project2_test

Group_01

2021/7/7

```
library(tidyverse)
library(moderndive)
library(skimr)
library(kableExtra)
library(gridExtra)
library(broom)
library(plotly)
library(GGally)
library(sjPlot)
```

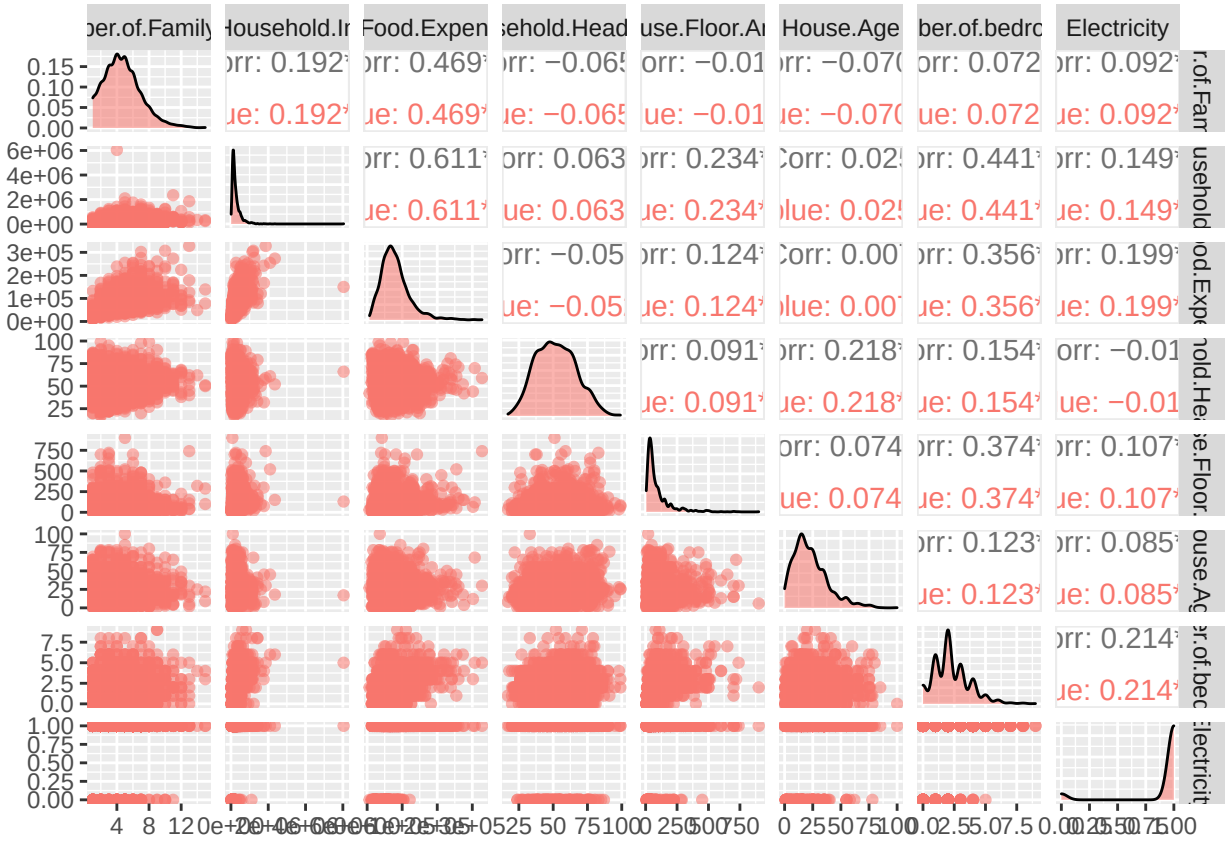
```
data.score <- data %>%
  dplyr::select(Total.Number.of.Family.members,Total.Household.Income,
                Total.Food.Expenditure, Household.Head.Age, House.Floor.Area, House.Age,
                Number.of.bedrooms, Electricity)
```

```
data.score %>%
  cor()
```

```
                              Total.Number.of.Family.members
Total.Number.of.Family.members                     1.00000000
Total.Household.Income                             0.19228742
Total.Food.Expenditure                             0.46924215
Household.Head.Age                                -0.06541636
House.Floor.Area                                  -0.01415702
House.Age                                         -0.07003586
Number.of.bedrooms                                 0.07207630
Electricity                                        0.09193871
                              Total.Household.Income Total.Food.Expenditure
Total.Number.of.Family.members             0.19228742            0.469242145
Total.Household.Income                     1.00000000            0.611494530
Total.Food.Expenditure                     0.61149453            1.000000000
Household.Head.Age                         0.06280405           -0.051724735
House.Floor.Area                           0.23413840            0.124320633
House.Age                                  0.02471720            0.006725185
Number.of.bedrooms                         0.44137375            0.355734454
Electricity                                0.14866655            0.198610366
                              Household.Head.Age House.Floor.Area    House.Age
Total.Number.of.Family.members        -0.06541636      -0.01415702 -0.070035856
Total.Household.Income                 0.06280405       0.23413840  0.024717197
Total.Food.Expenditure                -0.05172474       0.12432063  0.006725185
Household.Head.Age                     1.00000000       0.09057216  0.218079293
```

```
House.Floor.Area                        0.09057216       1.00000000  0.074265080
House.Age                               0.21807929       0.07426508  1.000000000
Number.of.bedrooms                      0.15415511       0.37399081  0.123180471
Electricity                            -0.01304412       0.10693465  0.085327324
                                  Number.of.bedrooms Electricity
Total.Number.of.Family.members             0.0720763  0.09193871
Total.Household.Income                     0.4413738  0.14866655
Total.Food.Expenditure                     0.3557345  0.19861037
Household.Head.Age                         0.1541551 -0.01304412
House.Floor.Area                           0.3739908  0.10693465
House.Age                                  0.1231805  0.08532732
Number.of.bedrooms                         1.0000000  0.21376315
Electricity                                0.2137632  1.00000000
```

```
ggpairs(data.score, aes(colour = "blue", alpha = 0.4))
```




```
my_skim <- skim_with(numeric = sfl(hist = NULL))
my_skim(data.score)  %>%
  dplyr::select(-skim_type) %>%
  as_tibble() %>%
  kable(col.names = c("Variable", "Missing", "Complete", "Mean", "SD", "Min.", "1st Q.",
                      "Median", "3rd Q.", "Max."),
        caption = "Summary statistics",
        booktabs = TRUE,  digits = 2) %>%
  kable_styling(font_size = 10, latex_options = "hold_position") #create a summarized statistics table
```

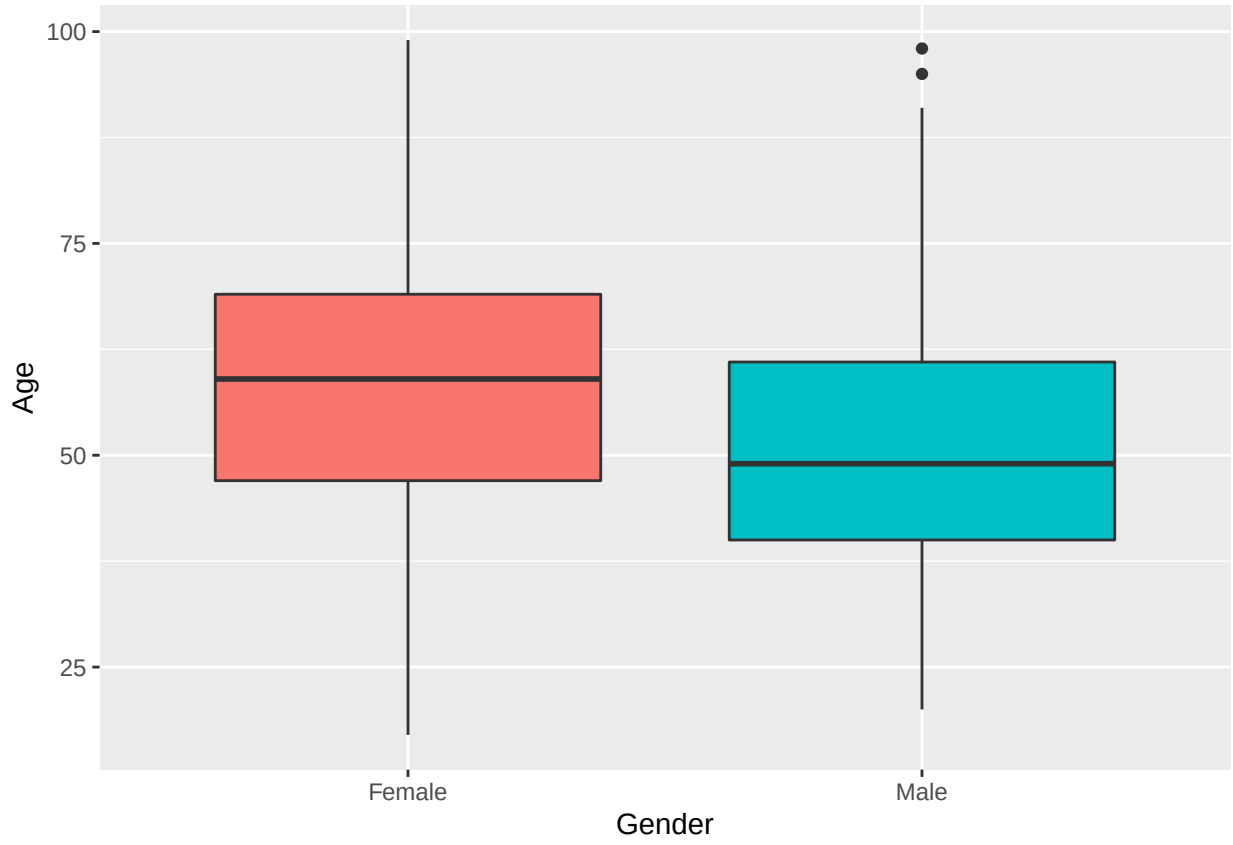
Table 1: Summary statistics

Variable	Missing	Complete	Mean	SD	Min.	1st Q.	Median	3rd Q.	
Total.Number.of.Family.members	0	1	4.67	2.33	1	3	4	6	
Total.Household.Income	0	1	269540.48	274564.17	11988	118565	188580	328335	6
Total.Food.Expenditure	0	1	80352.78	41194.36	6781	51922	73578	98493	
Household.Head.Age	0	1	52.23	14.52	17	41	52	63	
House.Floor.Area	0	1	90.92	99.20	5	32	54	102	
House.Age	0	1	22.98	15.32	0	12	20	31	
Number.of.bedrooms	0	1	2.26	1.44	0	1	2	3	
Electricity	0	1	0.93	0.26	0	1	1	1	

Gender&age

```
data.gender <- data %>%
  select(Household.Head.Sex, Household.Head.Age)
```

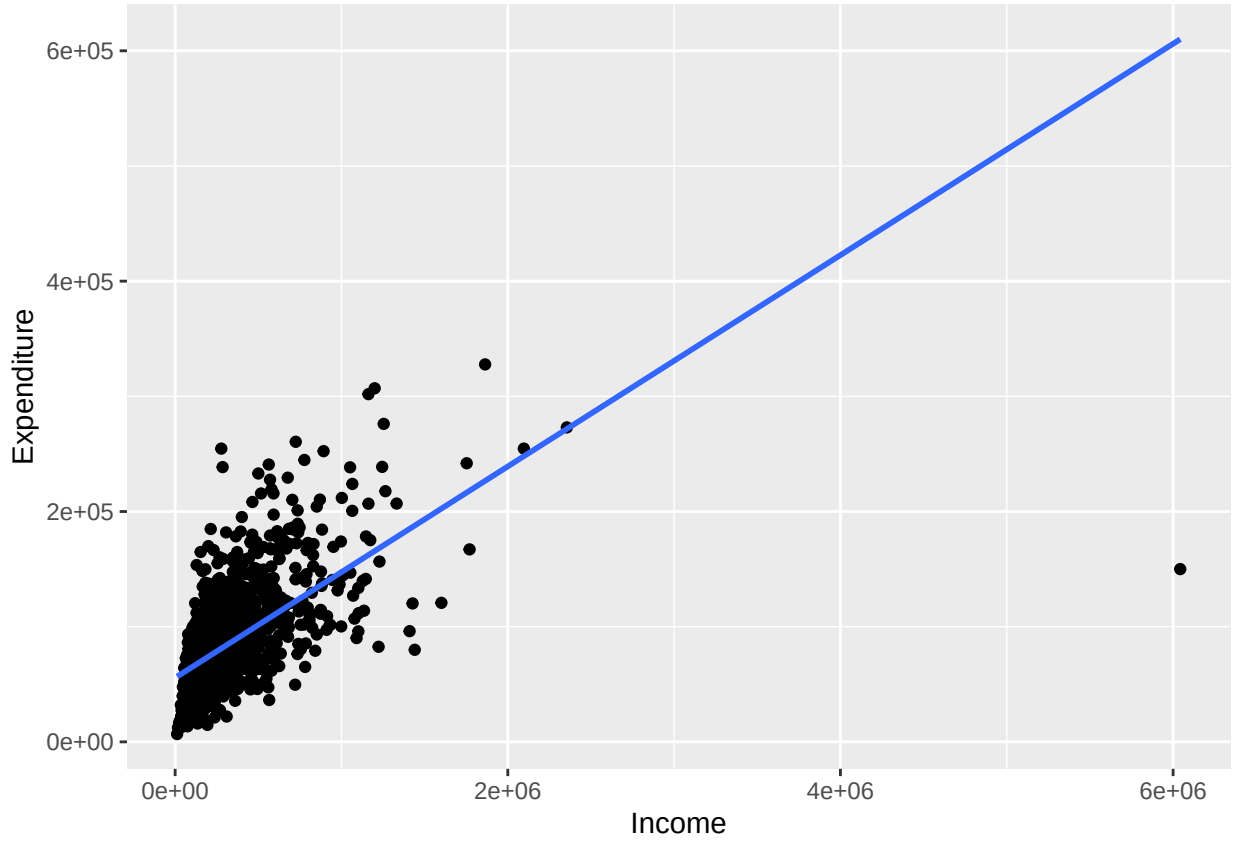
```
ggplot(data = data.gender, aes(x = Household.Head.Sex, y = Household.Head.Age, fill = Household.Head.Se
  geom_boxplot() +
  labs(x = "Gender", y = "Age")+
  theme(legend.position = "none")
```



balance

```
data.balance <- data %>%
  select(Total.Household.Income, Total.Food.Expenditure)
```

```
ggplot(data = data.balance, aes(x = Total.Household.Income, y = Total.Food.Expenditure)) +
  geom_point() +
  labs(x = "Income", y = "Expenditure") +
  geom_smooth(method = glm, se = FALSE) +
  theme(legend.position = "none")
```



Model

```
model_full <- glm(Total.Number.of.Family.members ~ Total.Household.Income +
                  Total.Food.Expenditure + Household.Head.Age + House.Floor.Area + House.Age +
                  Number.of.bedrooms + Electricity, data = data)
```

```
model_full %>%
  summary()
```

```
Call:
```

```
glm(formula = Total.Number.of.Family.members ~ Total.Household.Income +
    Total.Food.Expenditure + Household.Head.Age + House.Floor.Area +
    House.Age + Number.of.bedrooms + Electricity, data = data)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-5.5671  -1.4626  -0.3084   1.2037  10.7417

Coefficients:
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)             2.746e+00  2.667e-01  10.298  < 2e-16 ***
Total.Household.Income -1.022e-06  2.384e-07  -4.287 1.91e-05 ***
Total.Food.Expenditure  3.197e-05  1.540e-06  20.759  < 2e-16 ***
Household.Head.Age     -4.491e-04  3.520e-03  -0.128  0.89850
House.Floor.Area       -7.261e-04  5.357e-04  -1.355  0.17550
House.Age              -9.472e-03  3.301e-03  -2.870  0.00416 **
Number.of.bedrooms     -9.756e-02  4.121e-02  -2.367  0.01802 *
Electricity             1.696e-01  1.929e-01   0.879  0.37955
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 4.130968)

    Null deviance: 9384.0  on 1724  degrees of freedom
Residual deviance: 7092.9  on 1717  degrees of freedom
AIC: 7352.3

Number of Fisher Scoring iterations: 2
```

```
model_significant <- glm(Total.Number.of.Family.members ~ Total.Household.Income +
                Total.Food.Expenditure + House.Age +
                Number.of.bedrooms, data = data)
```

```
model_significant %>%
  summary()
```

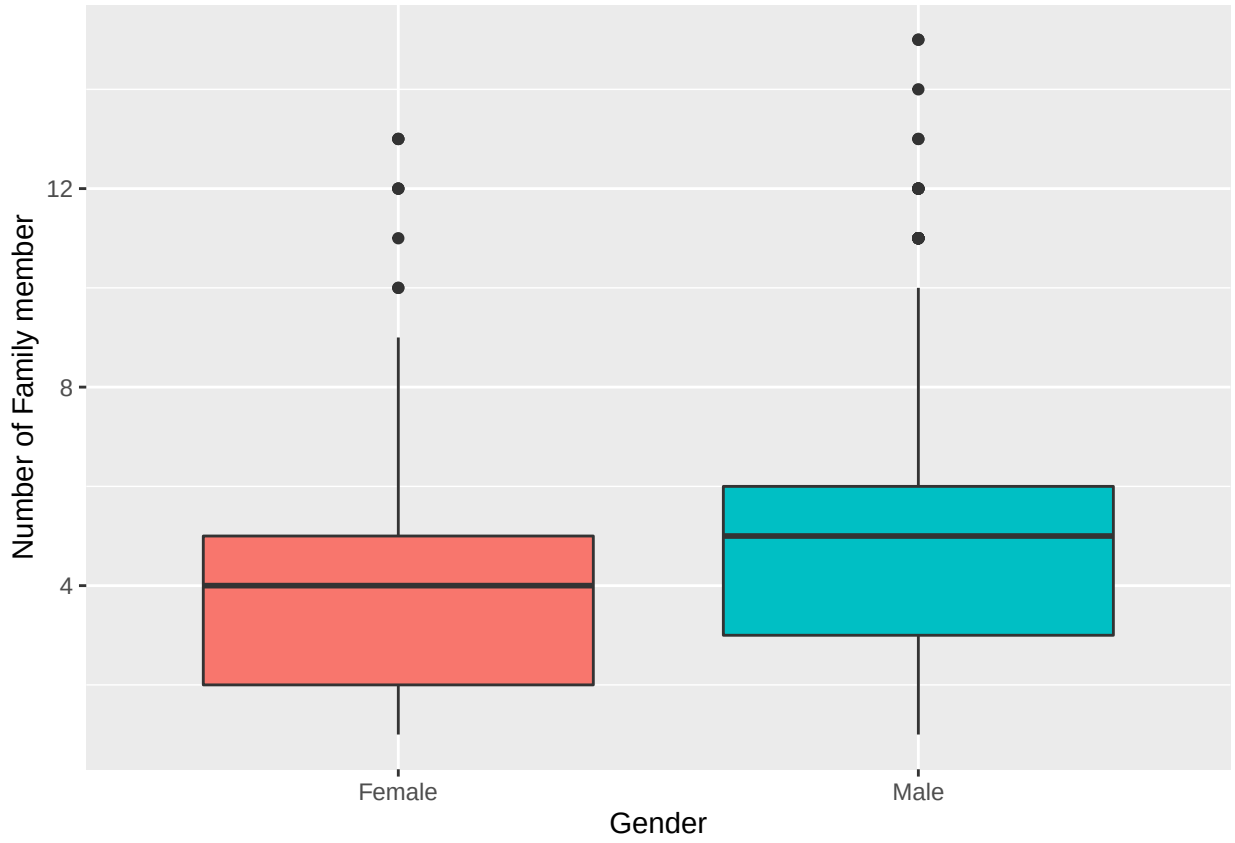
```
Call:
glm(formula = Total.Number.of.Family.members ~ Total.Household.Income +
    Total.Food.Expenditure + House.Age + Number.of.bedrooms,
    data = data)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-5.5796  -1.4561  -0.3048   1.1778  10.6187

Coefficients:
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)             2.828e+00  1.375e-01  20.560  < 2e-16 ***
Total.Household.Income -1.061e-06  2.364e-07  -4.487 7.71e-06 ***
Total.Food.Expenditure  3.229e-05  1.513e-06  21.340  < 2e-16 ***
House.Age              -9.507e-03  3.223e-03  -2.950  0.00322 **
Number.of.bedrooms     -1.103e-01  3.855e-02  -2.862  0.00425 **
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for gaussian family taken to be 4.129948)

    Null deviance: 9384.0  on 1724  degrees of freedom
Residual deviance: 7103.5  on 1720  degrees of freedom
AIC: 7348.8

Number of Fisher Scoring iterations: 2
```

Family number & Gender

```
data.sex_number <- data %>%
  select(Household.Head.Sex, Total.Number.of.Family.members)
```

```
ggplot(data = data.sex_number, aes(x = Household.Head.Sex, y = Total.Number.of.Family.members, fill = H
  geom_boxplot() +
  labs(x = "Gender", y = "Number of Family member")+
  theme(legend.position = "none")
```



Log-odds

```
data.sex_number$Household.Head.Sex <- as.factor(data.sex_number$Household.Head.Sex)
```

```
model_sex_number <- glm(Household.Head.Sex ~ Total.Number.of.Family.members, data = data.sex_number,
                        family = binomial(link = "logit"))
```

```
model_sex_number %>%
  summary()
```

```
Call:
glm(formula = Household.Head.Sex ~ Total.Number.of.Family.members,
    family = binomial(link = "logit"), data = data.sex_number)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.4219   0.4705   0.6602   0.7163   0.9054

Coefficients:
                             Estimate Std. Error z value Pr(>|z|)
(Intercept)                   0.49674    0.13174   3.771 0.000163 ***
Total.Number.of.Family.members  0.18319    0.02844   6.442 1.18e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1790.9  on 1724  degrees of freedom
Residual deviance: 1745.4  on 1723  degrees of freedom
AIC: 1749.4

Number of Fisher Scoring iterations: 4
```

```
levels(data.sex_number$Household.Head.Sex)
```

```
[1] "Female" "Male"
```

```
modelcoefs <- round(coef(model_sex_number),2)
```

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta \cdot \text{number of family members} = 0.5 + 0.18 \cdot \text{number of family members},$$

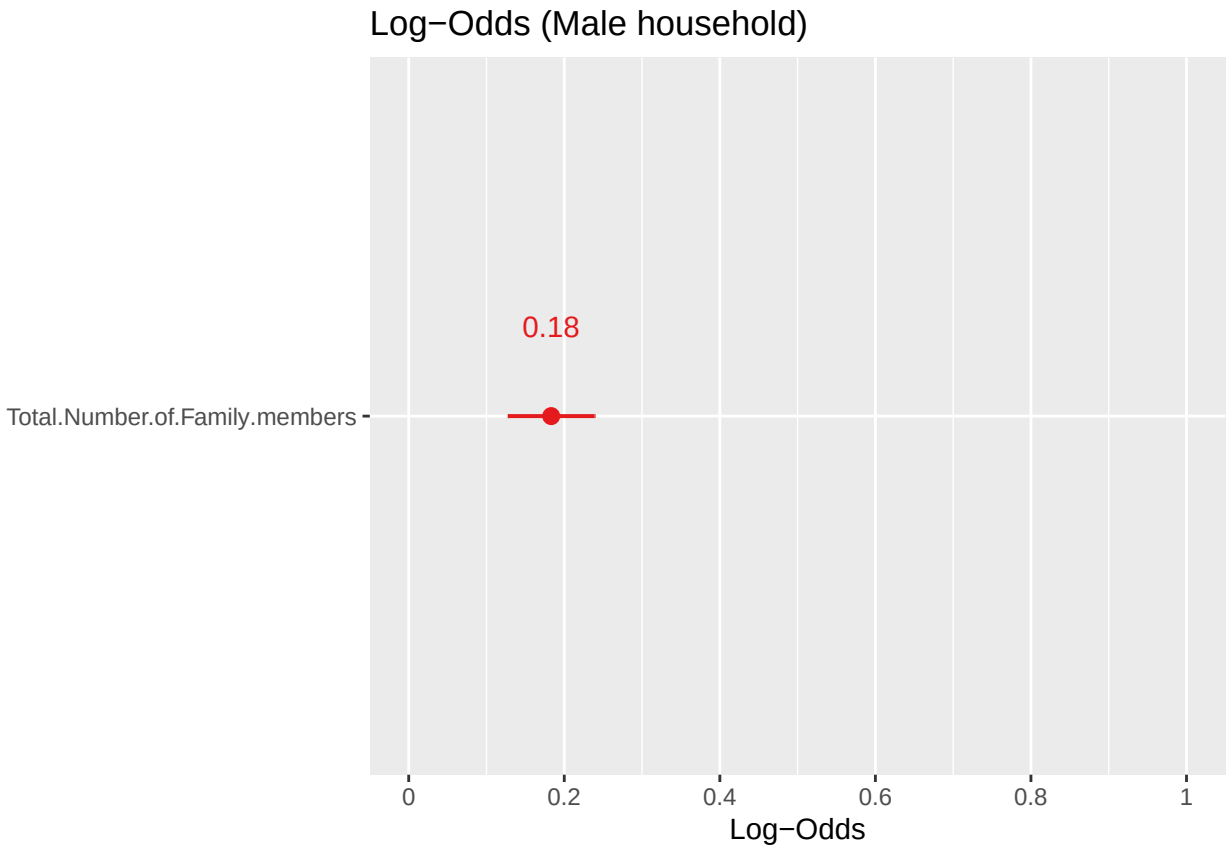
Where $p = Prob(Male)$ and $1 - p = Prob(Female)$. Hence, the log-odds of the household being male increase by 0.18 for every one unit increase in number of family members. This provides us with a point estimate of how the log-odds changes with age.

However, we are also interested in producing a 95% confidence interval for these log-odds.

```
confint(model_sex_number) %>%
  kable()
```

	2.5 %	97.5 %
(Intercept)	0.2388990	0.7555347
Total.Number.of.Family.members	0.1282353	0.2397474

```
plot_model(model_sex_number, show.values = TRUE, transform = NULL,
           title = "Log-Odds (Male household)", show.p = FALSE)
```

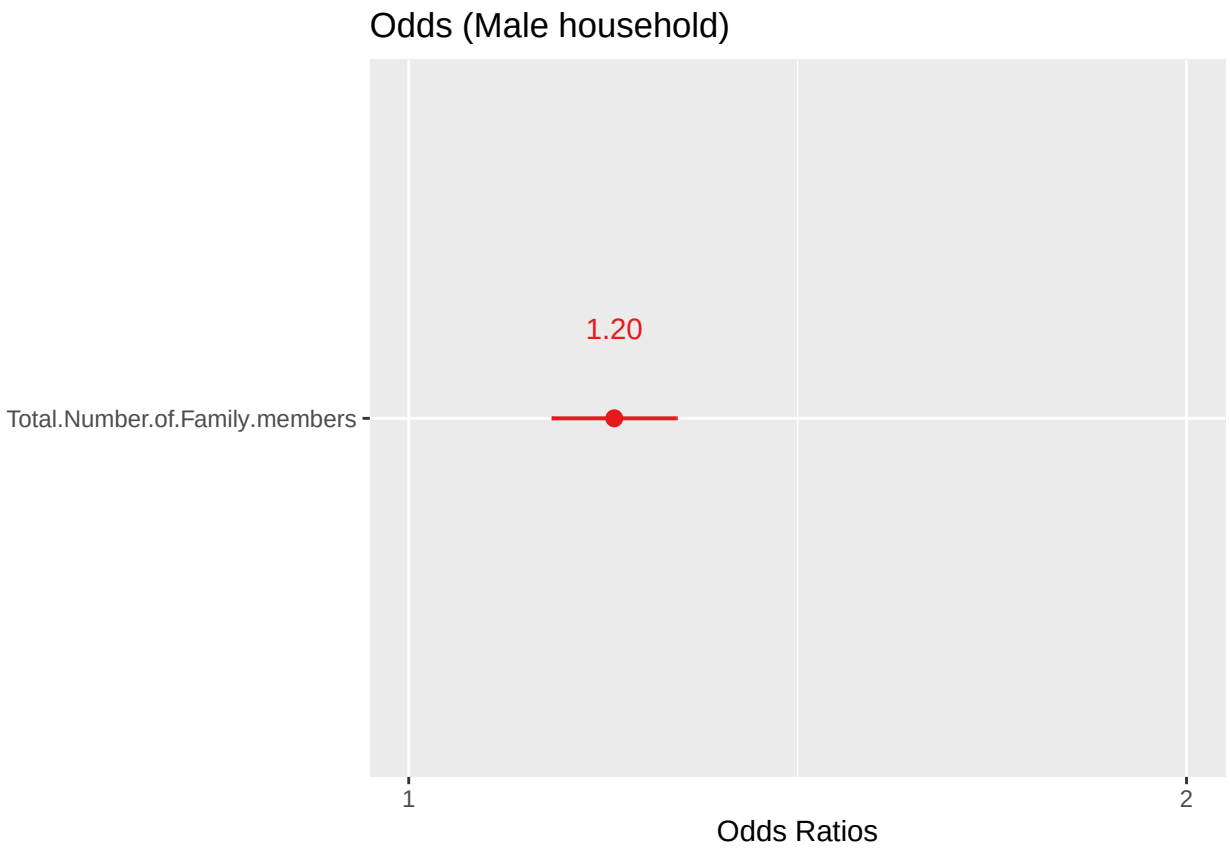


Now, let's add the estimates of the log-odds to our data set:

```
data.sex_number <- data.sex_number %>%
  mutate(logodds.male = predict(model_sex_number))
```

Odds

```
plot_model(model_sex_number, show.values = TRUE, axis.lim = c(1,1.5),
           title = "Odds (Male household)", show.p = FALSE)
```



Now, let's add the estimates of the odds to our data set:

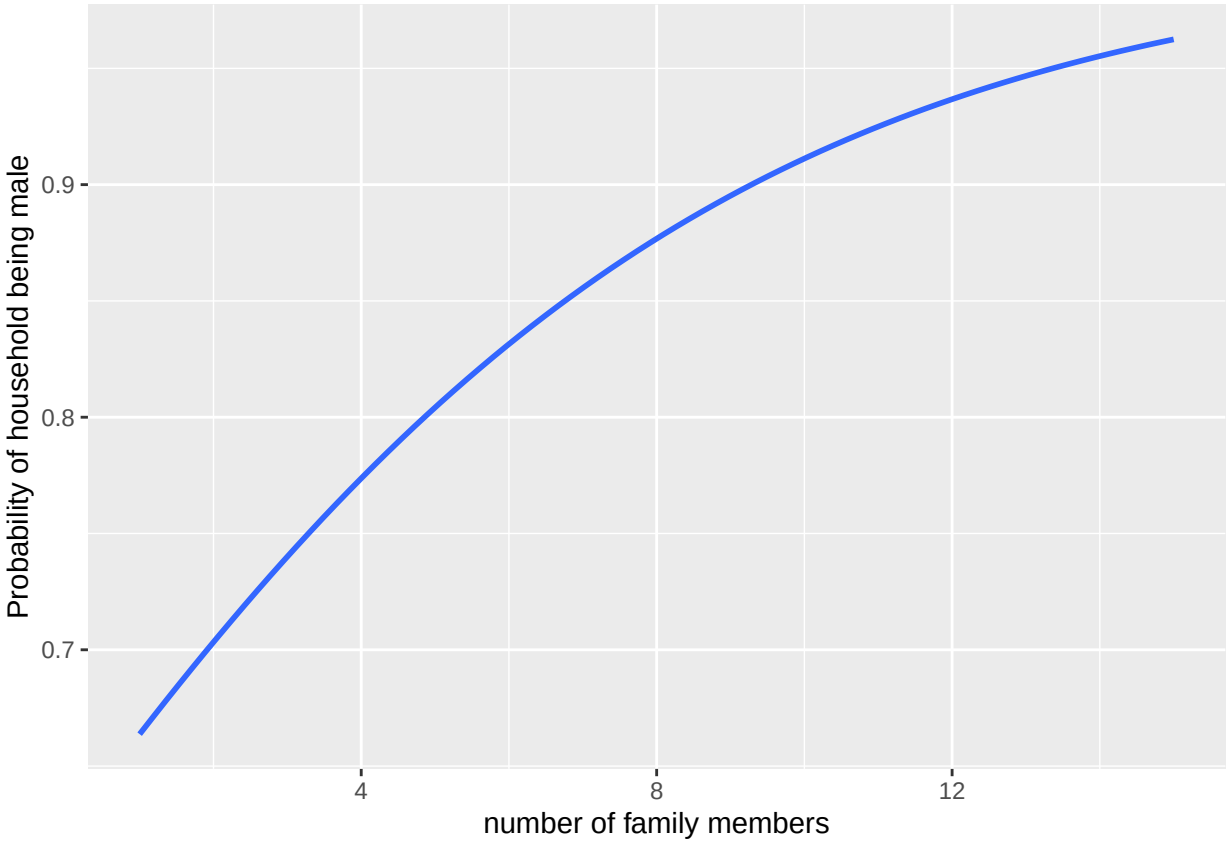
```
data.sex_number <- data.sex_number %>%
  mutate(odds.male = exp(logodds.male))
```

Probabilities

```
data.sex_number <- data.sex_number %>%
  mutate(probs.male = fitted(model_sex_number))
```

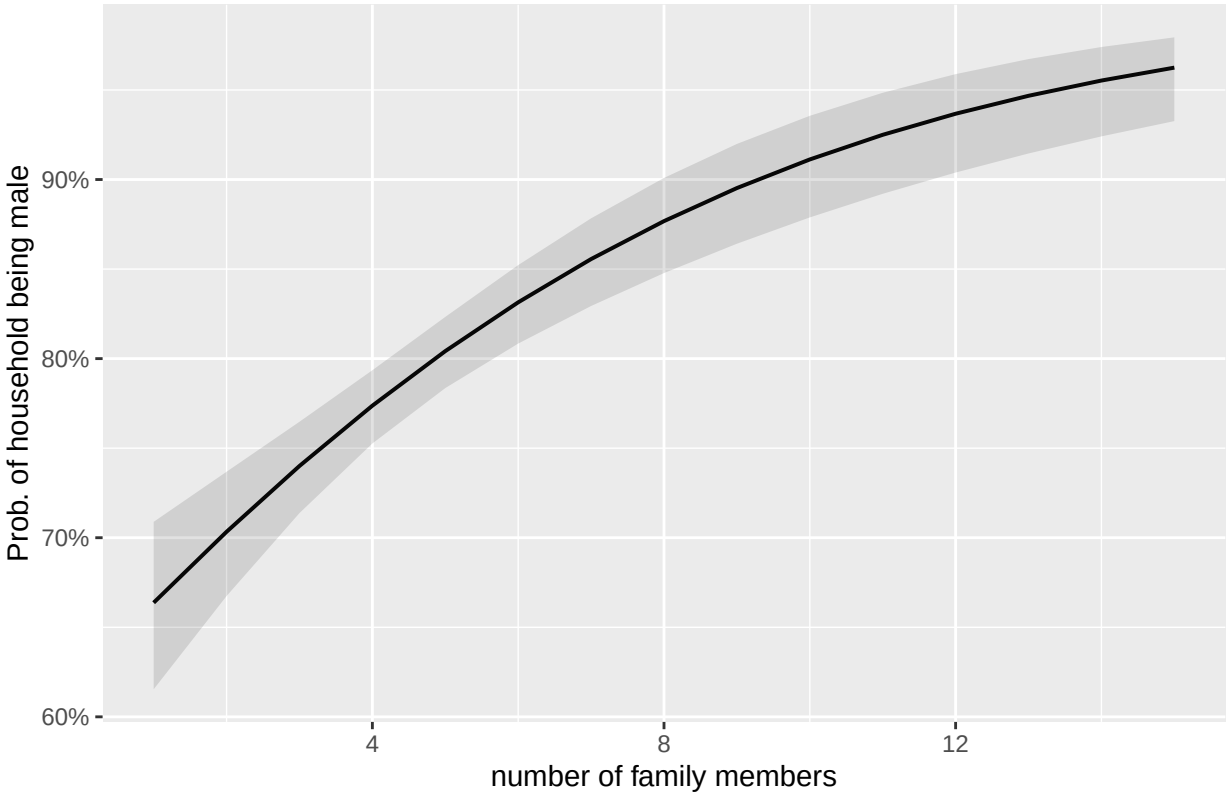
Plot the probability of being male

```
ggplot(data = data.sex_number, aes(x = Total.Number.of.Family.members, y = probs.male)) +
  geom_smooth(method="glm",
              method.args = list(family="binomial"),
              se = FALSE) +
  labs(x = "number of family members", y = "Probability of household being male")
```




```
plot_model(model_sex_number, type = "pred", title = "",
           axis.title = c("number of family members", "Prob. of household being male"))
```

```
$Total.Number.of.Family.members
```


Prob. of household being male
90%
80%
70%
60%
4
8
12
number of family members