13] == 0     ***
## xNon ischemic:VISIT_YEARS_Cat(12,13] == 0 ***
## xIschemic:VISIT_YEARS_Cat(13,14] == 0     ***
```

```
## xNon ischemic:VISIT_YEARS_Cat(13,14] == 0 ***
## xIschemic:VISIT_YEARS_Cat(14,15] == 0     ***
## xNon ischemic:VISIT_YEARS_Cat(14,15] == 0 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_ETIOLOGIA$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x            emmean   SE  df asymp.LCL asymp.UCL
##  [0,1]           Ischemic       56.0 1.07 Inf      53.9      58.1
##  (1,2]           Ischemic       52.5 1.12 Inf      50.3      54.7
##  (2,3]           Ischemic       50.6 1.15 Inf      48.4      52.9
##  (3,4]           Ischemic       49.2 1.20 Inf      46.9      51.6
##  (4,5]           Ischemic       47.0 1.24 Inf      44.6      49.4
##  (5,6]           Ischemic       47.0 1.29 Inf      44.5      49.6
##  (6,7]           Ischemic       43.1 1.34 Inf      40.5      45.8
##  (7,8]           Ischemic       42.0 1.41 Inf      39.2      44.8
##  (8,9]           Ischemic       41.1 1.53 Inf      38.1      44.1
##  (9,10]          Ischemic       38.0 1.62 Inf      34.8      41.1
##  (10,11]         Ischemic       36.6 1.72 Inf      33.3      40.0
##  (11,12]         Ischemic       33.0 1.91 Inf      29.2      36.7
##  (12,13]         Ischemic       30.6 2.05 Inf      26.6      34.6
##  (13,14]         Ischemic       31.3 2.16 Inf      27.1      35.6
##  (14,15]         Ischemic       26.9 3.19 Inf      20.6      33.1
##  [0,1]           Non ischemic   59.0 1.26 Inf      56.6      61.5
##  (1,2]           Non ischemic   56.8 1.32 Inf      54.2      59.4
##  (2,3]           Non ischemic   54.0 1.34 Inf      51.3      56.6
##  (3,4]           Non ischemic   52.2 1.38 Inf      49.5      54.9
##  (4,5]           Non ischemic   49.8 1.41 Inf      47.0      52.5
##  (5,6]           Non ischemic   49.2 1.46 Inf      46.3      52.0
##  (6,7]           Non ischemic   44.7 1.53 Inf      41.7      47.8
##  (7,8]           Non ischemic   41.7 1.60 Inf      38.5      44.8
##  (8,9]           Non ischemic   39.6 1.73 Inf      36.2      42.9
##  (9,10]          Non ischemic   36.8 1.83 Inf      33.2      40.4
##  (10,11]         Non ischemic   35.0 1.98 Inf      31.1      38.9
##  (11,12]         Non ischemic   35.6 2.17 Inf      31.3      39.8
##  (12,13]         Non ischemic   35.3 2.42 Inf      30.6      40.1
##  (13,14]         Non ischemic   33.3 2.69 Inf      28.1      38.6
##  (14,15]         Non ischemic   26.5 3.50 Inf      19.6      33.3
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_ETIOLOGIA$plot_marginal_means
```



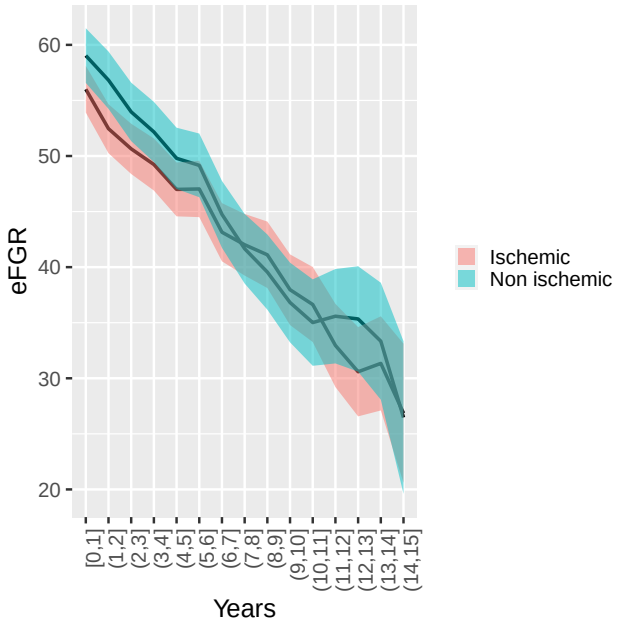

```
fiber.emt <- emtrends(model_ETIOLOGIA$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x             VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  Ischemic                  -1.92 0.0639 Inf     -2.05     -1.80
##  Non ischemic              -2.20 0.0724 Inf     -2.34     -2.06
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast                estimate     SE  df z.ratio p.value
##  Ischemic - Non ischemic    0.277 0.0966 Inf   2.871  0.0041
##
## Degrees-of-freedom method: asymptotic
```

```
model_ETIOLOGIA$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


60
50
40
30
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
Ischemic
Non ischemic

9 Mixed model adding Mortality

No veig clar aquests models. Hi ha variables explicatives (p.e. el SEX), però la mortalitat és un **outcome** i aquí s'utilitza com si fods una variable explicativa que expliqués els valors de "epi" quan és al revés: els valors de "epi" expliquen el outcome mortalitat. Ho vàreu publicar així??

```
model_MORT <- Mixed_models_FG(dades$mort_rec, dades$epi)
model_MORT$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF  F value    Pr(>F)
## x                4976    4976     1  932.5   36.741 1.957e-09 ***
## x:VISIT_YEARS 195730  195730     1 8650.8 1445.111 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_MORT$cftest_tnum
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS + (1 | id), data = dades)
##
## Linear Hypotheses:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0     63.75948    1.36670  46.652  < 2e-16 ***
## x == 0              -10.04407    1.65705  -6.061 1.35e-09 ***
## x:VISIT_YEARS == 0   -2.38711    0.06279 -38.015  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_MORT$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                    5836  5836.4     1  941.1  42.922 9.367e-11 ***
## x:VISIT_YEARS_Cat 193249 13803.5    14 8464.1 101.512 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_MORT$cftest_tcat
```

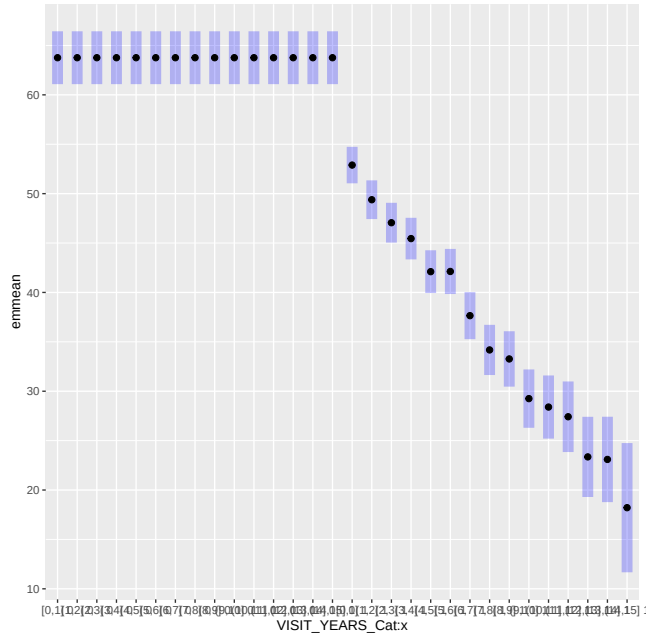
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                 63.7593     1.3649  46.712  < 2e-16 ***
## x == 0                          -10.8669     1.6587  -6.551 5.70e-11 ***
## x:VISIT_YEARS_Cat(1,2] == 0      -3.5081     0.4786  -7.330 2.31e-13 ***
## x:VISIT_YEARS_Cat(2,3] == 0      -5.8350     0.5358 -10.890  < 2e-16 ***
```

```
## x:VISIT_YEARS_Cat(3,4] == 0    -7.4418     0.6188 -12.026  < 2e-16 ***
## x:VISIT_YEARS_Cat(4,5] == 0   -10.7894     0.6705 -16.091  < 2e-16 ***
## x:VISIT_YEARS_Cat(5,6] == 0   -10.7699     0.7663 -14.055  < 2e-16 ***
## x:VISIT_YEARS_Cat(6,7] == 0   -15.2438     0.8392 -18.165  < 2e-16 ***
## x:VISIT_YEARS_Cat(7,8] == 0   -18.7132     0.9535 -19.627  < 2e-16 ***
## x:VISIT_YEARS_Cat(8,9] == 0   -19.6256     1.1291 -17.382  < 2e-16 ***
## x:VISIT_YEARS_Cat(9,10] == 0  -23.6405     1.2239 -19.316  < 2e-16 ***
## x:VISIT_YEARS_Cat(10,11] == 0 -24.4944     1.3743 -17.824  < 2e-16 ***
## x:VISIT_YEARS_Cat(11,12] == 0 -25.4762     1.5968 -15.954  < 2e-16 ***
## x:VISIT_YEARS_Cat(12,13] == 0 -29.5396     1.8756 -15.750  < 2e-16 ***
## x:VISIT_YEARS_Cat(13,14] == 0 -29.7964     2.0228 -14.731  < 2e-16 ***
## x:VISIT_YEARS_Cat(14,15] == 0 -34.6806     3.2185 -10.775  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_MORT$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           0   63.8 1.365 Inf      61.1      66.4
##  (1,2]           0   63.8 1.365 Inf      61.1      66.4
##  (2,3]           0   63.8 1.365 Inf      61.1      66.4
##  (3,4]           0   63.8 1.365 Inf      61.1      66.4
##  (4,5]           0   63.8 1.365 Inf      61.1      66.4
##  (5,6]           0   63.8 1.365 Inf      61.1      66.4
##  (6,7]           0   63.8 1.365 Inf      61.1      66.4
##  (7,8]           0   63.8 1.365 Inf      61.1      66.4
##  (8,9]           0   63.8 1.365 Inf      61.1      66.4
##  (9,10]          0   63.8 1.365 Inf      61.1      66.4
##  (10,11]         0   63.8 1.365 Inf      61.1      66.4
##  (11,12]         0   63.8 1.365 Inf      61.1      66.4
##  (12,13]         0   63.8 1.365 Inf      61.1      66.4
##  (13,14]         0   63.8 1.365 Inf      61.1      66.4
##  (14,15]         0   63.8 1.365 Inf      61.1      66.4
##  [0,1]           1   52.9 0.942 Inf      51.0      54.7
##  (1,2]           1   49.4 1.000 Inf      47.4      51.3
##  (2,3]           1   47.1 1.028 Inf      45.0      49.1
##  (3,4]           1   45.5 1.074 Inf      43.3      47.6
##  (4,5]           1   42.1 1.105 Inf      39.9      44.3
##  (5,6]           1   42.1 1.166 Inf      39.8      44.4
##  (6,7]           1   37.6 1.215 Inf      35.3      40.0
##  (7,8]           1   34.2 1.296 Inf      31.6      36.7
##  (8,9]           1   33.3 1.431 Inf      30.5      36.1
##  (9,10]          1   29.3 1.507 Inf      26.3      32.2
##  (10,11]         1   28.4 1.631 Inf      25.2      31.6
##  (11,12]         1   27.4 1.823 Inf      23.8      31.0
##  (12,13]         1   23.4 2.071 Inf      19.3      27.4
##  (13,14]         1   23.1 2.206 Inf      18.8      27.4
##  (14,15]         1   18.2 3.337 Inf      11.7      24.8
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_MORT$plot_marginal_means
```



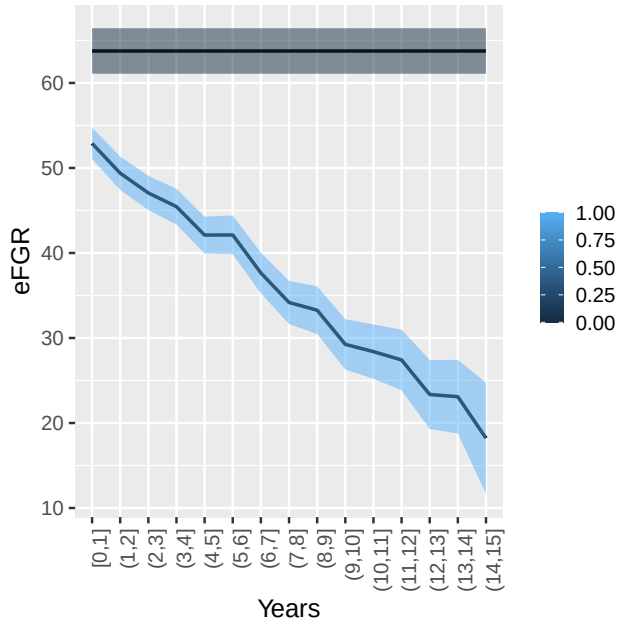

```
fiber.emt <- emtrends(model_MORT$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  0               0.00 0.0000 Inf      0.00      0.00
##  1              -2.39 0.0628 Inf     -2.51     -2.26
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast estimate     SE  df z.ratio p.value
##  x0 - x1      2.39 0.0628 Inf  38.015  <.0001
##
## Degrees-of-freedom method: asymptotic
```

```
model_MORT$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


eFGR
60
50
40
30
20
10
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
1.00
0.75
0.50
0.25
0.00

10 Mixed model adding IMC (<18.5; 18.5-24.9; 25-29.9; >=30)

Amb aquestes categories de IMC les figures queden una mica malament perquè hi ha molt posc individus amb IMC<18.5. Més endavant refaig el mateix anàlisi, però eliminant aquesta categoria

```
table(dades$IMCcat, useNA = "ifany")
```

```
##
##    <18.5 18.5-<25   25-<30      30+     <NA>
##       43     2206     4048     3006       71
```

```
model_imc <- Mixed_models_FG(dades$IMCcat, dades$epi)
model_imc$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF  F value  Pr(>F)
## x                958     319     3  942.6   2.4556 0.06176 .
## x:VISIT_YEARS 238663   59666     4 8579.6 458.9037 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_imc$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value Pr(>F)
## x                    781   260.3     3  965.5  1.9944 0.1132
## x:VISIT_YEARS_Cat 240287  5006.0    48 8375.8 38.3504 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_imc$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                          58.1486    10.1604   5.723 1.05e-08 ***
## x18.5-<25 == 0                            -3.8713    10.2935  -0.376 0.706847
## x25-<30 == 0                              -1.2860    10.2393  -0.126 0.900055
## x30+ == 0                                  1.4426    10.2613   0.141 0.888200
## x<18.5:VISIT_YEARS_Cat(1,2] == 0          -4.0384     5.6227  -0.718 0.472614
## x18.5-<25:VISIT_YEARS_Cat(1,2] == 0       -3.7786     0.7834  -4.824 1.41e-06 ***
## x25-<30:VISIT_YEARS_Cat(1,2] == 0         -2.0777     0.5686  -3.654 0.000258 ***
## x30+:VISIT_YEARS_Cat(1,2] == 0            -3.5553     0.6812  -5.219 1.80e-07 ***
## x<18.5:VISIT_YEARS_Cat(2,3] == 0          -4.7370     5.6198  -0.843 0.399272
## x18.5-<25:VISIT_YEARS_Cat(2,3] == 0       -5.8935     0.8683  -6.788 1.14e-11 ***
## x25-<30:VISIT_YEARS_Cat(2,3] == 0         -4.8330     0.6342  -7.621 2.53e-14 ***
## x30+:VISIT_YEARS_Cat(2,3] == 0            -5.2679     0.7622  -6.911 4.80e-12 ***
```

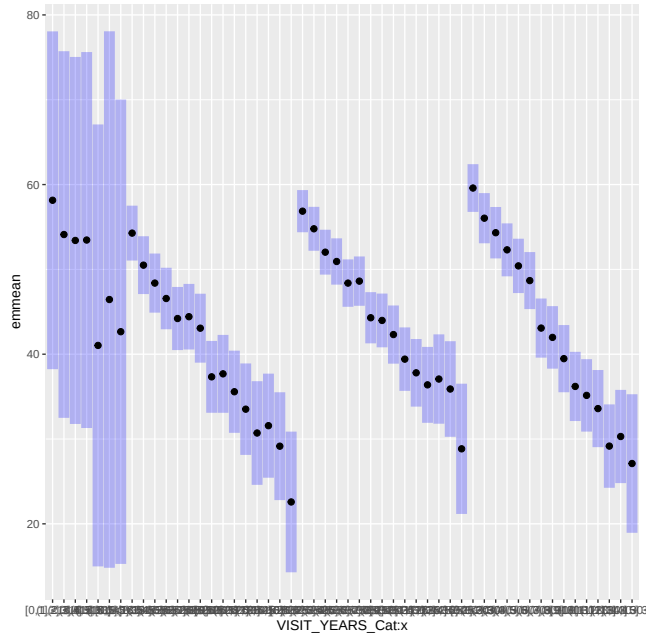
```
## x<18.5:VISIT_YEARS_Cat(3,4] == 0       -4.6891     6.1184  -0.766 0.443448
## x18.5-<25:VISIT_YEARS_Cat(3,4] == 0    -7.7105     1.0073  -7.655 1.93e-14 ***
## x25-<30:VISIT_YEARS_Cat(3,4] == 0      -5.9322     0.7195  -8.245 2.22e-16 ***
## x30+:VISIT_YEARS_Cat(3,4] == 0         -7.2883     0.8513  -8.561  < 2e-16 ***
## x<18.5:VISIT_YEARS_Cat(4,5] == 0      -17.1138     9.3235  -1.836 0.066425 .
## x18.5-<25:VISIT_YEARS_Cat(4,5] == 0   -10.0703     1.0931  -9.213  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(4,5] == 0      -8.4794     0.7824 -10.837  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(4,5] == 0         -9.1801     0.9252  -9.922  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(5,6] == 0    -9.8559     1.2151  -8.111 4.44e-16 ***
## x25-<30:VISIT_YEARS_Cat(5,6] == 0      -8.2475     0.8815  -9.357  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(5,6] == 0        -10.9126     1.0611 -10.284  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(6,7] == 0   -11.2102     1.3730  -8.165 2.22e-16 ***
## x25-<30:VISIT_YEARS_Cat(6,7] == 0     -12.5657     0.9736 -12.907  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(6,7] == 0        -16.5115     1.1618 -14.211  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(7,8] == 0   -16.9473     1.5007 -11.293  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(7,8] == 0     -12.8823     1.0911 -11.807  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(7,8] == 0        -17.6094     1.3129 -13.413  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(8,9] == 0   -16.5938     1.7530  -9.466  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(8,9] == 0     -14.5475     1.2801 -11.364  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(8,9] == 0        -20.1161     1.5057 -13.360  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(9,10] == 0  -18.7030     1.9212  -9.735  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(9,10] == 0    -17.4454     1.4900 -11.708  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(9,10] == 0       -23.3914     1.5857 -14.752  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(10,11] == 0 -20.7587     2.2681  -9.153  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(10,11] == 0   -19.0584     1.6465 -11.575  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(10,11] == 0      -24.4467     1.7110 -14.288  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(11,12] == 0 -23.5691     2.7017  -8.724  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(11,12] == 0   -20.4769     1.9470 -10.517  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(11,12] == 0      -26.0038     1.8886 -13.769  < 2e-16 ***
## x<18.5:VISIT_YEARS_Cat(12,13] == 0    -11.7028    13.0963  -0.894 0.371541
## x18.5-<25:VISIT_YEARS_Cat(12,13] == 0 -22.7046     2.7161  -8.359  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(12,13] == 0   -19.7908     2.4080  -8.219 2.22e-16 ***
## x30+:VISIT_YEARS_Cat(12,13] == 0      -30.4253     2.1144 -14.390  < 2e-16 ***
## x<18.5:VISIT_YEARS_Cat(13,14] == 0    -15.4969    10.3076  -1.503 0.132727
## x18.5-<25:VISIT_YEARS_Cat(13,14] == 0 -25.1226     2.8459  -8.828  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(13,14] == 0   -20.9673     2.6166  -8.013 1.11e-15 ***
## x30+:VISIT_YEARS_Cat(13,14] == 0      -29.2946     2.4577 -11.920  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(14,15] == 0 -31.6977     3.9344  -8.057 8.88e-16 ***
## x25-<30:VISIT_YEARS_Cat(14,15] == 0   -28.0186     3.7311  -7.510 5.93e-14 ***
## x30+:VISIT_YEARS_Cat(14,15] == 0      -32.4797     3.9424  -8.239 2.22e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_imc$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x        emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           <18.5      58.1 10.16 Inf      38.2      78.1
##  (1,2]           <18.5      54.1 11.03 Inf      32.5      75.7
##  (2,3]           <18.5      53.4 11.04 Inf      31.8      75.0
##  (3,4]           <18.5      53.5 11.31 Inf      31.3      75.6
##  (4,5]           <18.5      41.0 13.29 Inf      15.0      67.1
##  (12,13]         <18.5      46.4 16.14 Inf      14.8      78.1
##  (13,14]         <18.5      42.7 13.97 Inf      15.3      70.0
```

```
##  [0,1]           18.5-<25   54.3  1.65 Inf      51.0      57.5
##  (1,2]           18.5-<25   50.5  1.74 Inf      47.1      53.9
##  (2,3]           18.5-<25   48.4  1.78 Inf      44.9      51.9
##  (3,4]           18.5-<25   46.6  1.85 Inf      42.9      50.2
##  (4,5]           18.5-<25   44.2  1.90 Inf      40.5      47.9
##  (5,6]           18.5-<25   44.4  1.97 Inf      40.6      48.3
##  (6,7]           18.5-<25   43.1  2.07 Inf      39.0      47.1
##  (7,8]           18.5-<25   37.3  2.16 Inf      33.1      41.6
##  (8,9]           18.5-<25   37.7  2.34 Inf      33.1      42.3
##  (9,10]          18.5-<25   35.6  2.47 Inf      30.7      40.4
##  (10,11]         18.5-<25   33.5  2.75 Inf      28.1      38.9
##  (11,12]         18.5-<25   30.7  3.12 Inf      24.6      36.8
##  (12,13]         18.5-<25   31.6  3.13 Inf      25.4      37.7
##  (13,14]         18.5-<25   29.2  3.24 Inf      22.8      35.5
##  (14,15]         18.5-<25   22.6  4.23 Inf      14.3      30.9
##  [0,1]           25-<30     56.9  1.27 Inf      54.4      59.3
##  (1,2]           25-<30     54.8  1.32 Inf      52.2      57.4
##  (2,3]           25-<30     52.0  1.35 Inf      49.4      54.7
##  (3,4]           25-<30     50.9  1.39 Inf      48.2      53.7
##  (4,5]           25-<30     48.4  1.43 Inf      45.6      51.2
##  (5,6]           25-<30     48.6  1.48 Inf      45.7      51.5
##  (6,7]           25-<30     44.3  1.54 Inf      41.3      47.3
##  (7,8]           25-<30     44.0  1.62 Inf      40.8      47.1
##  (8,9]           25-<30     42.3  1.75 Inf      38.9      45.7
##  (9,10]          25-<30     39.4  1.91 Inf      35.7      43.2
##  (10,11]         25-<30     37.8  2.03 Inf      33.8      41.8
##  (11,12]         25-<30     36.4  2.28 Inf      31.9      40.9
##  (12,13]         25-<30     37.1  2.69 Inf      31.8      42.3
##  (13,14]         25-<30     35.9  2.88 Inf      30.3      41.5
##  (14,15]         25-<30     28.8  3.92 Inf      21.2      36.5
##  [0,1]           30+        59.6  1.44 Inf      56.8      62.4
##  (1,2]           30+        56.0  1.51 Inf      53.1      59.0
##  (2,3]           30+        54.3  1.55 Inf      51.3      57.4
##  (3,4]           30+        52.3  1.59 Inf      49.2      55.4
##  (4,5]           30+        50.4  1.63 Inf      47.2      53.6
##  (5,6]           30+        48.7  1.72 Inf      45.3      52.0
##  (6,7]           30+        43.1  1.78 Inf      39.6      46.6
##  (7,8]           30+        42.0  1.88 Inf      38.3      45.7
##  (8,9]           30+        39.5  2.02 Inf      35.5      43.4
##  (9,10]          30+        36.2  2.08 Inf      32.1      40.3
##  (10,11]         30+        35.1  2.18 Inf      30.9      39.4
##  (11,12]         30+        33.6  2.32 Inf      29.0      38.1
##  (12,13]         30+        29.2  2.51 Inf      24.2      34.1
##  (13,14]         30+        30.3  2.80 Inf      24.8      35.8
##  (14,15]         30+        27.1  4.17 Inf      18.9      35.3
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_imc$plot_marginal_means
```



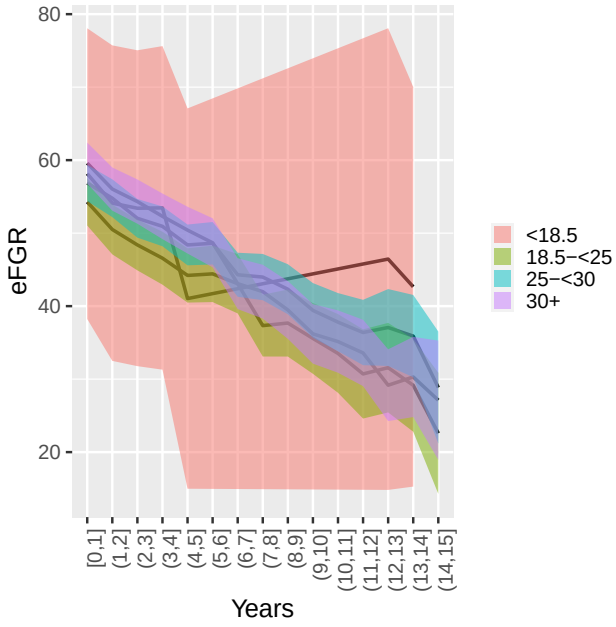

```
fiber.emt <- emtrends(model_imc$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x         VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  <18.5                -1.33 0.6367 Inf     -2.58   -0.0863
##  18.5-<25             -2.01 0.0983 Inf     -2.21   -1.8206
##  25-<30               -1.80 0.0744 Inf     -1.94   -1.6497
##  30+                  -2.36 0.0820 Inf     -2.52   -2.2013
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast              estimate    SE  df z.ratio p.value
##  <18.5 - (18.5-<25)       0.679 0.644 Inf   1.054  0.7175
##  <18.5 - (25-<30)         0.461 0.641 Inf   0.720  0.8893
##  <18.5 - (30+)            1.028 0.642 Inf   1.601  0.3779
##  (18.5-<25) - (25-<30)   -0.218 0.123 Inf  -1.765  0.2901
##  (18.5-<25) - (30+)       0.349 0.128 Inf   2.725  0.0326
##  (25-<30) - (30+)         0.566 0.111 Inf   5.115  <.0001
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 4 estimates
```

```
model_imc$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


80
60
40
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
<18.5
18.5–<25
25–<30
30+

11 Mixed model adding IMC (deleting <18.5 category)

Amb aquestes categories de IMC les figures queden una mica malament perquè hi ha molt posc individus amb IMC<18.5. Més endavant refaig el mateix anàlisi, però eliminant aquesta categoria

```
xdades <- dades
dades <- subset(dades, IMCcat!="<18.5")
model_imc <- Mixed_models_FG(dades$IMCcat, dades$epi)
model_imc$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## x                 966     483     2  934.5   3.711 0.02481 *
## x:VISIT_YEARS 238014   79338     3 8515.8 609.259 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_imc$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## x                    786   393.1     2  961.5  3.0083 0.04984 *
## x:VISIT_YEARS_Cat 239417  5700.4    42 8333.6 43.6197 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_imc$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                          54.2778     1.6440  33.016  < 2e-16 ***
## x25-<30 == 0                               2.5850     2.0738   1.247 0.212568
## x30+ == 0                                  5.3136     2.1790   2.439 0.014746 *
## x18.5-<25:VISIT_YEARS_Cat(1,2] == 0       -3.7768     0.7838  -4.819 1.45e-06 ***
## x25-<30:VISIT_YEARS_Cat(1,2] == 0         -2.0768     0.5689  -3.651 0.000261 ***
## x30+:VISIT_YEARS_Cat(1,2] == 0            -3.5537     0.6816  -5.214 1.85e-07 ***
## x18.5-<25:VISIT_YEARS_Cat(2,3] == 0       -5.8912     0.8688  -6.781 1.19e-11 ***
## x25-<30:VISIT_YEARS_Cat(2,3] == 0         -4.8317     0.6345  -7.615 2.64e-14 ***
## x30+:VISIT_YEARS_Cat(2,3] == 0            -5.2660     0.7626  -6.905 5.02e-12 ***
## x18.5-<25:VISIT_YEARS_Cat(3,4] == 0       -7.7078     1.0078  -7.648 2.04e-14 ***
## x25-<30:VISIT_YEARS_Cat(3,4] == 0         -5.9306     0.7199  -8.238 2.22e-16 ***
## x30+:VISIT_YEARS_Cat(3,4] == 0            -7.2862     0.8518  -8.554  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(4,5] == 0      -10.0668     1.0937  -9.204  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(4,5] == 0         -8.4776     0.7829 -10.829  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(4,5] == 0            -9.1771     0.9257  -9.914  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(5,6] == 0       -9.8523     1.2158  -8.103 4.44e-16 ***
## x25-<30:VISIT_YEARS_Cat(5,6] == 0         -8.2455     0.8820  -9.349  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(5,6] == 0           -10.9092     1.0617 -10.275  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(6,7] == 0      -11.2062     1.3738  -8.157 4.44e-16 ***
```

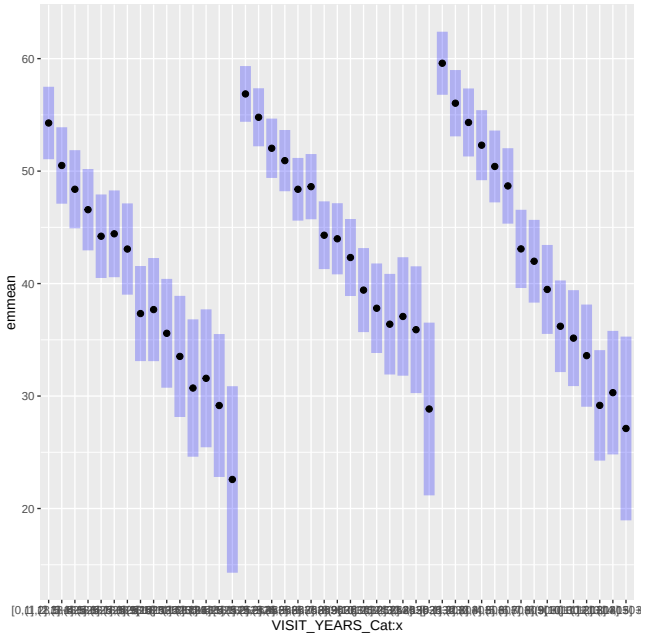
```
## x25-<30:VISIT_YEARS_Cat(6,7] == 0     -12.5636     0.9741 -12.897  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(6,7] == 0        -16.5076     1.1625 -14.200  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(7,8] == 0   -16.9432     1.5015 -11.284  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(7,8] == 0     -12.8797     1.0917 -11.798  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(7,8] == 0        -17.6056     1.3136 -13.402  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(8,9] == 0   -16.5895     1.7539  -9.458  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(8,9] == 0     -14.5446     1.2808 -11.355  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(8,9] == 0        -20.1115     1.5065 -13.350  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(9,10] == 0  -18.6988     1.9223  -9.728  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(9,10] == 0    -17.4422     1.4909 -11.699  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(9,10] == 0       -23.3868     1.5866 -14.740  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(10,11] == 0 -20.7544     2.2694  -9.145  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(10,11] == 0   -19.0554     1.6475 -11.566  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(10,11] == 0      -24.4417     1.7120 -14.277  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(11,12] == 0 -23.5648     2.7033  -8.717  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(11,12] == 0   -20.4737     1.9481 -10.510  < 2e-16 ***
## x30+:VISIT_YEARS_Cat(11,12] == 0      -25.9986     1.8897 -13.758  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(12,13] == 0 -22.7006     2.7177  -8.353  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(12,13] == 0   -19.7870     2.4094  -8.213 2.22e-16 ***
## x30+:VISIT_YEARS_Cat(12,13] == 0      -30.4206     2.1156 -14.379  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(13,14] == 0 -25.1186     2.8475  -8.821  < 2e-16 ***
## x25-<30:VISIT_YEARS_Cat(13,14] == 0   -20.9634     2.6181  -8.007 1.11e-15 ***
## x30+:VISIT_YEARS_Cat(13,14] == 0      -29.2895     2.4591 -11.911  < 2e-16 ***
## x18.5-<25:VISIT_YEARS_Cat(14,15] == 0 -31.6939     3.9366  -8.051 8.88e-16 ***
## x25-<30:VISIT_YEARS_Cat(14,15] == 0   -28.0145     3.7332  -7.504 6.20e-14 ***
## x30+:VISIT_YEARS_Cat(14,15] == 0      -32.4742     3.9446  -8.233 2.22e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_imc$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x        emmean   SE  df asymp.LCL asymp.UCL
##  [0,1]           18.5-<25   54.3 1.64 Inf      51.1      57.5
##  (1,2]           18.5-<25   50.5 1.73 Inf      47.1      53.9
##  (2,3]           18.5-<25   48.4 1.77 Inf      44.9      51.9
##  (3,4]           18.5-<25   46.6 1.85 Inf      43.0      50.2
##  (4,5]           18.5-<25   44.2 1.89 Inf      40.5      47.9
##  (5,6]           18.5-<25   44.4 1.97 Inf      40.6      48.3
##  (6,7]           18.5-<25   43.1 2.07 Inf      39.0      47.1
##  (7,8]           18.5-<25   37.3 2.16 Inf      33.1      41.6
##  (8,9]           18.5-<25   37.7 2.34 Inf      33.1      42.3
##  (9,10]          18.5-<25   35.6 2.47 Inf      30.7      40.4
##  (10,11]         18.5-<25   33.5 2.75 Inf      28.1      38.9
##  (11,12]         18.5-<25   30.7 3.12 Inf      24.6      36.8
##  (12,13]         18.5-<25   31.6 3.13 Inf      25.4      37.7
##  (13,14]         18.5-<25   29.2 3.24 Inf      22.8      35.5
##  (14,15]         18.5-<25   22.6 4.23 Inf      14.3      30.9
##  [0,1]           25-<30     56.9 1.26 Inf      54.4      59.3
##  (1,2]           25-<30     54.8 1.32 Inf      52.2      57.4
##  (2,3]           25-<30     52.0 1.35 Inf      49.4      54.7
##  (3,4]           25-<30     50.9 1.39 Inf      48.2      53.7
##  (4,5]           25-<30     48.4 1.42 Inf      45.6      51.2
##  (5,6]           25-<30     48.6 1.48 Inf      45.7      51.5
```

```
##  (6,7]           25-<30     44.3 1.54 Inf      41.3      47.3
##  (7,8]           25-<30     44.0 1.61 Inf      40.8      47.1
##  (8,9]           25-<30     42.3 1.75 Inf      38.9      45.7
##  (9,10]          25-<30     39.4 1.91 Inf      35.7      43.2
##  (10,11]         25-<30     37.8 2.03 Inf      33.8      41.8
##  (11,12]         25-<30     36.4 2.28 Inf      31.9      40.9
##  (12,13]         25-<30     37.1 2.69 Inf      31.8      42.3
##  (13,14]         25-<30     35.9 2.88 Inf      30.3      41.5
##  (14,15]         25-<30     28.8 3.92 Inf      21.2      36.5
##  [0,1]           30+        59.6 1.43 Inf      56.8      62.4
##  (1,2]           30+        56.0 1.50 Inf      53.1      59.0
##  (2,3]           30+        54.3 1.54 Inf      51.3      57.3
##  (3,4]           30+        52.3 1.59 Inf      49.2      55.4
##  (4,5]           30+        50.4 1.63 Inf      47.2      53.6
##  (5,6]           30+        48.7 1.71 Inf      45.3      52.0
##  (6,7]           30+        43.1 1.77 Inf      39.6      46.6
##  (7,8]           30+        42.0 1.88 Inf      38.3      45.7
##  (8,9]           30+        39.5 2.02 Inf      35.5      43.4
##  (9,10]          30+        36.2 2.08 Inf      32.1      40.3
##  (10,11]         30+        35.1 2.18 Inf      30.9      39.4
##  (11,12]         30+        33.6 2.32 Inf      29.0      38.1
##  (12,13]         30+        29.2 2.51 Inf      24.3      34.1
##  (13,14]         30+        30.3 2.80 Inf      24.8      35.8
##  (14,15]         30+        27.1 4.17 Inf      18.9      35.3
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_imc$plot_marginal_means
```




```
fiber.emt <- emtrends(model_imc$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

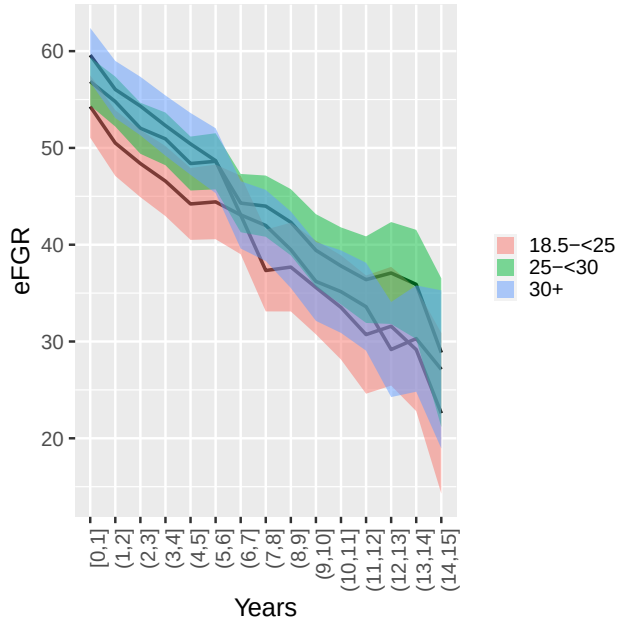
```
##  x         VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  18.5-<25             -2.01 0.0984 Inf     -2.21     -1.82
```

```
##  25-<30               -1.80 0.0745 Inf     -1.94     -1.65
##  30+                  -2.36 0.0821 Inf     -2.52     -2.20
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast              estimate    SE  df z.ratio p.value
##  (18.5-<25) - (25-<30)   -0.218 0.123 Inf  -1.763  0.1821
##  (18.5-<25) - (30+)       0.349 0.128 Inf   2.723  0.0178
##  (25-<30) - (30+)         0.566 0.111 Inf   5.110  <.0001
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 3 estimates
```

```
model_imc$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```




```
dades <- xdades
```

12 Mixed model adding Number of Admissions (grouped)

```
model_admi <- Mixed_models_FG(dades$ingressos_agrupats, dades$epi)
model_admi$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF  F value    Pr(>F)
## x                2169    1084     2  947.3   8.4325 0.0002344 ***
## x:VISIT_YEARS 252169   84056     3 8607.3 653.6966 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_admi$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                    2343  1171.3     2  975.3  9.1227 0.0001188 ***
## x:VISIT_YEARS_Cat 259134  6169.9    42 8425.0 48.0522 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_admi$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                    60.0932     1.0394  57.817  < 2e-16 ***
## x1-2 == 0                           -6.5416     1.8516  -3.533 0.000411 ***
## x>=3 == 0                           -7.8556     2.4829  -3.164 0.001557 **
## x0:VISIT_YEARS_Cat(1,2] == 0        -2.3969     0.4962  -4.831 1.36e-06 ***
## x1-2:VISIT_YEARS_Cat(1,2] == 0      -3.9221     0.7217  -5.435 5.48e-08 ***
## x>=3:VISIT_YEARS_Cat(1,2] == 0      -3.3727     0.9643  -3.498 0.000469 ***
## x0:VISIT_YEARS_Cat(2,3] == 0        -4.1212     0.5594  -7.367 1.74e-13 ***
## x1-2:VISIT_YEARS_Cat(2,3] == 0      -6.4231     0.7928  -8.102 4.44e-16 ***
## x>=3:VISIT_YEARS_Cat(2,3] == 0      -6.9831     1.0523  -6.636 3.22e-11 ***
## x0:VISIT_YEARS_Cat(3,4] == 0        -5.7445     0.6485  -8.858  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(3,4] == 0      -7.6085     0.8675  -8.770  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(3,4] == 0      -8.9720     1.1902  -7.538 4.77e-14 ***
## x0:VISIT_YEARS_Cat(4,5] == 0        -7.2873     0.7115 -10.242  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(4,5] == 0     -11.2420     0.9433 -11.918  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(4,5] == 0     -11.4335     1.2698  -9.004  < 2e-16 ***
## x0:VISIT_YEARS_Cat(5,6] == 0        -6.8450     0.8032  -8.522  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(5,6] == 0     -12.0543     1.0828 -11.132  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(5,6] == 0     -13.0256     1.3992  -9.310  < 2e-16 ***
## x0:VISIT_YEARS_Cat(6,7] == 0       -10.7721     0.8861 -12.156  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(6,7] == 0     -15.4873     1.2146 -12.751  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(6,7] == 0     -18.7232     1.5282 -12.252  < 2e-16 ***
## x0:VISIT_YEARS_Cat(7,8] == 0       -10.5765     0.9990 -10.587  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(7,8] == 0     -16.9897     1.4231 -11.938  < 2e-16 ***
```

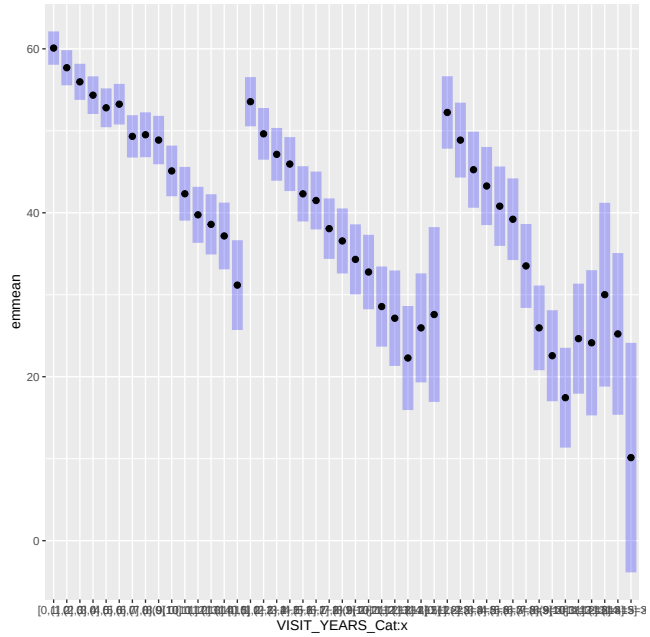
```
## x>=3:VISIT_YEARS_Cat(7,8] == 0   -26.2783     1.5693 -16.745  < 2e-16 ***
## x0:VISIT_YEARS_Cat(8,9] == 0     -11.2251     1.1466  -9.790  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(8,9] == 0   -19.2375     1.6406 -11.726  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(8,9] == 0   -29.6750     1.8834 -15.756  < 2e-16 ***
## x0:VISIT_YEARS_Cat(9,10] == 0    -14.9888     1.2367 -12.120  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(9,10] == 0  -20.7792     1.8179 -11.430  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(9,10] == 0  -34.7967     2.2725 -15.312  < 2e-16 ***
## x0:VISIT_YEARS_Cat(10,11] == 0   -17.7747     1.3580 -13.089  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(10,11] == 0 -24.9922     2.0377 -12.265  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(10,11] == 0 -27.5930     2.6917 -10.251  < 2e-16 ***
## x0:VISIT_YEARS_Cat(11,12] == 0   -20.3437     1.4431 -14.097  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(11,12] == 0 -26.4139     2.5996 -10.161  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(11,12] == 0 -28.0996     3.9920  -7.039 1.94e-12 ***
## x0:VISIT_YEARS_Cat(12,13] == 0   -21.5057     1.5994 -13.446  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(12,13] == 0 -31.2681     2.9030 -10.771  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(12,13] == 0 -22.2280     5.3133  -4.183 2.87e-05 ***
## x0:VISIT_YEARS_Cat(13,14] == 0   -22.9205     1.8311 -12.517  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(13,14] == 0 -27.5920     3.0749  -8.973  < 2e-16 ***
## x>=3:VISIT_YEARS_Cat(13,14] == 0 -27.0156     4.5643  -5.919 3.24e-09 ***
## x0:VISIT_YEARS_Cat(14,15] == 0   -28.9163     2.6152 -11.057  < 2e-16 ***
## x1-2:VISIT_YEARS_Cat(14,15] == 0 -25.9638     5.2481  -4.947 7.53e-07 ***
## x>=3:VISIT_YEARS_Cat(14,15] == 0 -42.1062     6.8202  -6.174 6.67e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_admi$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x   emmean   SE  df asymp.LCL asymp.UCL
##  [0,1]           0     60.1 1.04 Inf     58.06      62.1
##  (1,2]           0     57.7 1.09 Inf     55.55      59.8
##  (2,3]           0     56.0 1.12 Inf     53.77      58.2
##  (3,4]           0     54.3 1.17 Inf     52.05      56.6
##  (4,5]           0     52.8 1.21 Inf     50.44      55.2
##  (5,6]           0     53.2 1.26 Inf     50.77      55.7
##  (6,7]           0     49.3 1.32 Inf     46.74      51.9
##  (7,8]           0     49.5 1.40 Inf     46.78      52.3
##  (8,9]           0     48.9 1.51 Inf     45.92      51.8
##  (9,10]          0     45.1 1.58 Inf     42.01      48.2
##  (10,11]         0     42.3 1.67 Inf     39.04      45.6
##  (11,12]         0     39.7 1.74 Inf     36.33      43.2
##  (12,13]         0     38.6 1.87 Inf     34.91      42.3
##  (13,14]         0     37.2 2.08 Inf     33.10      41.2
##  (14,15]         0     31.2 2.79 Inf     25.70      36.7
##  [0,1]           1-2   53.6 1.53 Inf     50.55      56.6
##  (1,2]           1-2   49.6 1.61 Inf     46.48      52.8
##  (2,3]           1-2   47.1 1.64 Inf     43.91      50.3
##  (3,4]           1-2   45.9 1.68 Inf     42.65      49.2
##  (4,5]           1-2   42.3 1.72 Inf     38.94      45.7
##  (5,6]           1-2   41.5 1.80 Inf     37.97      45.0
##  (6,7]           1-2   38.1 1.88 Inf     34.37      41.8
##  (7,8]           1-2   36.6 2.02 Inf     32.60      40.5
##  (8,9]           1-2   34.3 2.18 Inf     30.04      38.6
##  (9,10]          1-2   32.8 2.32 Inf     28.23      37.3
```

```
##  (10,11]         1-2   28.6 2.49 Inf     23.67      33.4
##  (11,12]         1-2   27.1 2.97 Inf     21.32      33.0
##  (12,13]         1-2   22.3 3.24 Inf     15.94      28.6
##  (13,14]         1-2   26.0 3.39 Inf     19.31      32.6
##  (14,15]         1-2   27.6 5.44 Inf     16.92      38.3
##  [0,1]           >=3   52.2 2.25 Inf     47.82      56.7
##  (1,2]           >=3   48.9 2.33 Inf     44.30      53.4
##  (2,3]           >=3   45.3 2.37 Inf     40.62      49.9
##  (3,4]           >=3   43.3 2.43 Inf     38.50      48.0
##  (4,5]           >=3   40.8 2.47 Inf     35.96      45.6
##  (5,6]           >=3   39.2 2.54 Inf     34.23      44.2
##  (6,7]           >=3   33.5 2.61 Inf     28.39      38.6
##  (7,8]           >=3   26.0 2.64 Inf     20.79      31.1
##  (8,9]           >=3   22.6 2.83 Inf     17.01      28.1
##  (9,10]          >=3   17.4 3.11 Inf     11.36      23.5
##  (10,11]         >=3   24.6 3.42 Inf     17.93      31.4
##  (11,12]         >=3   24.1 4.52 Inf     15.28      33.0
##  (12,13]         >=3   30.0 5.72 Inf     18.80      41.2
##  (13,14]         >=3   25.2 5.03 Inf     15.36      35.1
##  (14,15]         >=3   10.1 7.14 Inf     -3.87      24.1
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_admi$plot_marginal_means
```




```
fiber.emt <- emtrends(model_admi$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x   VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  0               -1.66 0.0618 Inf     -1.78     -1.54
##  1-2             -2.30 0.0942 Inf     -2.49     -2.12
##  >=3             -3.10 0.1223 Inf     -3.34     -2.86
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast    estimate    SE  df z.ratio p.value
##  0 - (1-2)      0.645 0.113 Inf   5.723  <.0001
##  0 - >=3        1.443 0.137 Inf  10.534  <.0001
##  (1-2) - >=3    0.799 0.154 Inf   5.174  <.0001
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 3 estimates
```

```
model_admi$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```

13 Mixed model adding HTA

```
model_HTA <- Mixed_models_FG(dades$HTA, dades$epi)
model_HTA$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x               3744    3744     1  951.6  28.779 1.019e-07 ***
## x:VISIT_YEARS 240210  120105     2 8608.9 923.301 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_HTA$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                   4162  4161.9     1  983.0  31.898 2.126e-08 ***
## x:VISIT_YEARS_Cat 240546  8590.9    28 8440.7  65.844 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_HTA$cftest_tcat
```

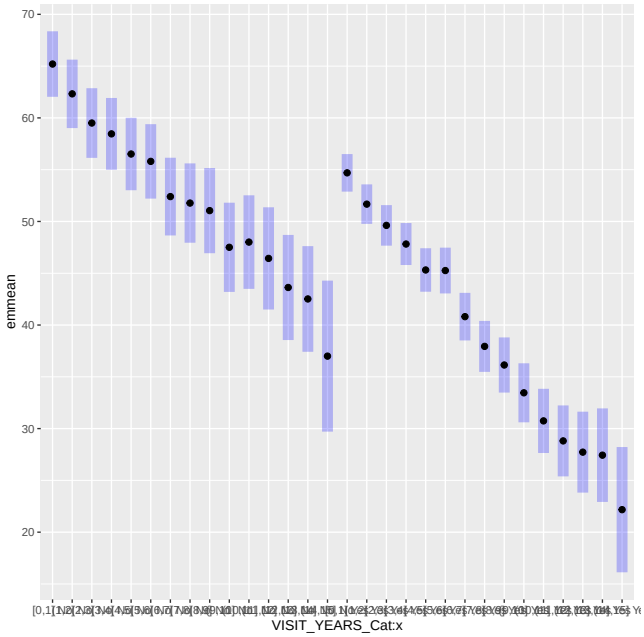
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                    65.2001     1.6137  40.404  < 2e-16 ***
## xYes == 0                          -10.5057     1.8601  -5.648 1.62e-08 ***
## xNo:VISIT_YEARS_Cat(1,2] == 0       -2.8789     0.7375  -3.903 9.48e-05 ***
## xYes:VISIT_YEARS_Cat(1,2] == 0      -3.0209     0.4424  -6.828 8.61e-12 ***
## xNo:VISIT_YEARS_Cat(2,3] == 0       -5.6956     0.8042  -7.082 1.42e-12 ***
## xYes:VISIT_YEARS_Cat(2,3] == 0      -5.0740     0.4967 -10.216  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(3,4] == 0       -6.7424     0.9112  -7.399 1.37e-13 ***
## xYes:VISIT_YEARS_Cat(3,4] == 0      -6.8736     0.5642 -12.183  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(4,5] == 0       -8.6878     0.9403  -9.240  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(4,5] == 0      -9.3792     0.6289 -14.915  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(5,6] == 0       -9.3990     1.0296  -9.129  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(5,6] == 0      -9.4334     0.7216 -13.073  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(6,7] == 0      -12.7988     1.1672 -10.965  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(6,7] == 0     -13.8855     0.7889 -17.600  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(7,8] == 0      -13.4225     1.2300 -10.913  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(7,8] == 0     -16.7566     0.9088 -18.439  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(8,9] == 0      -14.1523     1.4489  -9.768  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(8,9] == 0     -18.5536     1.0455 -17.745  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(9,10] == 0     -17.6948     1.5883 -11.141  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(9,10] == 0    -21.2387     1.1671 -18.197  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(10,11] == 0    -17.1913     1.7333  -9.918  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(10,11] == 0   -23.9499     1.3217 -18.121  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(11,12] == 0    -18.7667     2.0081  -9.345  < 2e-16 ***
```

```
## xYes:VISIT_YEARS_Cat(11,12] == 0 -25.8824     1.5171 -17.060  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(12,13] == 0  -21.5742     2.0969 -10.289  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(12,13] == 0 -26.9677     1.7946 -15.027  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(13,14] == 0  -22.6824     2.1123 -10.738  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(13,14] == 0 -27.2591     2.1344 -12.771  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(14,15] == 0  -28.2029     3.3946  -8.308  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(14,15] == 0 -32.5219     2.9606 -10.985  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_HTA$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x   emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           No    65.2 1.614 Inf      62.0      68.4
##  (1,2]           No    62.3 1.686 Inf      59.0      65.6
##  (2,3]           No    59.5 1.716 Inf      56.1      62.9
##  (3,4]           No    58.5 1.769 Inf      55.0      61.9
##  (4,5]           No    56.5 1.785 Inf      53.0      60.0
##  (5,6]           No    55.8 1.834 Inf      52.2      59.4
##  (6,7]           No    52.4 1.915 Inf      48.6      56.2
##  (7,8]           No    51.8 1.954 Inf      47.9      55.6
##  (8,9]           No    51.0 2.099 Inf      46.9      55.2
##  (9,10]          No    47.5 2.198 Inf      43.2      51.8
##  (10,11]         No    48.0 2.305 Inf      43.5      52.5
##  (11,12]         No    46.4 2.518 Inf      41.5      51.4
##  (12,13]         No    43.6 2.589 Inf      38.6      48.7
##  (13,14]         No    42.5 2.602 Inf      37.4      47.6
##  (14,15]         No    37.0 3.720 Inf      29.7      44.3
##  [0,1]           Yes   54.7 0.925 Inf      52.9      56.5
##  (1,2]           Yes   51.7 0.973 Inf      49.8      53.6
##  (2,3]           Yes   49.6 0.999 Inf      47.7      51.6
##  (3,4]           Yes   47.8 1.034 Inf      45.8      49.8
##  (4,5]           Yes   45.3 1.071 Inf      43.2      47.4
##  (5,6]           Yes   45.3 1.128 Inf      43.1      47.5
##  (6,7]           Yes   40.8 1.172 Inf      38.5      43.1
##  (7,8]           Yes   37.9 1.256 Inf      35.5      40.4
##  (8,9]           Yes   36.1 1.358 Inf      33.5      38.8
##  (9,10]          Yes   33.5 1.454 Inf      30.6      36.3
##  (10,11]         Yes   30.7 1.581 Inf      27.6      33.8
##  (11,12]         Yes   28.8 1.748 Inf      25.4      32.2
##  (12,13]         Yes   27.7 1.993 Inf      23.8      31.6
##  (13,14]         Yes   27.4 2.304 Inf      22.9      32.0
##  (14,15]         Yes   22.2 3.085 Inf      16.1      28.2
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_HTA$plot_marginal_means
```



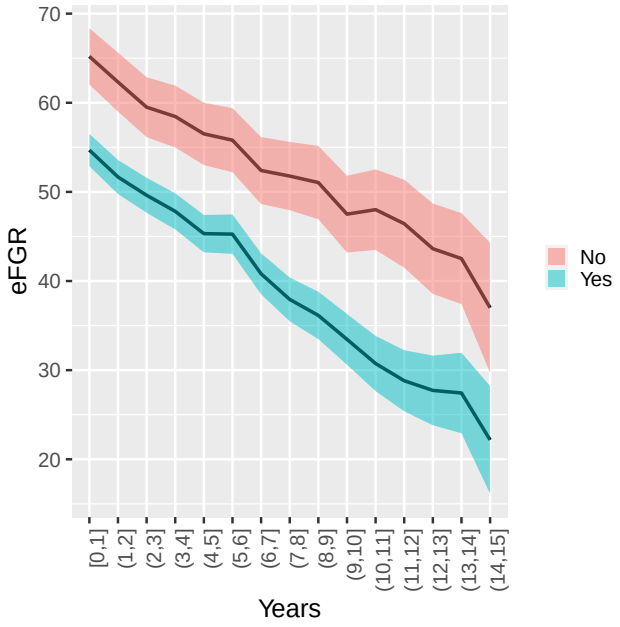

```
fiber.emt <- emtrends(model_HTA$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x   VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  No              -1.77 0.0792 Inf     -1.93     -1.62
##  Yes             -2.20 0.0601 Inf     -2.32     -2.09
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast estimate     SE  df z.ratio p.value
##  No - Yes    0.431 0.0994 Inf   4.340  <.0001
##
## Degrees-of-freedom method: asymptotic
```

```
model_HTA$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


70
60
50
40
30
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
No
Yes

14 Mixed model adding IECA/ARA II

```
model_ACEI_ARB <- Mixed_models_FG(dades$ACEI_ARB_s, dades$epi)
model_ACEI_ARB$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x              17994   17994     1  990.2  138.11 < 2.2e-16 ***
## x:VISIT_YEARS 237768  118884     2 8636.1  912.51 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_ACEI_ARB$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                  17824   17824     1  988.5 136.405 < 2.2e-16 ***
## x:VISIT_YEARS_Cat 237164   11294    21 8423.0  86.429 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

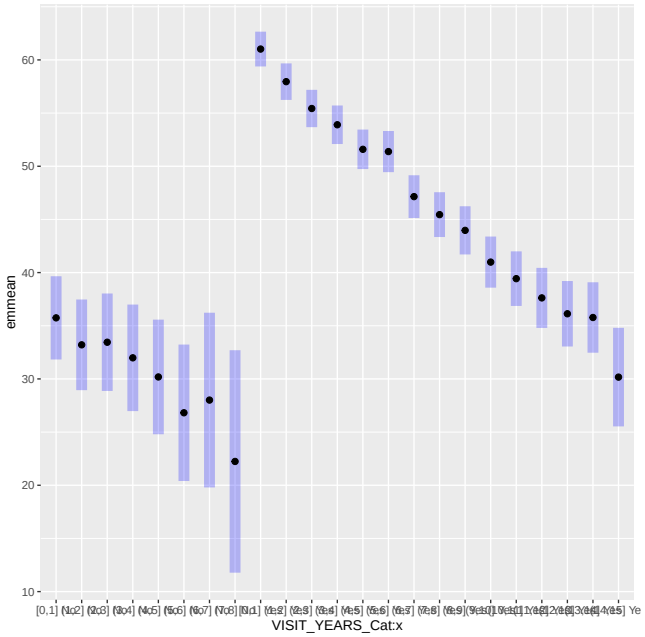
```
model_ACEI_ARB$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                    35.7423     1.9971  17.897  < 2e-16 ***
## xYes == 0                           25.2792     2.1645  11.679  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(1,2] == 0       -2.5359     1.1297  -2.245 0.024790 *
## xYes:VISIT_YEARS_Cat(1,2] == 0      -3.0663     0.4040  -7.590  3.2e-14 ***
## xNo:VISIT_YEARS_Cat(2,3] == 0       -2.2920     1.4184  -1.616 0.106121
## xYes:VISIT_YEARS_Cat(2,3] == 0      -5.5902     0.4444 -12.579  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(3,4] == 0       -3.7585     1.7534  -2.144 0.032072 *
## xYes:VISIT_YEARS_Cat(3,4] == 0      -7.1199     0.5006 -14.222  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(4,5] == 0       -5.5571     2.0258  -2.743 0.006085 **
## xYes:VISIT_YEARS_Cat(4,5] == 0      -9.4289     0.5425 -17.381  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(5,6] == 0       -8.9254     2.6928  -3.314 0.000918 ***
## xYes:VISIT_YEARS_Cat(5,6] == 0      -9.6411     0.6080 -15.857  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(6,7] == 0       -7.7314     3.7561  -2.058 0.039556 *
## xYes:VISIT_YEARS_Cat(6,7] == 0     -13.8774     0.6675 -20.789  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(7,8] == 0      -13.5029     5.0023  -2.699 0.006948 **
## xYes:VISIT_YEARS_Cat(7,8] == 0     -15.5714     0.7424 -20.973  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(8,9] == 0     -17.0504     0.8553 -19.935  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(9,10] == 0    -20.0349     0.9478 -21.138  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(10,11] == 0   -21.5916     1.0533 -20.499  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(11,12] == 0   -23.4015     1.2127 -19.297  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(12,13] == 0   -24.8940     1.3643 -18.247  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(13,14] == 0   -25.2447     1.5000 -16.830  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(14,15] == 0   -30.8511     2.2326 -13.818  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_ACEI_ARB$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x   emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           No    35.7 1.997 Inf      31.8      39.7
##  (1,2]           No    33.2 2.175 Inf      28.9      37.5
##  (2,3]           No    33.5 2.338 Inf      28.9      38.0
##  (3,4]           No    32.0 2.556 Inf      27.0      37.0
##  (4,5]           No    30.2 2.750 Inf      24.8      35.6
##  (5,6]           No    26.8 3.273 Inf      20.4      33.2
##  (6,7]           No    28.0 4.192 Inf      19.8      36.2
##  (7,8]           No    22.2 5.337 Inf      11.8      32.7
##  [0,1]           Yes   61.0 0.835 Inf      59.4      62.7
##  (1,2]           Yes   58.0 0.876 Inf      56.2      59.7
##  (2,3]           Yes   55.4 0.895 Inf      53.7      57.2
##  (3,4]           Yes   53.9 0.925 Inf      52.1      55.7
##  (4,5]           Yes   51.6 0.948 Inf      49.7      53.5
##  (5,6]           Yes   51.4 0.987 Inf      49.4      53.3
##  (6,7]           Yes   47.1 1.025 Inf      45.1      49.2
##  (7,8]           Yes   45.5 1.075 Inf      43.3      47.6
##  (8,9]           Yes   44.0 1.156 Inf      41.7      46.2
##  (9,10]          Yes   41.0 1.226 Inf      38.6      43.4
##  (10,11]         Yes   39.4 1.310 Inf      36.9      42.0
##  (11,12]         Yes   37.6 1.441 Inf      34.8      40.4
##  (12,13]         Yes   36.1 1.571 Inf      33.0      39.2
##  (13,14]         Yes   35.8 1.690 Inf      32.5      39.1
##  (14,15]         Yes   30.2 2.365 Inf      25.5      34.8
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_ACEI_ARB$plot_marginal_means
```



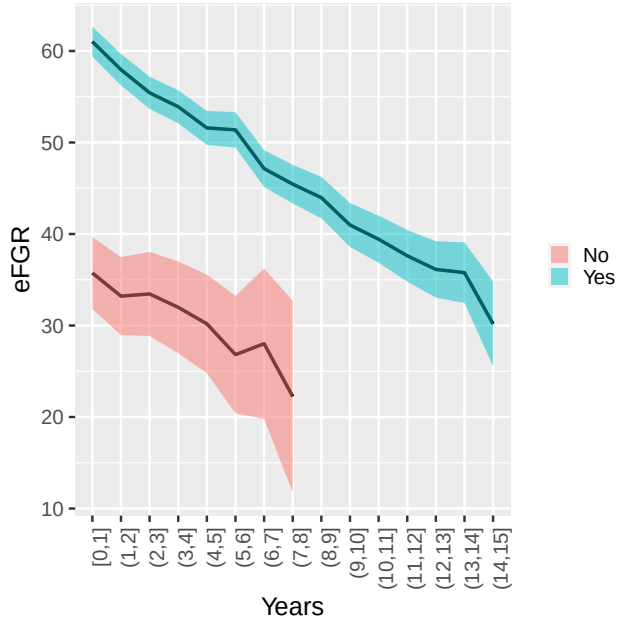

```
fiber.emt <- emtrends(model_ACEI_ARB$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x   VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  No              -1.36 0.2967 Inf     -1.94    -0.778
##  Yes             -2.06 0.0486 Inf     -2.16    -1.969
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast estimate    SE  df z.ratio p.value
##  No - Yes    0.704 0.301 Inf   2.343  0.0191
##
## Degrees-of-freedom method: asymptotic
```

```
model_ACEI_ARB$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```



A la figura de més amunt, la categoria "No", es queda a mig camí. La raó és que al llarg del temps tothom acaba rebent el tractament

15 Mixed model adding ARNI

```
model_ARNI <- Mixed_models_FG(dades$ARNI_s, dades$epi)
model_ARNI$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                4329    4329     1  936.9  33.229 1.111e-08 ***
## x:VISIT_YEARS 236378  118189     2 8563.1 907.160 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_ARNI$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                   3900  3899.7     1  969.4  29.852  5.93e-08 ***
## x:VISIT_YEARS_Cat 236969  8463.2    28 8395.4  64.785 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_ARNI$cftest_tcat
```

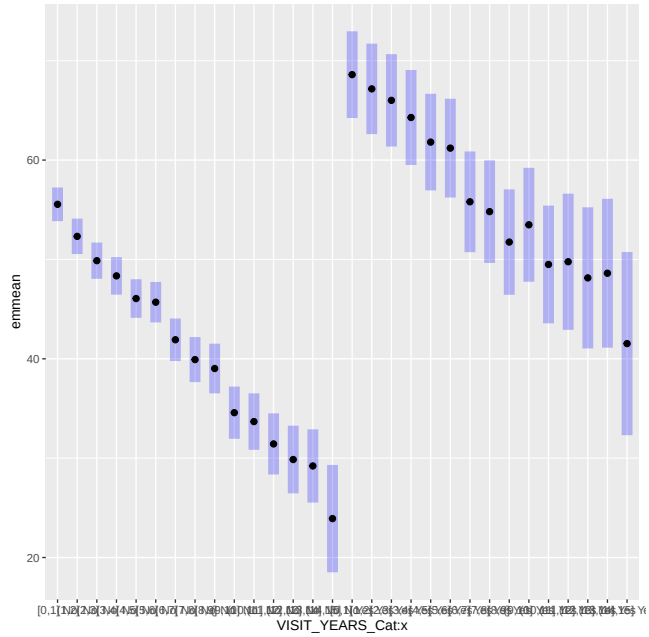
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                    55.5487     0.8653  64.196  < 2e-16 ***
## xYes == 0                           13.0504     2.3886   5.464 4.66e-08 ***
## xNo:VISIT_YEARS_Cat(1,2] == 0       -3.2251     0.4104  -7.858 4.00e-15 ***
## xYes:VISIT_YEARS_Cat(1,2] == 0      -1.4342     1.0136  -1.415   0.1571
## xNo:VISIT_YEARS_Cat(2,3] == 0       -5.6744     0.4576 -12.400  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(2,3] == 0      -2.5867     1.1257  -2.298   0.0216 *
## xNo:VISIT_YEARS_Cat(3,4] == 0       -7.2044     0.5205 -13.841  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(3,4] == 0      -4.3144     1.2572  -3.432   0.0006 ***
## xNo:VISIT_YEARS_Cat(4,5] == 0       -9.4848     0.5689 -16.671  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(4,5] == 0      -6.7892     1.3362  -5.081 3.75e-07 ***
## xNo:VISIT_YEARS_Cat(5,6] == 0       -9.8519     0.6499 -15.160  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(5,6] == 0      -7.3964     1.4379  -5.144 2.69e-07 ***
## xNo:VISIT_YEARS_Cat(6,7] == 0      -13.6320     0.7269 -18.754  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(6,7] == 0     -12.7987     1.5238  -8.399  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(7,8] == 0      -15.6302     0.8249 -18.948  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(7,8] == 0     -13.7878     1.6045  -8.593  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(8,9] == 0      -16.5272     0.9850 -16.779  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(8,9] == 0     -16.8508     1.7226  -9.782  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(9,10] == 0     -20.9719     1.0669 -19.657  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(9,10] == 0    -15.1132     2.0482  -7.379 1.60e-13 ***
## xNo:VISIT_YEARS_Cat(10,11] == 0    -21.8681     1.2009 -18.209  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(10,11] == 0   -19.1052     2.1850  -8.744  < 2e-16 ***
## xNo:VISIT_YEARS_Cat(11,12] == 0    -24.1168     1.3429 -17.958  < 2e-16 ***
```

```
## xYes:VISIT_YEARS_Cat(11,12] == 0 -18.8334     2.8023  -6.721 1.81e-11 ***
## xNo:VISIT_YEARS_Cat(12,13] == 0  -25.6869     1.5355 -16.729  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(12,13] == 0 -20.4554     2.9607  -6.909 4.88e-12 ***
## xNo:VISIT_YEARS_Cat(13,14] == 0  -26.3341     1.6963 -15.525  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(13,14] == 0 -19.9873     3.2020  -6.242 4.32e-10 ***
## xNo:VISIT_YEARS_Cat(14,15] == 0  -31.6329     2.6343 -12.008  < 2e-16 ***
## xYes:VISIT_YEARS_Cat(14,15] == 0 -27.0700     4.2126  -6.426 1.31e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_ARNI$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x   emmean    SE  df asymp.LCL asymp.UCL
##  [0,1]           No    55.5 0.865 Inf      53.9      57.2
##  (1,2]           No    52.3 0.909 Inf      50.5      54.1
##  (2,3]           No    49.9 0.931 Inf      48.0      51.7
##  (3,4]           No    48.3 0.964 Inf      46.5      50.2
##  (4,5]           No    46.1 0.991 Inf      44.1      48.0
##  (5,6]           No    45.7 1.040 Inf      43.7      47.7
##  (6,7]           No    41.9 1.090 Inf      39.8      44.1
##  (7,8]           No    39.9 1.157 Inf      37.7      42.2
##  (8,9]           No    39.0 1.277 Inf      36.5      41.5
##  (9,10]          No    34.6 1.341 Inf      31.9      37.2
##  (10,11]         No    33.7 1.450 Inf      30.8      36.5
##  (11,12]         No    31.4 1.570 Inf      28.4      34.5
##  (12,13]         No    29.9 1.737 Inf      26.5      33.3
##  (13,14]         No    29.2 1.881 Inf      25.5      32.9
##  (14,15]         No    23.9 2.757 Inf      18.5      29.3
##  [0,1]           Yes   68.6 2.226 Inf      64.2      73.0
##  (1,2]           Yes   67.2 2.322 Inf      62.6      71.7
##  (2,3]           Yes   66.0 2.373 Inf      61.4      70.7
##  (3,4]           Yes   64.3 2.438 Inf      59.5      69.1
##  (4,5]           Yes   61.8 2.481 Inf      56.9      66.7
##  (5,6]           Yes   61.2 2.537 Inf      56.2      66.2
##  (6,7]           Yes   55.8 2.586 Inf      50.7      60.9
##  (7,8]           Yes   54.8 2.634 Inf      49.6      60.0
##  (8,9]           Yes   51.7 2.707 Inf      46.4      57.1
##  (9,10]          Yes   53.5 2.925 Inf      47.8      59.2
##  (10,11]         Yes   49.5 3.022 Inf      43.6      55.4
##  (11,12]         Yes   49.8 3.496 Inf      42.9      56.6
##  (12,13]         Yes   48.1 3.624 Inf      41.0      55.2
##  (13,14]         Yes   48.6 3.823 Inf      41.1      56.1
##  (14,15]         Yes   41.5 4.703 Inf      32.3      50.7
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_ARNI$plot_marginal_means
```



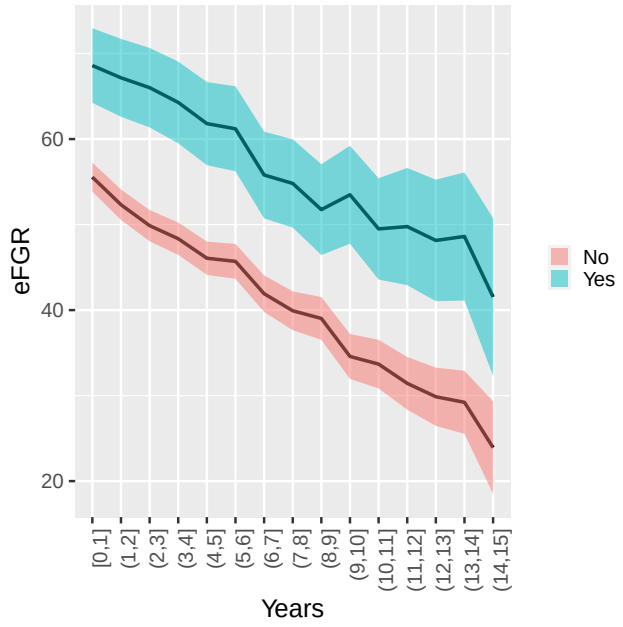

```
fiber.emt <- emtrends(model_ARNI$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x   VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  No              -2.10 0.0537 Inf     -2.20     -1.99
##  Yes             -1.82 0.1070 Inf     -2.03     -1.61
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast estimate   SE  df z.ratio p.value
##  No - Yes   -0.281 0.12 Inf  -2.345  0.0190
##
## Degrees-of-freedom method: asymptotic
```

```
model_ARNI$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


eFGR
60
40
20
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
No
Yes

16 Mixed model adding Months of Evolution of HF

```
model_evolMoths <- Mixed_models_FG(dades$evolMoths, dades$epi)
model_evolMoths$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                1410    1410     1  956.5   10.83  0.001035 **
## x:VISIT_YEARS 239041  119520     2 8613.1  918.11 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_evolMoths$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                    Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                    1604  1603.6     1  983.9  12.300 0.0004733 ***
## x:VISIT_YEARS_Cat 241155  8612.7    28 8441.9  66.065 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_evolMoths$cftest_tcat
```

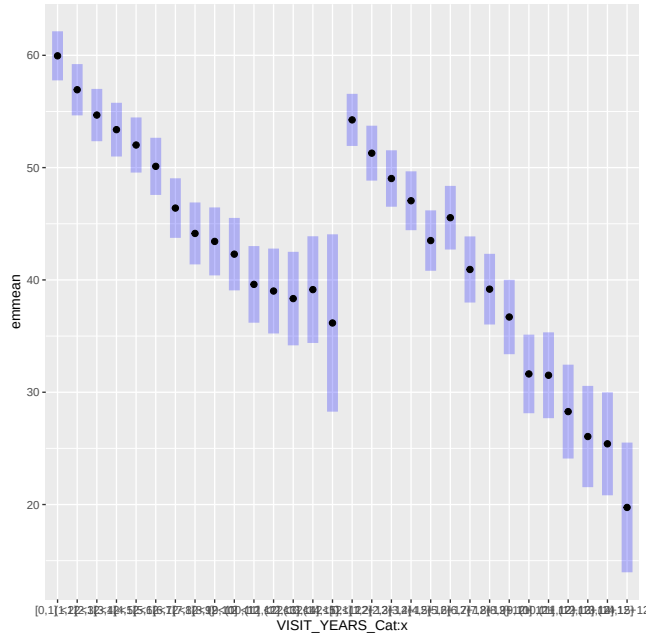
```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                    59.9538     1.1150  53.769  < 2e-16 ***
## x12+ == 0                           -5.7037     1.6263  -3.507 0.000453 ***
## x<12:VISIT_YEARS_Cat(1,2] == 0      -3.0196     0.5160  -5.852 4.87e-09 ***
## x12+:VISIT_YEARS_Cat(1,2] == 0      -2.9632     0.5594  -5.297 1.17e-07 ***
## x<12:VISIT_YEARS_Cat(2,3] == 0      -5.2738     0.5671  -9.300  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(2,3] == 0      -5.2204     0.6333  -8.243 2.22e-16 ***
## x<12:VISIT_YEARS_Cat(3,4] == 0      -6.5729     0.6316 -10.407  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(3,4] == 0      -7.2014     0.7377  -9.762  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(4,5] == 0      -7.9413     0.6899 -11.511  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(4,5] == 0     -10.7453     0.7997 -13.436  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(5,6] == 0      -9.8407     0.7699 -12.782  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(5,6] == 0      -8.7101     0.9199  -9.469  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(6,7] == 0     -13.5561     0.8591 -15.780  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(6,7] == 0     -13.3197     1.0056 -13.246  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(7,8] == 0     -15.8150     0.9422 -16.786  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(7,8] == 0     -15.0728     1.1550 -13.050  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(8,9] == 0     -16.5251     1.1366 -14.540  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(8,9] == 0     -17.5518     1.2698 -13.822  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(9,10] == 0    -17.6590     1.2715 -13.888  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(9,10] == 0    -22.6211     1.3943 -16.224  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(10,11] == 0   -20.3512     1.3920 -14.620  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(10,11] == 0   -22.7391     1.5985 -14.226  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(11,12] == 0   -20.9427     1.6207 -12.922  < 2e-16 ***
```

```
## x12+:VISIT_YEARS_Cat(11,12] == 0 -25.9744     1.8165 -14.299  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(12,13] == 0 -21.6154     1.8494 -11.688  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(12,13] == 0 -28.1937     2.0109 -14.020  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(13,14] == 0 -20.8157     2.1866  -9.520  < 2e-16 ***
## x12+:VISIT_YEARS_Cat(13,14] == 0 -28.8429     2.0548 -14.037  < 2e-16 ***
## x<12:VISIT_YEARS_Cat(14,15] == 0 -23.7877     3.8901  -6.115 9.66e-10 ***
## x12+:VISIT_YEARS_Cat(14,15] == 0 -34.5077     2.7263 -12.657  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_evolMoths$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x   emmean   SE  df asymp.LCL asymp.UCL
##  [0,1]           <12   60.0 1.12 Inf      57.8      62.1
##  (1,2]           <12   56.9 1.17 Inf      54.7      59.2
##  (2,3]           <12   54.7 1.19 Inf      52.4      57.0
##  (3,4]           <12   53.4 1.22 Inf      51.0      55.8
##  (4,5]           <12   52.0 1.25 Inf      49.6      54.5
##  (5,6]           <12   50.1 1.30 Inf      47.6      52.7
##  (6,7]           <12   46.4 1.35 Inf      43.7      49.0
##  (7,8]           <12   44.1 1.41 Inf      41.4      46.9
##  (8,9]           <12   43.4 1.54 Inf      40.4      46.5
##  (9,10]          <12   42.3 1.65 Inf      39.1      45.5
##  (10,11]         <12   39.6 1.74 Inf      36.2      43.0
##  (11,12]         <12   39.0 1.93 Inf      35.2      42.8
##  (12,13]         <12   38.3 2.12 Inf      34.2      42.5
##  (13,14]         <12   39.1 2.42 Inf      34.4      43.9
##  (14,15]         <12   36.2 4.03 Inf      28.3      44.1
##  [0,1]           12+   54.3 1.18 Inf      51.9      56.6
##  (1,2]           12+   51.3 1.25 Inf      48.8      53.7
##  (2,3]           12+   49.0 1.28 Inf      46.5      51.5
##  (3,4]           12+   47.0 1.34 Inf      44.4      49.7
##  (4,5]           12+   43.5 1.37 Inf      40.8      46.2
##  (5,6]           12+   45.5 1.45 Inf      42.7      48.4
##  (6,7]           12+   40.9 1.50 Inf      38.0      43.9
##  (7,8]           12+   39.2 1.61 Inf      36.0      42.3
##  (8,9]           12+   36.7 1.69 Inf      33.4      40.0
##  (9,10]          12+   31.6 1.79 Inf      28.1      35.1
##  (10,11]         12+   31.5 1.95 Inf      27.7      35.3
##  (11,12]         12+   28.3 2.13 Inf      24.1      32.5
##  (12,13]         12+   26.1 2.30 Inf      21.5      30.6
##  (13,14]         12+   25.4 2.34 Inf      20.8      30.0
##  (14,15]         12+   19.7 2.95 Inf      14.0      25.5
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_evolMoths$plot_marginal_means
```



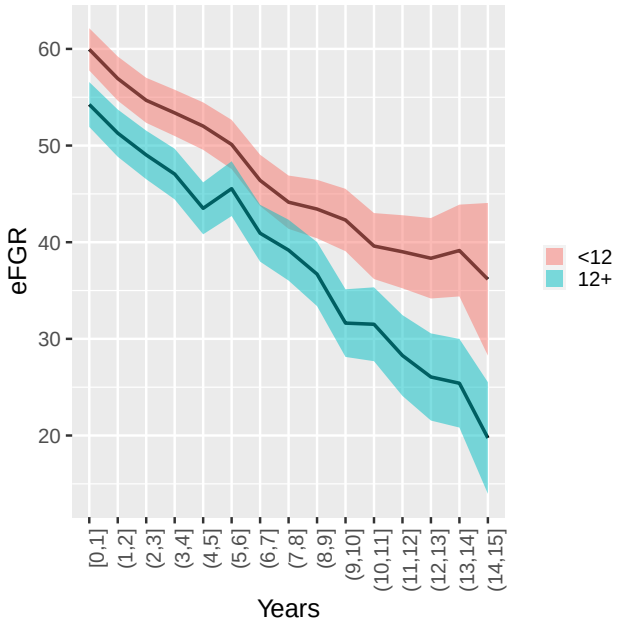

```
fiber.emt <- emtrends(model_evolMoths$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x   VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  <12              -1.90 0.0650 Inf     -2.03     -1.77
##  12+              -2.22 0.0708 Inf     -2.36     -2.08
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast    estimate     SE  df z.ratio p.value
##  <12 - (12+)    0.322 0.0962 Inf   3.353  0.0008
##
## Degrees-of-freedom method: asymptotic
```

```
model_evolMoths$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


60
50
40
30
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
<12
12+

17 Mixed model adding HbA1c control (cutoff 50%.)

Recordar que hi ha missings: 747 de 9374

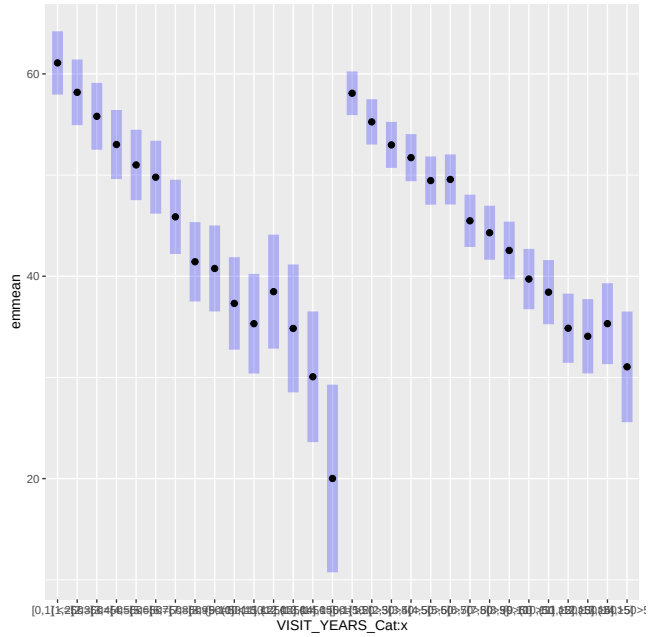
```
model_HbA1ccat50 <- Mixed_models_FG(dades$HbA1ccat50, dades$epi)
model_HbA1ccat50$anova_tnum

## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF  F value  Pr(>F)
## x                436     436     1  783.7   3.3169 0.06895 .
## x:VISIT_YEARS 238555  119277     2 8000.4 906.8496 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


model_HbA1ccat50$anova_tcat

## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value Pr(>F)
## x                    315   315.3     1  810.4  2.3919 0.1224
## x:VISIT_YEARS_Cat 239865  8566.6    28 7859.0 64.9897 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


model_HbA1ccat50$cftest_tcat

##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                      61.0849     1.5951  38.294  < 2e-16 ***
## x>50 == 0                             -2.9977     1.9383  -1.547    0.122
## x<=50:VISIT_YEARS_Cat(1,2] == 0       -2.9040     0.7094  -4.094 4.25e-05 ***
## x>50:VISIT_YEARS_Cat(1,2] == 0        -2.8304     0.4799  -5.898 3.68e-09 ***
## x<=50:VISIT_YEARS_Cat(2,3] == 0       -5.2759     0.7806  -6.759 1.39e-11 ***
## x>50:VISIT_YEARS_Cat(2,3] == 0        -5.1044     0.5235  -9.750  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(3,4] == 0       -8.0653     0.8911  -9.051  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(3,4] == 0        -6.3650     0.5830 -10.917  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(4,5] == 0      -10.0826     0.9526 -10.584  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(4,5] == 0        -8.6308     0.6392 -13.502  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(5,6] == 0      -11.2954     1.0664 -10.592  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(5,6] == 0        -8.5183     0.7211 -11.813  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(6,7] == 0      -15.2137     1.1245 -13.530  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(6,7] == 0       -12.6079     0.8161 -15.449  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(7,8] == 0      -19.6519     1.3283 -14.794  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(7,8] == 0       -13.7870     0.8872 -15.541  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(8,9] == 0      -20.3151     1.5679 -12.957  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(8,9] == 0       -15.5357     1.0172 -15.273  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(9,10] == 0     -23.7696     1.7896 -13.282  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(9,10] == 0      -18.3622     1.1151 -16.467  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(10,11] == 0    -25.7728     2.0166 -12.781  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(10,11] == 0     -19.6596     1.2413 -15.838  < 2e-16 ***
```

```
## x<=50:VISIT_YEARS_Cat(11,12] == 0 -22.6076     2.4520  -9.220  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(11,12] == 0  -23.2214     1.4030 -16.551  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(12,13] == 0 -26.2389     2.8554  -9.189  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(12,13] == 0  -24.0159     1.5622 -15.373  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(13,14] == 0 -31.0203     2.9331 -10.576  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(13,14] == 0  -22.7705     1.7562 -12.966  < 2e-16 ***
## x<=50:VISIT_YEARS_Cat(14,15] == 0 -41.0698     4.4862  -9.155  < 2e-16 ***
## x>50:VISIT_YEARS_Cat(14,15] == 0  -27.0401     2.5892 -10.444  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_HbA1ccat50$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x    emmean   SE  df asymp.LCL asymp.UCL
##  [0,1]           <=50   61.1 1.60 Inf      58.0      64.2
##  (1,2]           <=50   58.2 1.65 Inf      54.9      61.4
##  (2,3]           <=50   55.8 1.69 Inf      52.5      59.1
##  (3,4]           <=50   53.0 1.74 Inf      49.6      56.4
##  (4,5]           <=50   51.0 1.77 Inf      47.5      54.5
##  (5,6]           <=50   49.8 1.84 Inf      46.2      53.4
##  (6,7]           <=50   45.9 1.87 Inf      42.2      49.5
##  (7,8]           <=50   41.4 2.00 Inf      37.5      45.4
##  (8,9]           <=50   40.8 2.17 Inf      36.5      45.0
##  (9,10]          <=50   37.3 2.33 Inf      32.7      41.9
##  (10,11]         <=50   35.3 2.51 Inf      30.4      40.2
##  (11,12]         <=50   38.5 2.87 Inf      32.8      44.1
##  (12,13]         <=50   34.8 3.23 Inf      28.5      41.2
##  (13,14]         <=50   30.1 3.29 Inf      23.6      36.5
##  (14,15]         <=50   20.0 4.73 Inf      10.7      29.3
##  [0,1]           >50    58.1 1.10 Inf      55.9      60.2
##  (1,2]           >50    55.3 1.14 Inf      53.0      57.5
##  (2,3]           >50    53.0 1.16 Inf      50.7      55.3
##  (3,4]           >50    51.7 1.19 Inf      49.4      54.1
##  (4,5]           >50    49.5 1.22 Inf      47.1      51.8
##  (5,6]           >50    49.6 1.26 Inf      47.1      52.0
##  (6,7]           >50    45.5 1.32 Inf      42.9      48.1
##  (7,8]           >50    44.3 1.36 Inf      41.6      47.0
##  (8,9]           >50    42.6 1.45 Inf      39.7      45.4
##  (9,10]          >50    39.7 1.52 Inf      36.7      42.7
##  (10,11]         >50    38.4 1.62 Inf      35.3      41.6
##  (11,12]         >50    34.9 1.74 Inf      31.4      38.3
##  (12,13]         >50    34.1 1.87 Inf      30.4      37.7
##  (13,14]         >50    35.3 2.04 Inf      31.3      39.3
##  (14,15]         >50    31.0 2.79 Inf      25.6      36.5
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_HbA1ccat50$plot_marginal_means
```



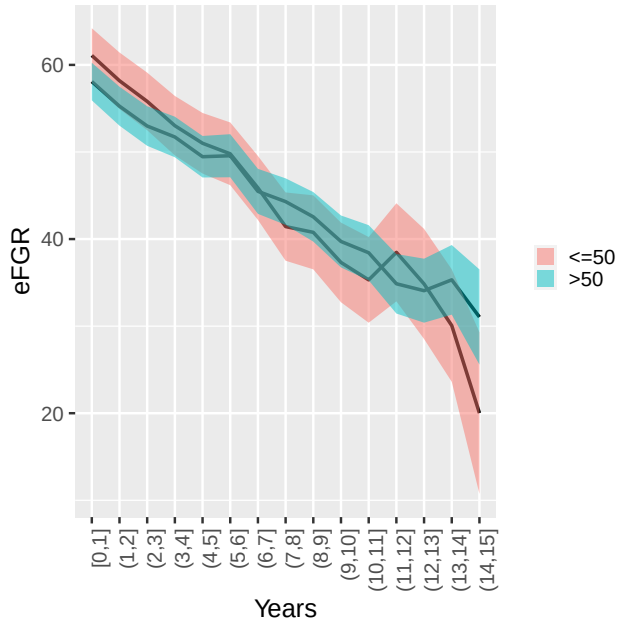

```
fiber.emt <- emtrends(model_HbA1ccat50$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x    VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  <=50             -2.42 0.0894 Inf      -2.6     -2.25
##  >50              -1.89 0.0576 Inf      -2.0     -1.78
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast   estimate    SE  df z.ratio p.value
##  <=50 - >50    -0.53 0.106 Inf  -4.989  <.0001
##
## Degrees-of-freedom method: asymptotic
```

```
model_HbA1ccat50$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```


60
40
20
eFGR
[0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,11]
(11,12]
(12,13]
(13,14]
(14,15]
Years
<=50
>50

18 Mixed model adding Baseline Glomerular Filtration (i.e. Epi categories)

```
model_FGbasal <- Mixed_models_FG(dades$FGbasal, dades$epi)
model_FGbasal$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x             321371   64274     5 1101.2  503.80 < 2.2e-16 ***
## x:VISIT_YEARS 265548   44258     6 9033.9  346.91 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_FGbasal$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                 317836   63567     5 1190.2 498.380 < 2.2e-16 ***
## x:VISIT_YEARS_Cat 275627    3403    81 8517.1  26.679 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_FGbasal$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                        Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                       15.67621    2.31836   6.762 1.36e-11 ***
## x15-<30 == 0                           11.43644    2.65376   4.310 1.64e-05 ***
## x30-<45 == 0                           23.62711    2.54588   9.281  < 2e-16 ***
## x45-<60 == 0                           35.98705    2.52505  14.252  < 2e-16 ***
## x60-90 == 0                            54.98709    2.45757  22.375  < 2e-16 ***
## x90+ == 0                              78.81494    2.59182  30.409  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(1,2] == 0          1.04304    2.10865   0.495 0.620850
## x15-<30:VISIT_YEARS_Cat(1,2] == 0       1.04992    1.18552   0.886 0.375823
## x30-<45:VISIT_YEARS_Cat(1,2] == 0      -0.52638    0.87795  -0.600 0.548806
## x45-<60:VISIT_YEARS_Cat(1,2] == 0      -2.72141    0.82476  -3.300 0.000968 ***
## x60-90:VISIT_YEARS_Cat(1,2] == 0       -4.94422    0.65355  -7.565 3.86e-14 ***
## x90+:VISIT_YEARS_Cat(1,2] == 0         -5.89526    0.93363  -6.314 2.71e-10 ***
## x<15:VISIT_YEARS_Cat(2,3] == 0          2.05413    2.40102   0.856 0.392262
## x15-<30:VISIT_YEARS_Cat(2,3] == 0       1.34144    1.35837   0.988 0.323378
## x30-<45:VISIT_YEARS_Cat(2,3] == 0      -2.11329    1.00672  -2.099 0.035801 *
## x45-<60:VISIT_YEARS_Cat(2,3] == 0      -5.73554    0.91984  -6.235 4.51e-10 ***
## x60-90:VISIT_YEARS_Cat(2,3] == 0       -7.37625    0.70224 -10.504  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(2,3] == 0         -9.08961    1.05806  -8.591  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(3,4] == 0          3.41646    2.96521   1.152 0.249246
## x15-<30:VISIT_YEARS_Cat(3,4] == 0       0.07589    1.58657   0.048 0.961849
## x30-<45:VISIT_YEARS_Cat(3,4] == 0      -3.94608    1.17023  -3.372 0.000746 ***
## x45-<60:VISIT_YEARS_Cat(3,4] == 0      -5.87966    1.05128  -5.593 2.23e-08 ***
```

```
## x60-90:VISIT_YEARS_Cat(3,4] == 0     -9.60333    0.79033 -12.151  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(3,4] == 0      -10.84325    1.15456  -9.392  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(4,5] == 0        5.58454    3.29014   1.697 0.089629 .
## x15-<30:VISIT_YEARS_Cat(4,5] == 0    -1.16791    1.81350  -0.644 0.519571
## x30-<45:VISIT_YEARS_Cat(4,5] == 0    -6.19904    1.35987  -4.559 5.15e-06 ***
## x45-<60:VISIT_YEARS_Cat(4,5] == 0    -8.92530    1.18528  -7.530 5.06e-14 ***
## x60-90:VISIT_YEARS_Cat(4,5] == 0    -10.85212    0.83006 -13.074  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(4,5] == 0      -14.96665    1.21425 -12.326  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(5,6] == 0        5.05469    3.89861   1.297 0.194791
## x15-<30:VISIT_YEARS_Cat(5,6] == 0    -4.22647    2.37797  -1.777 0.075511 .
## x30-<45:VISIT_YEARS_Cat(5,6] == 0    -7.59716    1.53318  -4.955 7.23e-07 ***
## x45-<60:VISIT_YEARS_Cat(5,6] == 0    -8.26374    1.34248  -6.156 7.48e-10 ***
## x60-90:VISIT_YEARS_Cat(5,6] == 0    -10.02766    0.93616 -10.711  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(5,6] == 0      -15.77833    1.30586 -12.083  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(6,7] == 0        3.35207    4.69773   0.714 0.475504
## x15-<30:VISIT_YEARS_Cat(6,7] == 0    -5.59572    3.17414  -1.763 0.077916 .
## x30-<45:VISIT_YEARS_Cat(6,7] == 0    -5.16471    1.85157  -2.789 0.005281 **
## x45-<60:VISIT_YEARS_Cat(6,7] == 0   -11.38458    1.46957  -7.747 9.33e-15 ***
## x60-90:VISIT_YEARS_Cat(6,7] == 0    -15.55286    1.00507 -15.474  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(6,7] == 0      -21.99092    1.40210 -15.684  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(7,8] == 0       -0.85173    5.09058  -0.167 0.867122
## x15-<30:VISIT_YEARS_Cat(7,8] == 0    -5.63882    4.57359  -1.233 0.217609
## x30-<45:VISIT_YEARS_Cat(7,8] == 0   -10.29405    2.27405  -4.527 5.99e-06 ***
## x45-<60:VISIT_YEARS_Cat(7,8] == 0   -13.96523    1.74131  -8.020 1.11e-15 ***
## x60-90:VISIT_YEARS_Cat(7,8] == 0    -17.57805    1.09621 -16.035  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(7,8] == 0      -21.28646    1.46432 -14.537  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(8,9] == 0        3.34359    6.99590   0.478 0.632696
## x15-<30:VISIT_YEARS_Cat(8,9] == 0    -2.40847    4.94543  -0.487 0.626251
## x30-<45:VISIT_YEARS_Cat(8,9] == 0   -12.86894    2.79616  -4.602 4.18e-06 ***
## x45-<60:VISIT_YEARS_Cat(8,9] == 0   -10.04362    2.49147  -4.031 5.55e-05 ***
## x60-90:VISIT_YEARS_Cat(8,9] == 0    -19.60679    1.23767 -15.842  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(8,9] == 0      -23.42393    1.57079 -14.912  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(9,10] == 0      -2.76752    7.03606  -0.393 0.694073
## x15-<30:VISIT_YEARS_Cat(9,10] == 0  -10.67240    5.45198  -1.958 0.050285 .
## x30-<45:VISIT_YEARS_Cat(9,10] == 0  -16.54317    3.11035  -5.319 1.04e-07 ***
## x45-<60:VISIT_YEARS_Cat(9,10] == 0  -16.82823    3.21940  -5.227 1.72e-07 ***
## x60-90:VISIT_YEARS_Cat(9,10] == 0   -21.43145    1.30601 -16.410  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(9,10] == 0     -25.86807    1.81159 -14.279  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(10,11] == 0      9.05450    8.52422   1.062 0.288141
## x15-<30:VISIT_YEARS_Cat(10,11] == 0  -7.00870    6.00022  -1.168 0.242777
## x30-<45:VISIT_YEARS_Cat(10,11] == 0 -19.06365    3.16236  -6.028 1.66e-09 ***
## x45-<60:VISIT_YEARS_Cat(10,11] == 0 -16.28048    3.32027  -4.903 9.42e-07 ***
## x60-90:VISIT_YEARS_Cat(10,11] == 0  -23.90598    1.45633 -16.415  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(10,11] == 0    -26.65257    2.13970 -12.456  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(11,12] == 0      3.72481   11.68059   0.319 0.749811
## x15-<30:VISIT_YEARS_Cat(11,12] == 0 -10.55166    8.39244  -1.257 0.208652
## x30-<45:VISIT_YEARS_Cat(11,12] == 0 -20.05682    4.19996  -4.775 1.79e-06 ***
## x45-<60:VISIT_YEARS_Cat(11,12] == 0 -18.08339    4.82410  -3.749 0.000178 ***
## x60-90:VISIT_YEARS_Cat(11,12] == 0  -24.06843    1.61201 -14.931  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(11,12] == 0    -30.73762    2.31750 -13.263  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(12,13] == 0      2.94090    8.52422   0.345 0.730091
## x30-<45:VISIT_YEARS_Cat(12,13] == 0 -13.10511    8.34518  -1.570 0.116326
## x45-<60:VISIT_YEARS_Cat(12,13] == 0 -16.14216    4.85146  -3.327 0.000877 ***
## x60-90:VISIT_YEARS_Cat(12,13] == 0  -29.76801    1.74304 -17.078  < 2e-16 ***
```

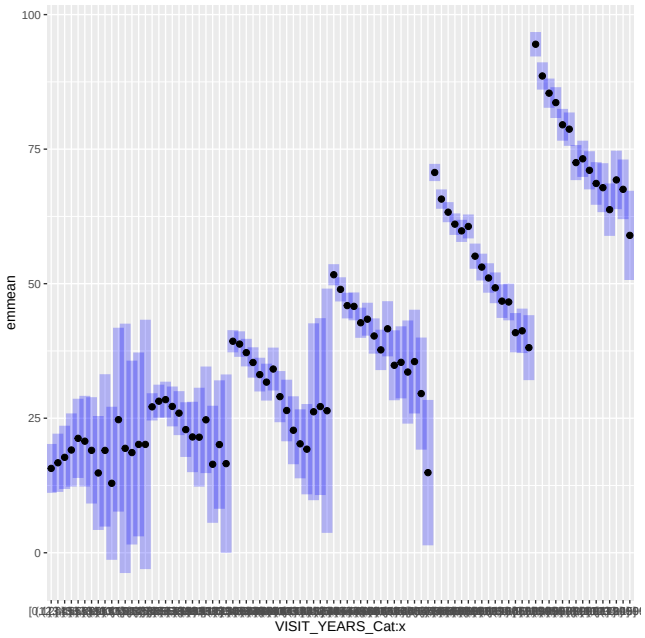
```
## x90+:VISIT_YEARS_Cat(12,13] == 0    -25.20952    2.62132  -9.617  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(13,14] == 0      4.45344    8.52422   0.522 0.601360
## x30-<45:VISIT_YEARS_Cat(13,14] == 0 -12.14231    8.34518  -1.455 0.145667
## x45-<60:VISIT_YEARS_Cat(13,14] == 0 -22.08938    5.25269  -4.205 2.61e-05 ***
## x60-90:VISIT_YEARS_Cat(13,14] == 0  -29.42667    2.00354 -14.687  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(13,14] == 0    -26.95939    2.68043 -10.058  < 2e-16 ***
## x<15:VISIT_YEARS_Cat(14,15] == 0      4.45735   11.68059   0.382 0.702756
## x30-<45:VISIT_YEARS_Cat(14,15] == 0 -12.91169   11.55057  -1.118 0.263636
## x45-<60:VISIT_YEARS_Cat(14,15] == 0 -36.77590    6.84367  -5.374 7.71e-08 ***
## x60-90:VISIT_YEARS_Cat(14,15] == 0  -32.55085    3.01049 -10.812  < 2e-16 ***
## x90+:VISIT_YEARS_Cat(14,15] == 0    -35.51826    4.13220  -8.595  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_FGbasal$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x      emmean     SE  df asymp.LCL asymp.UCL
##  [0,1]           <15      15.7  2.318 Inf   11.1323      20.2
##  (1,2]           <15      16.7  2.761 Inf   11.3077      22.1
##  (2,3]           <15      17.7  2.998 Inf   11.8539      23.6
##  (3,4]           <15      19.1  3.469 Inf   12.2945      25.9
##  (4,5]           <15      21.3  3.755 Inf   13.9004      28.6
##  (5,6]           <15      20.7  4.299 Inf   12.3056      29.2
##  (6,7]           <15      19.0  5.041 Inf    9.1474      28.9
##  (7,8]           <15      14.8  5.402 Inf    4.2374      25.4
##  (8,9]           <15      19.0  7.223 Inf    4.8628      33.2
##  (9,10]          <15      12.9  7.257 Inf   -1.3140      27.1
##  (10,11]         <15      24.7  8.716 Inf    7.6474      41.8
##  (11,12]         <15      19.4 11.821 Inf   -3.7685      42.6
##  (12,13]         <15      18.6  8.716 Inf    1.5338      35.7
##  (13,14]         <15      20.1  8.716 Inf    3.0463      37.2
##  (14,15]         <15      20.1 11.821 Inf   -3.0359      43.3
##  [0,1]           15-<30   27.1  1.291 Inf   24.5816      29.6
##  (1,2]           15-<30   28.2  1.566 Inf   25.0928      31.2
##  (2,3]           15-<30   28.5  1.701 Inf   25.1193      31.8
##  (3,4]           15-<30   27.2  1.889 Inf   23.4853      30.9
##  (4,5]           15-<30   25.9  2.085 Inf   21.8578      30.0
##  (5,6]           15-<30   22.9  2.592 Inf   17.8055      28.0
##  (6,7]           15-<30   21.5  3.338 Inf   14.9754      28.1
##  (7,8]           15-<30   21.5  4.689 Inf   12.2844      30.7
##  (8,9]           15-<30   24.7  5.052 Inf   14.8025      34.6
##  (9,10]          15-<30   16.4  5.550 Inf    5.5617      27.3
##  (10,11]         15-<30   20.1  6.090 Inf    8.1686      32.0
##  (11,12]         15-<30   16.6  8.456 Inf   -0.0121      33.1
##  [0,1]           30-<45   39.3  1.052 Inf   37.2414      41.4
##  (1,2]           30-<45   38.8  1.210 Inf   36.4047      41.1
##  (2,3]           30-<45   37.2  1.308 Inf   34.6267      39.8
##  (3,4]           30-<45   35.4  1.438 Inf   32.5384      38.2
##  (4,5]           30-<45   33.1  1.599 Inf   29.9711      36.2
##  (5,6]           30-<45   31.7  1.749 Inf   28.2789      35.1
##  (6,7]           30-<45   34.1  2.034 Inf   30.1524      38.1
##  (7,8]           30-<45   29.0  2.425 Inf   24.2572      33.8
##  (8,9]           30-<45   26.4  2.919 Inf   20.7124      32.2
```

```
##  (9,10]          30-<45   22.8  3.221 Inf   16.4468      29.1
##  (10,11]         30-<45   20.2  3.270 Inf   13.8299      26.6
##  (11,12]         30-<45   19.2  4.281 Inf   10.8557      27.6
##  (12,13]         30-<45   26.2  8.385 Inf    9.7633      42.6
##  (13,14]         30-<45   27.2  8.385 Inf   10.7261      43.6
##  (14,15]         30-<45   26.4 11.580 Inf    3.6960      49.1
##  [0,1]           45-<60   51.7  1.001 Inf   49.7022      53.6
##  (1,2]           45-<60   48.9  1.147 Inf   46.6941      51.2
##  (2,3]           45-<60   45.9  1.217 Inf   43.5425      48.3
##  (3,4]           45-<60   45.8  1.320 Inf   43.1964      48.4
##  (4,5]           45-<60   42.7  1.430 Inf   39.9358      45.5
##  (5,6]           45-<60   43.4  1.562 Inf   40.3379      46.5
##  (6,7]           45-<60   40.3  1.672 Inf   37.0017      43.6
##  (7,8]           45-<60   37.7  1.916 Inf   33.9428      41.5
##  (8,9]           45-<60   41.6  2.616 Inf   36.4918      46.7
##  (9,10]          45-<60   34.8  3.316 Inf   28.3349      41.3
##  (10,11]         45-<60   35.4  3.416 Inf   28.6881      42.1
##  (11,12]         45-<60   33.6  4.891 Inf   23.9930      43.2
##  (12,13]         45-<60   35.5  4.918 Inf   25.8817      45.2
##  (13,14]         45-<60   29.6  5.315 Inf   19.1572      40.0
##  (14,15]         45-<60   14.9  6.892 Inf    1.3794      28.4
##  [0,1]           60-90    70.7  0.815 Inf   69.0651      72.3
##  (1,2]           60-90    65.7  0.918 Inf   63.9199      67.5
##  (2,3]           60-90    63.3  0.951 Inf   61.4226      65.2
##  (3,4]           60-90    61.1  1.018 Inf   59.0639      63.1
##  (4,5]           60-90    59.8  1.050 Inf   57.7541      61.9
##  (5,6]           60-90    60.6  1.137 Inf   58.4078      62.9
##  (6,7]           60-90    55.1  1.194 Inf   52.7694      57.5
##  (7,8]           60-90    53.1  1.271 Inf   50.5940      55.6
##  (8,9]           60-90    51.1  1.396 Inf   48.3212      53.8
##  (9,10]          60-90    49.2  1.457 Inf   46.3759      52.1
##  (10,11]         60-90    46.8  1.593 Inf   43.6342      49.9
##  (11,12]         60-90    46.6  1.738 Inf   43.1894      50.0
##  (12,13]         60-90    40.9  1.860 Inf   37.2494      44.5
##  (13,14]         60-90    41.2  2.107 Inf   37.1079      45.4
##  (14,15]         60-90    38.1  3.080 Inf   32.0753      44.1
##  [0,1]           90+      94.5  1.159 Inf   92.2200      96.8
##  (1,2]           90+      88.6  1.294 Inf   86.0605      91.1
##  (2,3]           90+      85.4  1.386 Inf   82.6855      88.1
##  (3,4]           90+      83.6  1.461 Inf   80.7840      86.5
##  (4,5]           90+      79.5  1.508 Inf   76.5696      82.5
##  (5,6]           90+      78.7  1.583 Inf   75.6097      81.8
##  (6,7]           90+      72.5  1.663 Inf   69.2417      75.8
##  (7,8]           90+      73.2  1.717 Inf   69.8397      76.6
##  (8,9]           90+      71.1  1.809 Inf   67.5212      74.6
##  (9,10]          90+      68.6  2.022 Inf   64.6601      72.6
##  (10,11]         90+      67.8  2.321 Inf   63.2892      72.4
##  (11,12]         90+      63.8  2.486 Inf   58.8807      68.6
##  (12,13]         90+      69.3  2.771 Inf   63.8497      74.7
##  (13,14]         90+      67.5  2.827 Inf   61.9907      73.1
##  (14,15]         90+      59.0  4.231 Inf   50.6810      67.3
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_FGbasal$plot_marginal_means
```



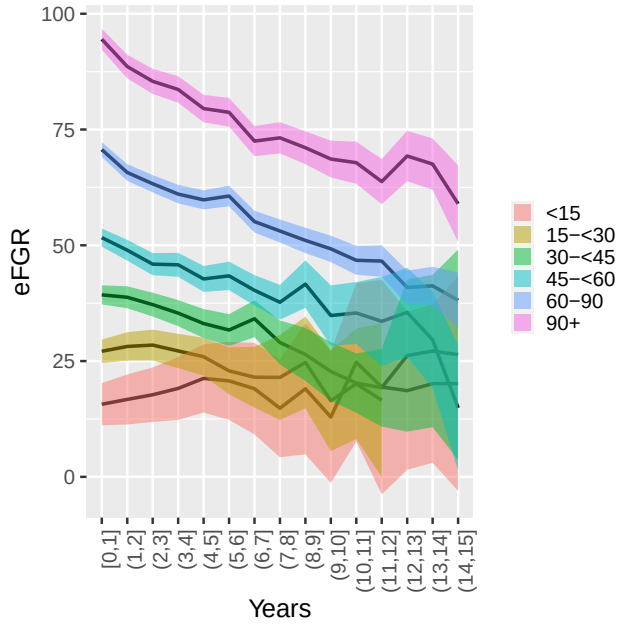

```
fiber.emt <- emtrends(model_FGbasal$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x      VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  <15                0.520 0.3240 Inf    -0.115    1.1551
##  15-<30            -0.437 0.2354 Inf    -0.898    0.0244
##  30-<45            -1.422 0.1464 Inf    -1.708   -1.1348
##  45-<60            -1.744 0.1262 Inf    -1.992   -1.4969
##  60-90             -2.254 0.0689 Inf    -2.389   -2.1186
##  90+               -2.584 0.0962 Inf    -2.773   -2.3955
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast            estimate    SE  df z.ratio p.value
##  <15 - (15-<30)         0.957 0.400 Inf   2.390  0.1597
##  <15 - (30-<45)         1.942 0.356 Inf   5.461  <.0001
##  <15 - (45-<60)         2.264 0.348 Inf   6.512  <.0001
##  <15 - (60-90)          2.774 0.331 Inf   8.374  <.0001
##  <15 - (90+)            3.104 0.338 Inf   9.184  <.0001
##  (15-<30) - (30-<45)    0.985 0.277 Inf   3.552  0.0051
##  (15-<30) - (45-<60)    1.307 0.267 Inf   4.894  <.0001
##  (15-<30) - (60-90)     1.817 0.245 Inf   7.405  <.0001
##  (15-<30) - (90+)       2.147 0.254 Inf   8.442  <.0001
##  (30-<45) - (45-<60)    0.323 0.193 Inf   1.669  0.5521
##  (30-<45) - (60-90)     0.832 0.162 Inf   5.143  <.0001
##  (30-<45) - (90+)       1.162 0.175 Inf   6.637  <.0001
##  (45-<60) - (60-90)     0.509 0.144 Inf   3.542  0.0053
##  (45-<60) - (90+)       0.840 0.159 Inf   5.291  <.0001
##  (60-90) - (90+)        0.330 0.118 Inf   2.791  0.0588
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 6 estimates
```

```
model_FGbasal$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```



19 Mixed model adding Age (Up/Low 50yo) and Sex)

Proposaves fer:

- Dones (<50a o ≥50a) pel possible efecte protector hormonal que es perd després de la menopausa.
- Dones <50a vs homes <50 anys i dones ≥50anys vs homes ≥50anys.

M'ha semblat de crear una variable amb 4 categories:

- Dones <50a
- Dones ≥50a
- Homes <50a
- Homes ≥50a

i seguir la mateixa dinàmica de la resta.

Veuràs que més endavant hi ha la comparació de cada grup (amb un comentari meu).

Nota que hi ha poques dones de <50a:

```
table(datpre$SexAge, useNA = "ifany")
```

```
##
## Women/<50 Women/50+   Men/<50   Men/50+
##        57      2801       220      6391
```

```
model_SexAge <- Mixed_models_FG(dades$SexAge, dades$epi)
model_SexAge$anova_tnum
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##               Sum Sq Mean Sq NumDF  DenDF  F value    Pr(>F)
## x               3710    1237     3 4892.8   9.5104  2.92e-06 ***
## x:VISIT_YEARS 226640   56660     4 8671.1 435.7486 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_SexAge$anova_tcat
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                   Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## x                   4104  1368.1     3 4952.3  10.505 6.941e-07 ***
## x:VISIT_YEARS_Cat 230716  5015.6    46 8421.9  38.511 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
model_SexAge$cftest_tcat
```

```
##
##          Simultaneous Tests for General Linear Hypotheses
##
## Fit: lmer(formula = y ~ x + x:VISIT_YEARS_Cat + (1 | id), data = dades)
##
## Linear Hypotheses:
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept) == 0                          54.4649     3.0593  17.803  < 2e-16 ***
## xWomen/50+ == 0                           -3.0887     2.8018  -1.102   0.2703
## xMen/<50 == 0                              9.0991     3.5587   2.557   0.0106 *
## xMen/50+ == 0                              5.3394     3.2091   1.664   0.0961 .
## xWomen/<50:VISIT_YEARS_Cat(1,2] == 0       0.9490     4.4080   0.215   0.8295
## xWomen/50+:VISIT_YEARS_Cat(1,2] == 0      -4.1955     0.6952  -6.035 1.59e-09 ***
## xMen/<50:VISIT_YEARS_Cat(1,2] == 0         1.9920     2.1709   0.918   0.3588
## xMen/50+:VISIT_YEARS_Cat(1,2] == 0        -2.6052     0.4665  -5.584 2.35e-08 ***
## xWomen/<50:VISIT_YEARS_Cat(2,3] == 0      -1.4160     5.8899  -0.240   0.8100
## xWomen/50+:VISIT_YEARS_Cat(2,3] == 0      -5.4606     0.7763  -7.034 2.00e-12 ***
## xMen/<50:VISIT_YEARS_Cat(2,3] == 0        -3.1779     2.5556  -1.244   0.2137
## xMen/50+:VISIT_YEARS_Cat(2,3] == 0        -5.1071     0.5186  -9.849  < 2e-16 ***
## xWomen/<50:VISIT_YEARS_Cat(3,4] == 0      16.1068     7.4854   2.152   0.0314 *
## xWomen/50+:VISIT_YEARS_Cat(3,4] == 0      -6.8696     0.8888  -7.729 1.09e-14 ***
## xMen/<50:VISIT_YEARS_Cat(3,4] == 0        -0.7985     3.9845  -0.200   0.8412
## xMen/50+:VISIT_YEARS_Cat(3,4] == 0        -6.8627     0.5815 -11.801  < 2e-16 ***
## xWomen/<50:VISIT_YEARS_Cat(4,5] == 0     -16.4714     9.3006  -1.771   0.0766 .
## xWomen/50+:VISIT_YEARS_Cat(4,5] == 0      -8.6531     0.9992  -8.660  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(4,5] == 0        -1.4924     5.0952  -0.293   0.7696
## xMen/50+:VISIT_YEARS_Cat(4,5] == 0        -9.1180     0.6240 -14.613  < 2e-16 ***
## xWomen/<50:VISIT_YEARS_Cat(5,6] == 0      -3.7277     9.3006  -0.401   0.6886
## xWomen/50+:VISIT_YEARS_Cat(5,6] == 0      -9.4074     1.1041  -8.520  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(5,6] == 0        -6.8795     4.7408  -1.451   0.1467
## xMen/50+:VISIT_YEARS_Cat(5,6] == 0        -9.2160     0.7115 -12.954  < 2e-16 ***
## xWomen/<50:VISIT_YEARS_Cat(6,7] == 0      -5.5388     9.3006  -0.596   0.5515
## xWomen/50+:VISIT_YEARS_Cat(6,7] == 0     -13.1411     1.1825 -11.113  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(6,7] == 0        -3.2030     7.4153  -0.432   0.6658
## xMen/50+:VISIT_YEARS_Cat(6,7] == 0       -13.6052     0.7952 -17.109  < 2e-16 ***
## xWomen/<50:VISIT_YEARS_Cat(7,8] == 0     -13.3104     9.3006  -1.431   0.1524
## xWomen/50+:VISIT_YEARS_Cat(7,8] == 0     -17.7670     1.3101 -13.561  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(7,8] == 0         1.5239     7.0789   0.215   0.8296
## xMen/50+:VISIT_YEARS_Cat(7,8] == 0       -14.5055     0.8933 -16.237  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(8,9] == 0     -19.6857     1.6028 -12.282  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(8,9] == 0       -10.5712     8.7624  -1.206   0.2277
## xMen/50+:VISIT_YEARS_Cat(8,9] == 0       -15.5920     1.0099 -15.440  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(9,10] == 0    -23.0753     1.7987 -12.829  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(9,10] == 0       -3.1597     7.4153  -0.426   0.6700
## xMen/50+:VISIT_YEARS_Cat(9,10] == 0      -18.6551     1.1187 -16.676  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(10,11] == 0   -27.0666     1.9041 -14.215  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(10,11] == 0      -1.7477     7.4153  -0.236   0.8137
## xMen/50+:VISIT_YEARS_Cat(10,11] == 0     -18.8576     1.2831 -14.697  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(11,12] == 0   -27.0475     2.4721 -10.941  < 2e-16 ***
## xMen/<50:VISIT_YEARS_Cat(11,12] == 0       2.4986    12.2014   0.205   0.8377
## xMen/50+:VISIT_YEARS_Cat(11,12] == 0     -21.6705     1.4024 -15.452  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(12,13] == 0   -31.3788     2.9895 -10.496  < 2e-16 ***
## xMen/50+:VISIT_YEARS_Cat(12,13] == 0     -22.3461     1.5358 -14.550  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(13,14] == 0   -32.8710     3.2107 -10.238  < 2e-16 ***
```

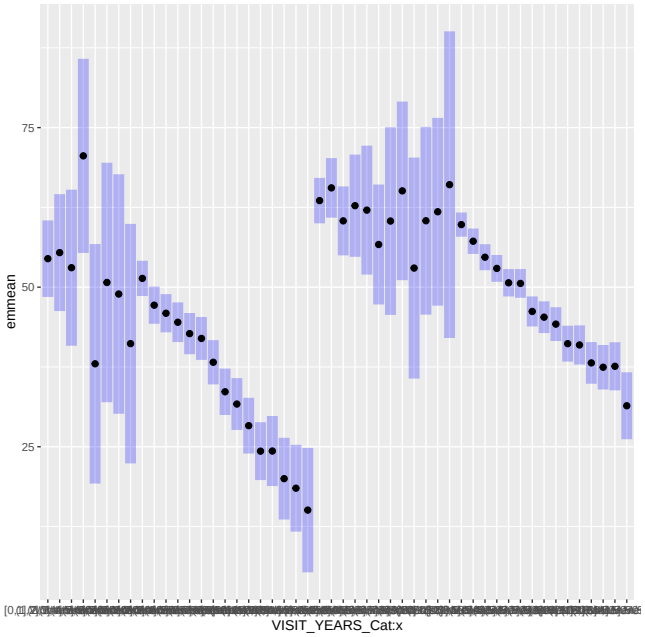
```
## xMen/50+:VISIT_YEARS_Cat(13,14] == 0   -22.1986     1.6996 -13.061  < 2e-16 ***
## xWomen/50+:VISIT_YEARS_Cat(14,15] == 0 -36.3043     4.7959  -7.570 3.73e-14 ***
## xMen/50+:VISIT_YEARS_Cat(14,15] == 0   -28.3862     2.5220 -11.256  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Univariate p values reported)
```

```
model_SexAge$emmeans_model_tcat
```

```
##  VISIT_YEARS_Cat x          emmean     SE  df asymp.LCL asymp.UCL
##  [0,1]           Women/<50    54.5  3.059 Inf     48.47      60.5
##  (1,2]           Women/<50    55.4  4.674 Inf     46.25      64.6
##  (2,3]           Women/<50    53.0  6.238 Inf     40.82      65.3
##  (3,4]           Women/<50    70.6  7.761 Inf     55.36      85.8
##  (4,5]           Women/<50    38.0  9.573 Inf     19.23      56.8
##  (5,6]           Women/<50    50.7  9.573 Inf     31.97      69.5
##  (6,7]           Women/<50    48.9  9.573 Inf     30.16      67.7
##  (7,8]           Women/<50    41.2  9.573 Inf     22.39      59.9
##  [0,1]           Women/50+    51.4  1.411 Inf     48.61      54.1
##  (1,2]           Women/50+    47.2  1.489 Inf     44.26      50.1
##  (2,3]           Women/50+    45.9  1.527 Inf     42.92      48.9
##  (3,4]           Women/50+    44.5  1.586 Inf     41.40      47.6
##  (4,5]           Women/50+    42.7  1.649 Inf     39.49      46.0
##  (5,6]           Women/50+    42.0  1.716 Inf     38.61      45.3
##  (6,7]           Women/50+    38.2  1.769 Inf     34.77      41.7
##  (7,8]           Women/50+    33.6  1.856 Inf     29.97      37.2
##  (8,9]           Women/50+    31.7  2.073 Inf     27.63      35.8
##  (9,10]          Women/50+    28.3  2.228 Inf     23.93      32.7
##  (10,11]         Women/50+    24.3  2.315 Inf     19.77      28.8
##  (11,12]         Women/50+    24.3  2.801 Inf     18.84      29.8
##  (12,13]         Women/50+    20.0  3.268 Inf     13.59      26.4
##  (13,14]         Women/50+    18.5  3.471 Inf     11.70      25.3
##  (14,15]         Women/50+    15.1  4.974 Inf      5.32      24.8
##  [0,1]           Men/<50      63.6  1.818 Inf     60.00      67.1
##  (1,2]           Men/<50      65.6  2.380 Inf     60.89      70.2
##  (2,3]           Men/<50      60.4  2.758 Inf     54.98      65.8
##  (3,4]           Men/<50      62.8  4.088 Inf     54.75      70.8
##  (4,5]           Men/<50      62.1  5.152 Inf     51.97      72.2
##  (5,6]           Men/<50      56.7  4.793 Inf     47.29      66.1
##  (6,7]           Men/<50      60.4  7.505 Inf     45.65      75.1
##  (7,8]           Men/<50      65.1  7.138 Inf     51.10      79.1
##  (8,9]           Men/<50      53.0  8.834 Inf     35.68      70.3
##  (9,10]          Men/<50      60.4  7.505 Inf     45.69      75.1
##  (10,11]         Men/<50      61.8  7.505 Inf     47.11      76.5
##  (11,12]         Men/<50      66.1 12.258 Inf     42.04      90.1
##  [0,1]           Men/50+      59.8  0.969 Inf     57.91      61.7
##  (1,2]           Men/50+      57.2  1.016 Inf     55.21      59.2
##  (2,3]           Men/50+      54.7  1.040 Inf     52.66      56.7
##  (3,4]           Men/50+      52.9  1.073 Inf     50.84      55.0
##  (4,5]           Men/50+      50.7  1.096 Inf     48.54      52.8
##  (5,6]           Men/50+      50.6  1.149 Inf     48.34      52.8
##  (6,7]           Men/50+      46.2  1.202 Inf     43.84      48.6
##  (7,8]           Men/50+      45.3  1.268 Inf     42.81      47.8
##  (8,9]           Men/50+      44.2  1.352 Inf     41.56      46.9
```

```
##  (9,10]          Men/50+     41.1  1.435 Inf     38.34      44.0
##  (10,11]         Men/50+     40.9  1.566 Inf     37.88      44.0
##  (11,12]         Men/50+     38.1  1.665 Inf     34.87      41.4
##  (12,13]         Men/50+     37.5  1.779 Inf     33.97      40.9
##  (13,14]         Men/50+     37.6  1.921 Inf     33.84      41.4
##  (14,15]         Men/50+     31.4  2.677 Inf     26.17      36.7
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
model_SexAge$plot_marginal_means
```




```
fiber.emt <- emtrends(model_SexAge$model_tnum, "x", var = "VISIT_YEARS")
fiber.emt
```

```
##  x          VISIT_YEARS.trend     SE  df asymp.LCL asymp.UCL
##  Women/<50             -0.720 1.0044 Inf     -2.69     1.249
##  Women/50+             -2.363 0.0925 Inf     -2.54    -2.182
##  Men/<50               -0.419 0.4313 Inf     -1.26     0.426
##  Men/50+               -1.903 0.0576 Inf     -2.02    -1.790
##
## Degrees-of-freedom method: asymptotic
## Confidence level used: 0.95
```

```
pairs(fiber.emt)
```

```
##  contrast                   estimate    SE  df z.ratio p.value
##  (Women/<50) - (Women/50+)     1.643 1.008 Inf   1.630  0.3619
##  (Women/<50) - (Men/<50)      -0.301 1.093 Inf  -0.275  0.9927
##  (Women/<50) - (Men/50+)       1.183 1.006 Inf   1.175  0.6424
##  (Women/50+) - (Men/<50)      -1.944 0.441 Inf  -4.408  0.0001
##  (Women/50+) - (Men/50+)      -0.461 0.109 Inf  -4.227  0.0001
##  (Men/<50) - (Men/50+)         1.484 0.434 Inf   3.421  0.0035
##
## Degrees-of-freedom method: asymptotic
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Nota que:

- en el subgrup de dones, no hi ha diferencies significatives entre grups d'edat (pvalue =0.3619)
- que en subgrup de <50a, els homes no es diferencien significativament de les dones (pvalue =0.9927)
- que en subgrup de ≥50a, els homes i les dones es diferencien significativament (pvalue =0.0001)
- en el subgrup de homes, hi ha diferencies significatives entre grups d'edat (pvalue =0.0035)

```
model_SexAge$emmeans_model_tcat %>% logitudinal_plot + ylab('eFGR')
```