Project Title

A STAT 139 Final Project

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Abstract

Introduction

- Obesity is an exerbating problem in the US.
- Explore the association of 21 different factors with bmi, 13 of which are behavior-related factors such as the typical number of hours sleep per night

Methods

- Data description
    - data source is NHANES 2013-2014
    - Variables of interest
    - Only consider adults of age 20 or above
- Data preprocessing & assumptions
    - Merge data by participant sequence number
    - Exclude don't know/refused/missing values — discuss implications in limitations
- Perform EDA
- Fit regression models
- Check assumptions

Results

Exploratory Data Analysis

Limitations

Conclusions

Appendix

Appendix I: Data preprocessing

```
## Warning: package 'dplyr' was built under R version 3.3.2
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

##         gender          age         race          edu      marriage
##              0            0            0            0             0
##        famsize    famincome   alcohol12yr    alcoholfrq       grocery
##              0            0            0            0             0
##         eatout     delivery         milk meals_nothome meals_fastfood
##              0            0            0            0             0
##      depressed sleep_trouble     activity       tv_hrs      sleep_hr
##              0            0            0            0             0
##          smoke          bmi    bmi_class
##              0            0            0

##         gender          age         race          edu      marriage
##       "factor"    "integer"     "factor"     "factor"      "factor"
##        famsize    famincome   alcohol12yr    alcoholfrq       grocery
##      "integer"     "factor"     "factor"    "integer"     "integer"
##         eatout     delivery         milk meals_nothome meals_fastfood
##      "integer"    "integer"     "factor"    "integer"     "integer"
##      depressed sleep_trouble     activity       tv_hrs      sleep_hr
##       "factor"     "factor"     "factor"     "factor"     "integer"
##          smoke          bmi    bmi_class
##       "factor"    "numeric"  "character"
```

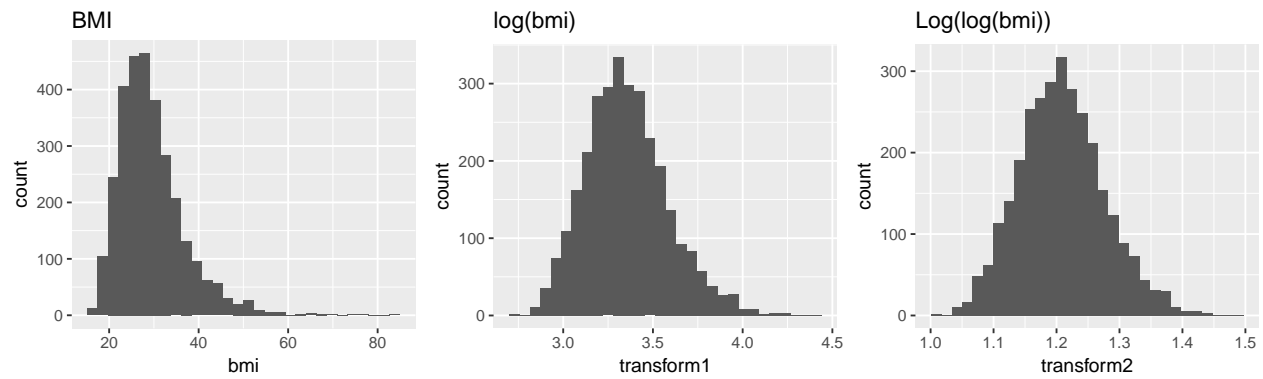## Appendix II: Exploratory Data Analysis

Response Variable (bmi)

```
## Loading required package: gridExtra

##
## Attaching package: 'gridExtra'

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

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```
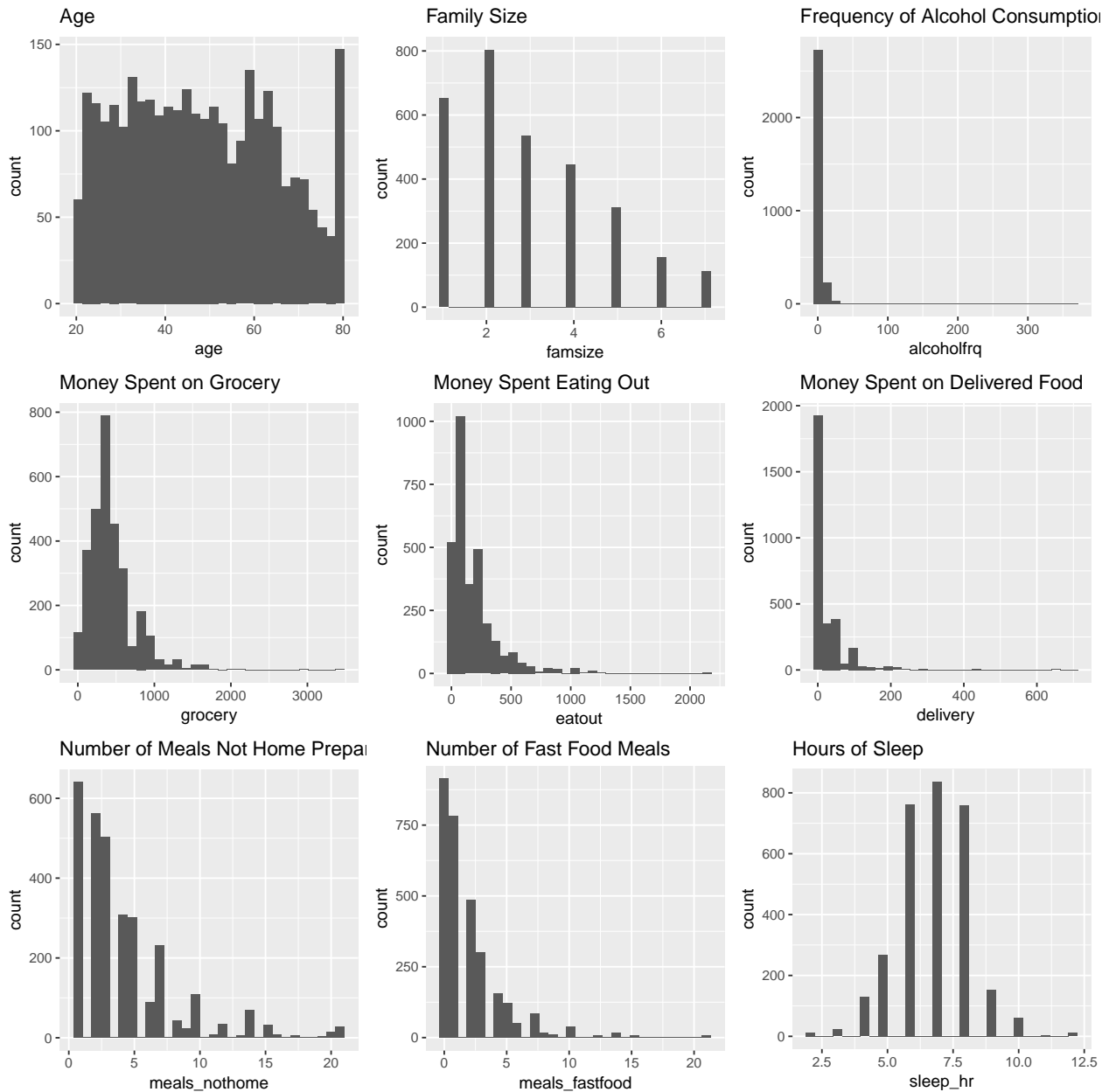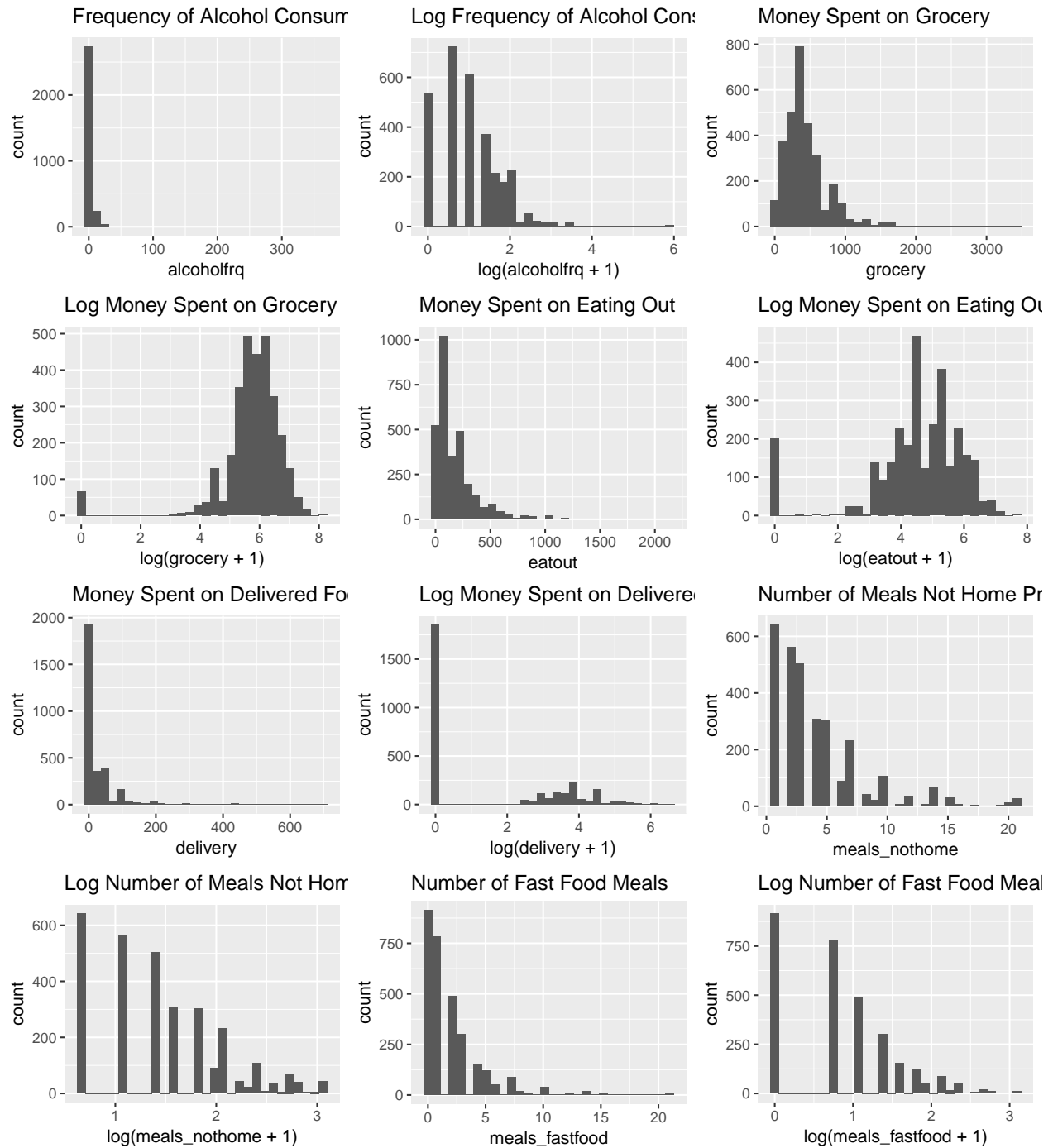
Predictor Variables

Numeric Variables

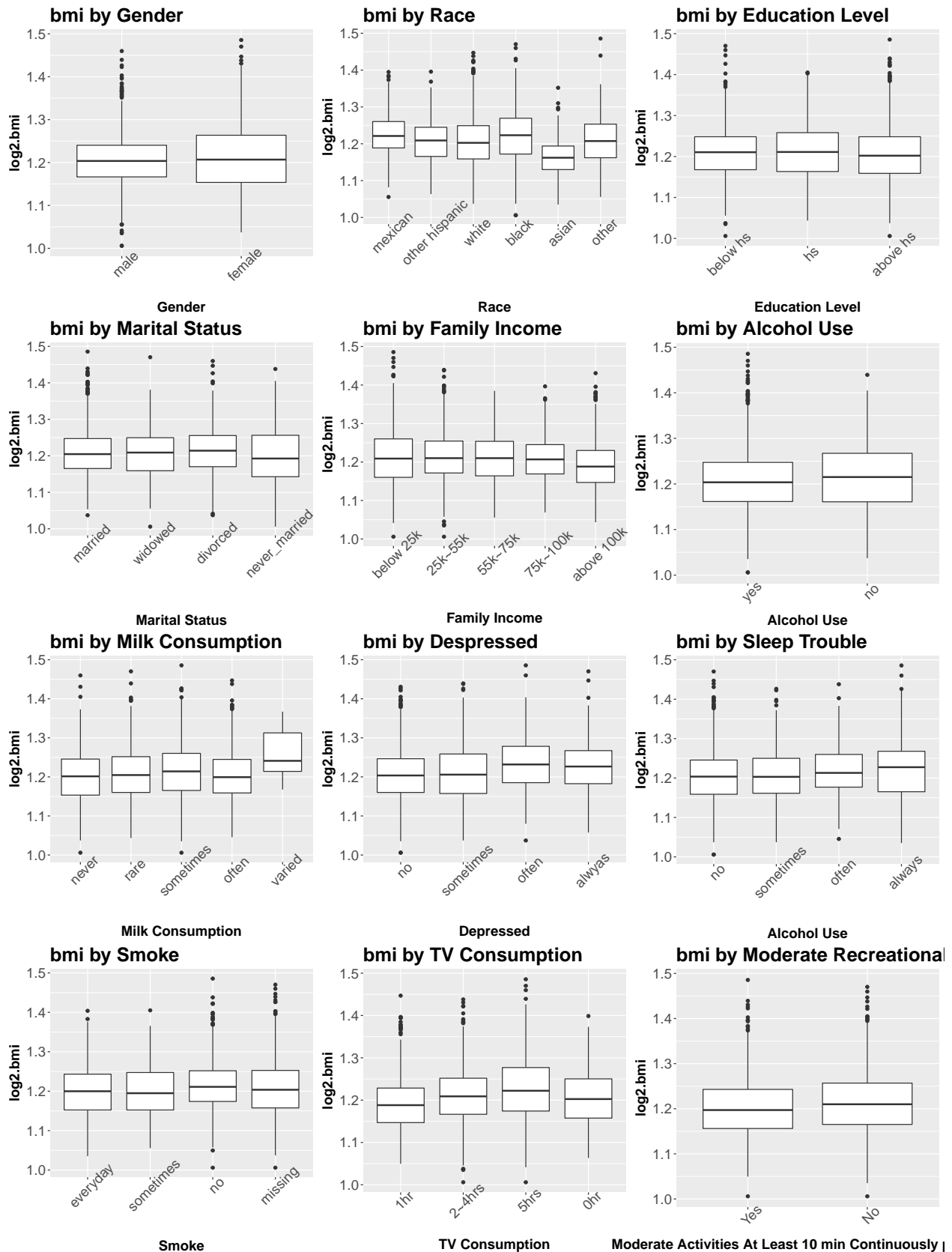Distribtuion of numeric variables

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
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## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```
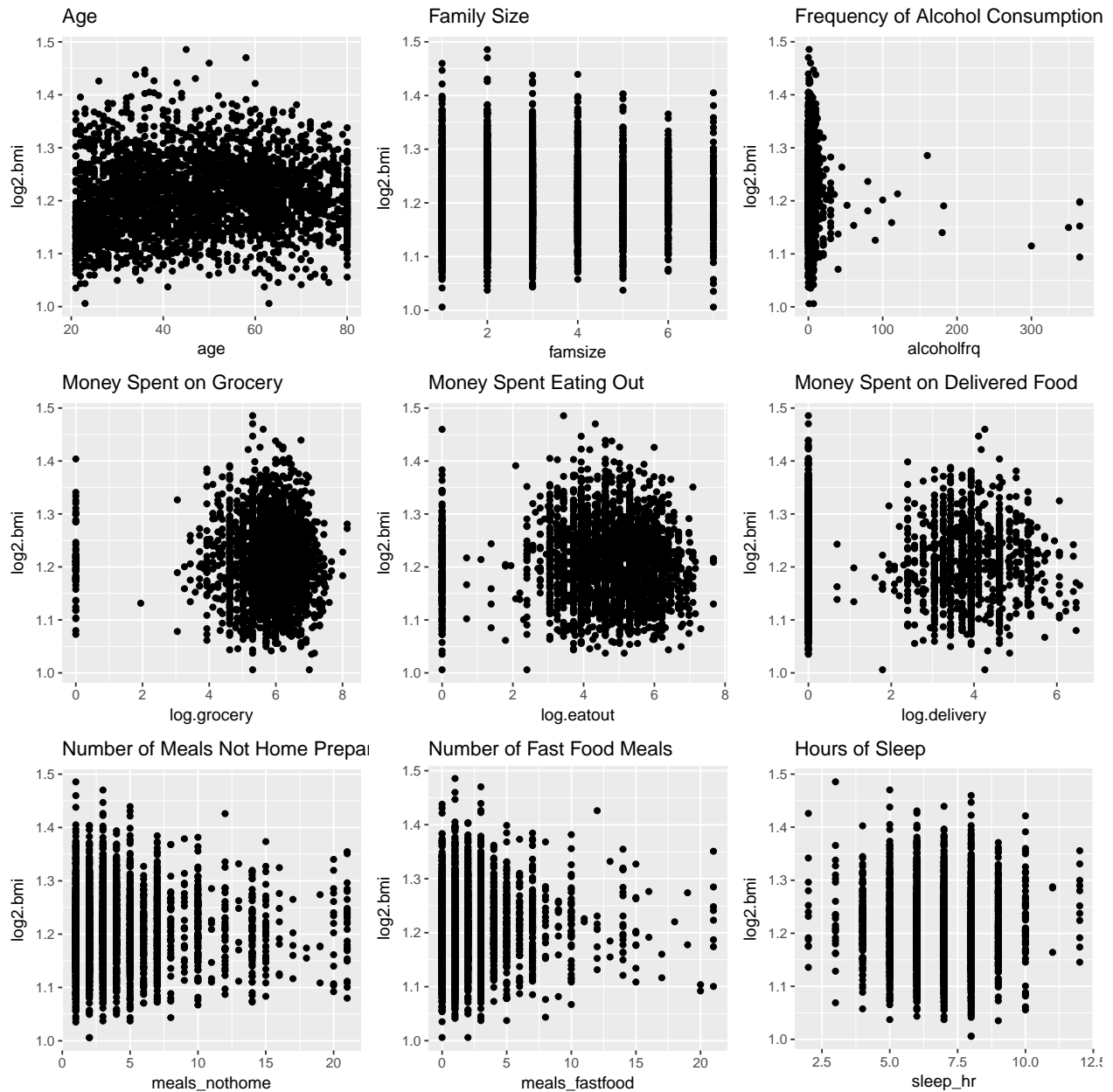
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
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## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

Categorical Variables

Response vs. numeric distribution

Models

```
#df_adult
check_assumptions <- function(model){
  hist(resid(model),col="grey",breaks=15)
  plot(resid(model)~fitted(model),cex=1.5)
  abline(h=0,lwd=2)
}
```

```
#baseline model
model1 = lm(log2.bmi~gender+age+race+edu+marriage+famsize+famincome+alcohol12yr+alcoholfrq+log.groc
summary(model1)
```
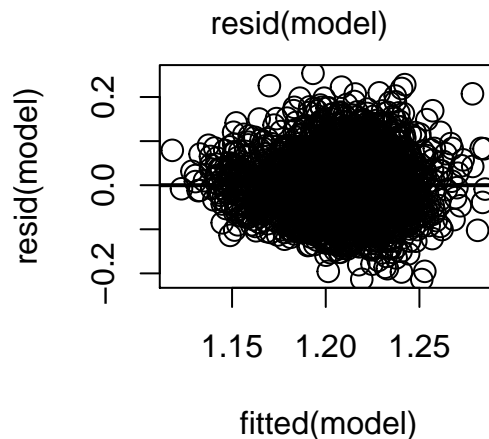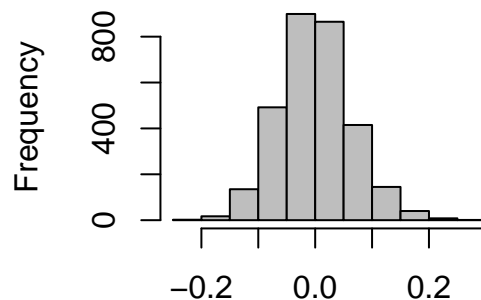
```
##
## Call:
## lm(formula = log2.bmi ~ gender + age + race + edu + marriage +
##     famsize + famincome + alcohol12yr + alcoholfrq + log.grocery +
##     log.eatout + log.delivery + milk + meals_nothome + meals_fastfood +
##     depressed + sleep_trouble + activity + tv_hrs + sleep_hr +
##     smoke, data = df_adult)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.214032 -0.043289 -0.002057  0.038672  0.253709
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             1.171e+00  1.243e-02  94.208  < 2e-16 ***
## genderfemale            7.127e-03  2.528e-03   2.820 0.004841 **
## age                     1.038e-04  8.997e-05   1.154 0.248658
## raceother hispanic     -1.975e-02  5.389e-03  -3.666 0.000251 ***
## racewhite              -1.749e-02  4.099e-03  -4.268 2.04e-05 ***
## raceblack              -5.720e-03  4.598e-03  -1.244 0.213525
## raceasian              -5.546e-02  5.608e-03  -9.890  < 2e-16 ***
## raceother              -1.258e-02  7.659e-03  -1.642 0.100633
## eduhs                   5.747e-03  4.061e-03   1.415 0.157073
## eduabove hs             8.939e-03  3.812e-03   2.345 0.019088 *
## marriagewidowed        -8.738e-03  5.792e-03  -1.509 0.131510
## marriagedivorced        1.723e-03  3.717e-03   0.464 0.642976
## marriagenever_married  -7.996e-03  3.574e-03  -2.237 0.025341 *
## famsize                 1.277e-03  8.495e-04   1.503 0.133014
## famincome25k~55k        4.751e-03  3.269e-03   1.453 0.146259
## famincome55k~75k       -1.287e-03  4.419e-03  -0.291 0.770970
## famincome75k~100k      -1.301e-03  4.785e-03  -0.272 0.785699
## famincomeabove 100k    -1.243e-02  4.225e-03  -2.942 0.003282 **
## alcohol12yrno           3.402e-03  3.569e-03   0.953 0.340651
## alcoholfrq             -1.526e-04  6.747e-05  -2.262 0.023749 *
## log.grocery             4.608e-04  1.160e-03   0.397 0.691285
## log.eatout              2.014e-03  8.689e-04   2.318 0.020538 *
## log.delivery           -5.193e-04  6.217e-04  -0.835 0.403591
## milkrare                7.879e-03  3.969e-03   1.985 0.047187 *
## milksometimes           9.602e-03  3.572e-03   2.688 0.007230 **
## milkoften               2.965e-03  3.525e-03   0.841 0.400353
## milkvaried              5.557e-02  2.171e-02   2.560 0.010506 *
## meals_nothome           2.929e-05  4.098e-04   0.071 0.943017
## meals_fastfood          7.060e-04  5.656e-04   1.248 0.212001
```

```
## depressedsometimes          1.316e-04  3.287e-03   0.040 0.968071
## depressedoften              2.296e-02  6.568e-03   3.496 0.000479 ***
## depressedalwyas             8.848e-03  6.973e-03   1.269 0.204564
## sleep_troublesometimes     -1.036e-04  2.971e-03  -0.035 0.972179
## sleep_troubleoften          6.407e-03  4.997e-03   1.282 0.199882
## sleep_troublealways         9.492e-03  4.584e-03   2.071 0.038479 *
## activityNo                  5.820e-03  2.436e-03   2.389 0.016954 *
## tv_hrs2~4hrs                1.581e-02  2.836e-03   5.573 2.73e-08 ***
## tv_hrs5hrs                  2.788e-02  4.097e-03   6.805 1.22e-11 ***
## tv_hrs0hr                   1.021e-02  8.565e-03   1.192 0.233410
## sleep_hr                   -1.966e-03  8.833e-04  -2.226 0.026079 *
## smokesometimes              7.657e-03  6.500e-03   1.178 0.238889
## smokeno                     2.294e-02  3.922e-03   5.848 5.53e-09 ***
## smokemissing                1.627e-02  3.637e-03   4.474 7.95e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06426 on 2976 degrees of freedom
## Multiple R-squared:  0.1172, Adjusted R-squared:  0.1048
## F-statistic: 9.411 on 42 and 2976 DF,  p-value: < 2.2e-16
```

```
check_assumptions(model1)
```
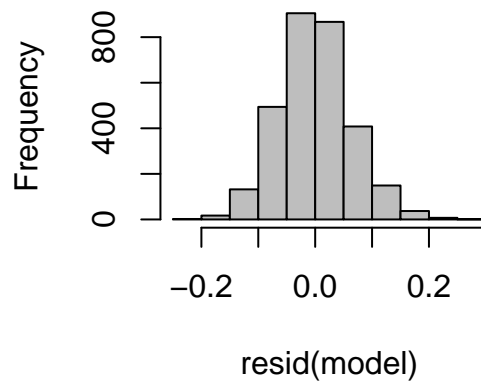
Histogram of resid(model)

```
# add sleep^2 to basemodel
df_adult["sleep_hr2"] = (df_adult$sleep_hr)^2
model_sleep = lm(log2.bmi ~ gender+age+race+edu+marriage+famsize+famincome+alcohol12yr+alcoholfrq+l
summary(model_sleep)
```
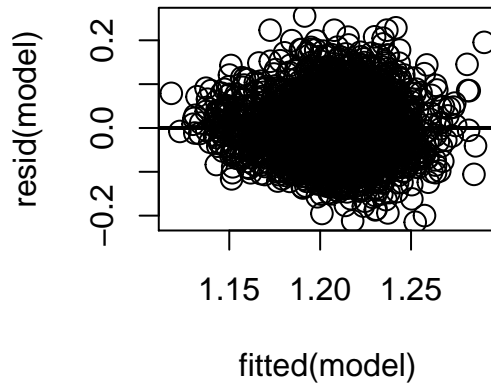
```
##
## Call:
## lm(formula = log2.bmi ~ gender + age + race + edu + marriage +
##     famsize + famincome + alcohol12yr + alcoholfrq + log.grocery +
##     log.eatout + log.delivery + milk + meals_nothome + meals_fastfood +
##     depressed + sleep_trouble + activity + tv_hrs + sleep_hr +
##     smoke + sleep_hr2, data = df_adult)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.215082 -0.043014 -0.001943  0.038810  0.255428
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             1.225e+00  2.065e-02  59.331  < 2e-16 ***
## genderfemale            6.945e-03  2.524e-03   2.751 0.005971 **
## age                     9.045e-05  8.991e-05   1.006 0.314469
## raceother hispanic     -2.015e-02  5.381e-03  -3.745 0.000184 ***
## racewhite              -1.779e-02  4.093e-03  -4.347 1.43e-05 ***
## raceblack              -6.392e-03  4.595e-03  -1.391 0.164231
## raceasian              -5.564e-02  5.599e-03  -9.938  < 2e-16 ***
## raceother              -1.324e-02  7.649e-03  -1.732 0.083444 .
## eduhs                   5.887e-03  4.054e-03   1.452 0.146569
## eduabove hs             9.229e-03  3.806e-03   2.425 0.015389 *
## marriagewidowed        -8.425e-03  5.783e-03  -1.457 0.145267
## marriagedivorced        1.622e-03  3.711e-03   0.437 0.662197
## marriagenever_married  -8.311e-03  3.569e-03  -2.329 0.019946 *
## famsize                 1.218e-03  8.483e-04   1.436 0.151135
## famincome25k~55k        5.135e-03  3.266e-03   1.573 0.115917
## famincome55k~75k       -5.976e-04  4.417e-03  -0.135 0.892385
## famincome75k~100k      -7.354e-04  4.780e-03  -0.154 0.877737
## famincomeabove 100k    -1.159e-02  4.225e-03  -2.743 0.006130 **
## alcohol12yrno           3.295e-03  3.564e-03   0.925 0.355298
## alcoholfrq             -1.501e-04  6.737e-05  -2.228 0.025932 *
## log.grocery             5.465e-04  1.159e-03   0.472 0.637235
## log.eatout              2.039e-03  8.675e-04   2.350 0.018822 *
## log.delivery           -5.095e-04  6.207e-04  -0.821 0.411791
## milkrare                7.891e-03  3.962e-03   1.992 0.046500 *
## milksometimes           9.471e-03  3.566e-03   2.656 0.007961 **
## milkoften               2.839e-03  3.519e-03   0.807 0.419927
## milkvaried              5.563e-02  2.167e-02   2.567 0.010306 *
## meals_nothome           3.535e-05  4.091e-04   0.086 0.931160
```

```
## meals_fastfood          6.243e-04  5.652e-04   1.105 0.269398
## depressedsometimes       8.619e-05  3.282e-03   0.026 0.979050
## depressedoften           2.178e-02  6.567e-03   3.316 0.000924 ***
## depressedalwyas          7.762e-03  6.969e-03   1.114 0.265488
## sleep_troublesometimes  -1.382e-05  2.966e-03  -0.005 0.996284
## sleep_troubleoften       6.089e-03  4.990e-03   1.220 0.222408
## sleep_troublealways      8.273e-03  4.592e-03   1.802 0.071677 .
## activityNo               5.728e-03  2.432e-03   2.355 0.018584 *
## tv_hrs2~4hrs             1.591e-02  2.832e-03   5.617 2.12e-08 ***
## tv_hrs5hrs               2.744e-02  4.092e-03   6.705 2.41e-11 ***
## tv_hrs0hr                9.888e-03  8.551e-03   1.156 0.247629
## sleep_hr                -1.872e-02  5.151e-03  -3.635 0.000283 ***
## smokesometimes           7.840e-03  6.489e-03   1.208 0.227066
## smokeno                  2.328e-02  3.917e-03   5.943 3.12e-09 ***
## smokemissing             1.683e-02  3.635e-03   4.630 3.81e-06 ***
## sleep_hr2                1.236e-03  3.745e-04   3.302 0.000973 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06415 on 2975 degrees of freedom
## Multiple R-squared:  0.1205, Adjusted R-squared:  0.1078
## F-statistic: 9.476 on 43 and 2975 DF,  p-value: < 2.2e-16
```

`check_assumptions(model_sleep)`

Histogram of resid(model)

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```r
#backward selection from model_sleep
model1a = step(model_sleep, trace = 0, direction = "backward")
summary(model1a)
```

```
##
## Call:
## lm(formula = log2.bmi ~ gender + race + edu + marriage + famsize +
##     famincome + alcoholfrq + log.eatout + milk + depressed +
##     activity + tv_hrs + sleep_hr + smoke + sleep_hr2, data = df_adult)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.215432 -0.043664 -0.001989  0.038894  0.245413
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)            1.240e+00  1.908e-02  65.007  < 2e-16 ***
## genderfemale           7.037e-03  2.442e-03   2.882 0.003978 **
## raceother hispanic    -1.971e-02  5.365e-03  -3.674 0.000243 ***
## racewhite             -1.738e-02  4.069e-03  -4.271 2.01e-05 ***
## raceblack             -6.108e-03  4.563e-03  -1.339 0.180810
## raceasian             -5.544e-02  5.559e-03  -9.973  < 2e-16 ***
## raceother             -1.299e-02  7.627e-03  -1.704 0.088550 .
## eduhs                  5.707e-03  4.041e-03   1.412 0.157991
## eduabove hs            8.542e-03  3.787e-03   2.255 0.024174 *
## marriagewidowed       -6.922e-03  5.592e-03  -1.238 0.215876
## marriagedivorced       2.029e-03  3.695e-03   0.549 0.582975
## marriagenever_married -9.156e-03  3.316e-03  -2.761 0.005790 **
## famsize                1.113e-03  7.897e-04   1.410 0.158699
## famincome25k~55k       5.214e-03  3.250e-03   1.604 0.108761
## famincome55k~75k      -6.442e-04  4.378e-03  -0.147 0.883015
## famincome75k~100k     -1.306e-03  4.746e-03  -0.275 0.783259
## famincomeabove 100k   -1.202e-02  4.134e-03  -2.908 0.003668 **
## alcoholfrq            -1.543e-04  6.729e-05  -2.292 0.021957 *
## log.eatout             2.184e-03  8.406e-04   2.598 0.009421 **
## milkrare               7.731e-03  3.957e-03   1.954 0.050814 .
## milksometimes          9.440e-03  3.560e-03   2.651 0.008058 **
```
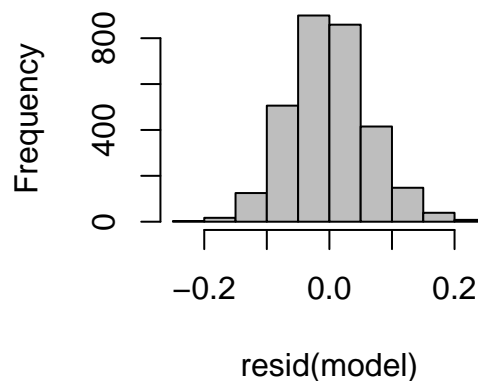
```
## milkoften              2.889e-03  3.511e-03   0.823 0.410629
## milkvaried             5.531e-02  2.166e-02   2.554 0.010693 *
## depressedsometimes     1.120e-03  3.213e-03   0.349 0.727327
## depressedoften         2.411e-02  6.453e-03   3.736 0.000191 ***
## depressedalwyas        1.225e-02  6.670e-03   1.837 0.066303 .
## activityNo             6.289e-03  2.416e-03   2.603 0.009300 **
## tv_hrs2~4hrs           1.621e-02  2.801e-03   5.788 7.88e-09 ***
## tv_hrs5hrs             2.826e-02  4.019e-03   7.033 2.49e-12 ***
## tv_hrs0hr              1.018e-02  8.543e-03   1.192 0.233358
## sleep_hr              -2.043e-02  5.104e-03  -4.003 6.41e-05 ***
## smokesometimes         6.701e-03  6.464e-03   1.037 0.299959
## smokeno                2.368e-02  3.838e-03   6.169 7.80e-10 ***
## smokemissing           1.705e-02  3.593e-03   4.745 2.18e-06 ***
## sleep_hr2              1.340e-03  3.722e-04   3.602 0.000321 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06415 on 2984 degrees of freedom
## Multiple R-squared:  0.1178, Adjusted R-squared:  0.1078
## F-statistic: 11.72 on 34 and 2984 DF,  p-value: < 2.2e-16
```
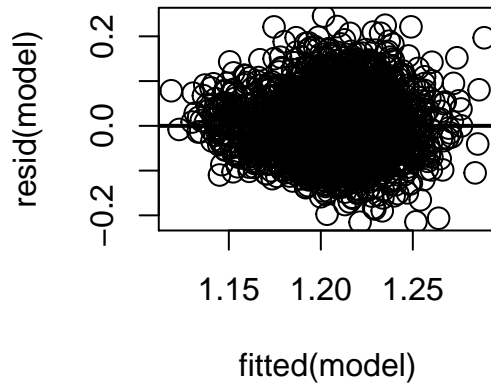
extractAIC(model1a)

```
## [1]     35.00 -16548.47
```

check_assumptions(model1a)

Histogram of resid(model)

```
#full model with all the 2 way interactions(including sleep_hr2)
model_interact = lm(log2.bmi ~ (gender+age+race+edu+marriage+famsize+famincome+alcohol12yr+alcoholf
summary(model_interact)
```

```
##
## Call:
## lm(formula = log2.bmi ~ (gender + age + race + edu + marriage +
##     famsize + famincome + alcohol12yr + alcoholfrq + log.grocery +
##     log.eatout + log.delivery + milk + meals_nothome + meals_fastfood +
##     depressed + sleep_trouble + activity + tv_hrs + sleep_hr +
##     smoke + sleep_hr2)^2, data = df_adult)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.202902 -0.034983 -0.002567  0.033169  0.202488
##
## Coefficients: (32 not defined because of singularities)
##                                   Estimate Std. Error t value
## (Intercept)                      1.317e+00  2.476e-01   5.320
## genderfemale                     1.227e-01  6.080e-02   2.019
## age                             -2.922e-03  2.192e-03  -1.333
## raceother hispanic              -2.481e-01  1.431e-01  -1.734
## racewhite                       -1.107e-01  1.094e-01  -1.012
## raceblack                       -2.634e-03  1.095e-01  -0.024
## raceasian                        7.217e-02  1.693e-01   0.426
## raceother                        5.446e-02  1.739e-01   0.313
## eduhs                            1.187e-01  8.306e-02   1.429
## eduabove hs                      5.673e-02  7.995e-02   0.710
## marriagewidowed                 -1.237e-01  1.621e-01  -0.763
## marriagedivorced                -2.721e-02  8.004e-02  -0.340
## marriagenever_married           -1.308e-01  8.169e-02  -1.601
## famsize                         -1.755e-02  1.815e-02  -0.967
## famincome25k~55k                -1.231e-01  7.102e-02  -1.733
## famincome55k~75k                -1.318e-01  1.154e-01  -1.143
## famincome75k~100k               -3.935e-02  1.302e-01  -0.302
## famincomeabove 100k             -6.075e-02  1.115e-01  -0.545
## alcohol12yrno                   -2.073e-02  8.290e-02  -0.250
```

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```
## alcoholfrq                              9.425e-03  7.172e-03   1.314
## log.grocery                             2.675e-02  2.503e-02   1.069
## log.eatout                              2.452e-02  1.791e-02   1.369
## log.delivery                           -1.743e-02  1.510e-02  -1.154
## milkrare                               -1.668e-01  9.754e-02  -1.710
## milksometimes                          -5.636e-02  8.568e-02  -0.658
## milkoften                               2.885e-03  8.663e-02   0.033
## milkvaried                              2.552e+00  1.057e+00   2.415
## meals_nothome                           3.899e-03  1.100e-02   0.354
## meals_fastfood                         -1.678e-02  1.366e-02  -1.228
## depressedsometimes                     -6.340e-02  7.323e-02  -0.866
## depressedoften                          2.126e-01  1.359e-01   1.564
## depressedalwyas                         8.630e-02  1.574e-01   0.548
## sleep_troublesometimes                 -1.233e-02  7.056e-02  -0.175
## sleep_troubleoften                     -8.189e-02  1.107e-01  -0.740
## sleep_troublealways                    -6.535e-02  9.331e-02  -0.700
## activityNo                              4.395e-02  5.858e-02   0.750
## tv_hrs2~4hrs                            1.456e-02  6.739e-02   0.216
## tv_hrs5hrs                             -6.825e-02  8.599e-02  -0.794
## tv_hrs0hr                              -3.385e-01  2.319e-01  -1.460
## sleep_hr                               -3.861e-02  7.038e-02  -0.549
## smokesometimes                         -2.462e-01  1.503e-01  -1.638
## smokeno                                 3.969e-03  8.366e-02   0.047
## smokemissing                            2.333e-02  7.696e-02   0.303
## sleep_hr2                               1.844e-03  6.240e-03   0.295
## genderfemale:age                        4.949e-04  2.199e-04   2.251
## genderfemale:raceother hispanic        -1.416e-02  1.346e-02  -1.052
## genderfemale:racewhite                 -1.905e-02  1.032e-02  -1.846
## genderfemale:raceblack                  4.345e-03  1.185e-02   0.367
## genderfemale:raceasian                 -2.842e-02  1.405e-02  -2.023
## genderfemale:raceother                 -1.813e-02  2.484e-02  -0.730
## genderfemale:eduhs                     -2.430e-03  1.070e-02  -0.227
## genderfemale:eduabove hs                9.108e-04  1.012e-02   0.090
## genderfemale:marriagewidowed            8.958e-03  1.636e-02   0.548
## genderfemale:marriagedivorced          -4.831e-03  9.754e-03  -0.495
## genderfemale:marriagenever_married      1.983e-04  8.817e-03   0.022
## genderfemale:famsize                    1.241e-03  2.114e-03   0.587
## genderfemale:famincome25k~55k          -6.844e-03  8.168e-03  -0.838
## genderfemale:famincome55k~75k          -6.927e-03  1.116e-02  -0.621
## genderfemale:famincome75k~100k         -7.592e-03  1.192e-02  -0.637
## genderfemale:famincomeabove 100k       -1.347e-02  1.047e-02  -1.287
## genderfemale:alcohol12yrno             -1.199e-02  9.207e-03  -1.302
## genderfemale:alcoholfrq                -1.084e-03  6.503e-04  -1.667
## genderfemale:log.grocery               -1.381e-03  3.301e-03  -0.418
## genderfemale:log.eatout                -2.278e-03  2.184e-03  -1.043
## genderfemale:log.delivery               2.481e-03  1.525e-03   1.627
## genderfemale:milkrare                  -1.288e-02  9.707e-03  -1.327
## genderfemale:milksometimes             -1.193e-03  8.717e-03  -0.137
```

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## genderfemale:milkoften             -5.743e-03  8.620e-03  -0.666
## genderfemale:milkvaried             2.497e-01  1.283e-01   1.946
## genderfemale:meals_nothome          1.430e-04  1.056e-03   0.135
## genderfemale:meals_fastfood         1.659e-03  1.506e-03   1.102
## genderfemale:depressedsometimes     3.532e-03  8.112e-03   0.435
## genderfemale:depressedoften        -1.235e-02  1.955e-02  -0.632
## genderfemale:depressedalwyas        1.086e-02  2.250e-02   0.483
## genderfemale:sleep_troublesometimes 7.804e-03  7.077e-03   1.103
## genderfemale:sleep_troubleoften     3.069e-02  1.294e-02   2.372
## genderfemale:sleep_troublealways    1.982e-02  1.186e-02   1.670
## genderfemale:activityNo             3.148e-03  5.927e-03   0.531
## genderfemale:tv_hrs2~4hrs           3.848e-03  6.846e-03   0.562
## genderfemale:tv_hrs5hrs             3.457e-03  1.033e-02   0.335
## genderfemale:tv_hrs0hr              1.358e-02  3.087e-02   0.440
## genderfemale:sleep_hr              -3.111e-02  1.583e-02  -1.965
## genderfemale:smokesometimes         5.782e-03  1.815e-02   0.319
## genderfemale:smokeno               -1.654e-02  9.620e-03  -1.719
## genderfemale:smokemissing          -2.531e-02  8.916e-03  -2.839
## genderfemale:sleep_hr2              2.431e-03  1.149e-03   2.117
## age:raceother hispanic             8.516e-04  5.094e-04   1.672
## age:racewhite                      2.683e-04  3.903e-04   0.687
## age:raceblack                      4.990e-04  4.481e-04   1.114
## age:raceasian                      6.340e-04  5.358e-04   1.183
## age:raceother                     -5.005e-04  8.733e-04  -0.573
## age:eduhs                         -1.632e-04  3.694e-04  -0.442
## age:eduabove hs                    4.007e-04  3.548e-04   1.130
## age:marriagewidowed               3.708e-04  7.891e-04   0.470
## age:marriagedivorced             -6.252e-04  3.562e-04  -1.755
## age:marriagenever_married         6.761e-04  3.055e-04   2.213
## age:famsize                       8.513e-05  7.858e-05   1.083
## age:famincome25k~55k             -1.370e-04  2.702e-04  -0.507
## age:famincome55k~75k              2.904e-04  3.751e-04   0.774
## age:famincome75k~100k            -2.747e-04  4.024e-04  -0.683
## age:famincomeabove 100k          -2.593e-04  3.583e-04  -0.724
## age:alcohol12yrno                -5.604e-05  3.128e-04  -0.179
## age:alcoholfrq                   -3.718e-05  2.661e-05  -1.397
## age:log.grocery                  -1.138e-04  1.212e-04  -0.939
## age:log.eatout                   -9.039e-05  7.802e-05  -1.159
## age:log.delivery                  1.236e-04  5.677e-05   2.178
## age:milkrare                      3.251e-05  3.648e-04   0.089
## age:milksometimes                 2.542e-04  3.240e-04   0.784
## age:milkoften                    -1.251e-04  3.043e-04  -0.411
## age:milkvaried                   -5.961e-02  2.391e-02  -2.493
## age:meals_nothome                 4.991e-05  3.947e-05   1.264
## age:meals_fastfood                6.409e-05  5.515e-05   1.162
## age:depressedsometimes           -1.667e-04  3.070e-04  -0.543
## age:depressedoften               -6.117e-04  6.356e-04  -0.962
## age:depressedalwyas               1.376e-04  8.776e-04   0.157
```

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```
## age:sleep_troublesometimes                    3.462e-05  2.492e-04   0.139
## age:sleep_troubleoften                        -1.985e-04  4.987e-04  -0.398
## age:sleep_troublealways                        4.055e-04  4.472e-04   0.907
## age:activityNo                                 3.592e-04  2.097e-04   1.713
## age:tv_hrs2~4hrs                              -5.830e-04  2.552e-04  -2.284
## age:tv_hrs5hrs                                -5.095e-04  3.719e-04  -1.370
## age:tv_hrs0hr                                 -4.712e-04  1.169e-03  -0.403
## age:sleep_hr                                   7.817e-04  5.682e-04   1.376
## age:smokesometimes                            -6.912e-04  7.844e-04  -0.881
## age:smokeno                                    4.601e-05  3.684e-04   0.125
## age:smokemissing                              -5.327e-05  3.409e-04  -0.156
## age:sleep_hr2                                 -5.020e-05  4.077e-05  -1.231
## raceother hispanic:eduhs                       1.061e-02  1.869e-02   0.568
## racewhite:eduhs                                8.973e-03  1.471e-02   0.610
## raceblack:eduhs                               -1.875e-02  1.645e-02  -1.140
## raceasian:eduhs                               -2.287e-02  2.976e-02  -0.768
## raceother:eduhs                               -6.970e-02  4.523e-02  -1.541
## raceother hispanic:eduabove hs                 1.310e-02  1.823e-02   0.719
## racewhite:eduabove hs                          1.054e-02  1.327e-02   0.794
## raceblack:eduabove hs                         -1.311e-02  1.514e-02  -0.866
## raceasian:eduabove hs                         -9.041e-03  2.626e-02  -0.344
## raceother:eduabove hs                         -7.676e-03  3.946e-02  -0.195
## raceother hispanic:marriagewidowed             2.412e-02  4.498e-02   0.536
## racewhite:marriagewidowed                      1.034e-02  2.915e-02   0.355
## raceblack:marriagewidowed                      2.553e-02  3.118e-02   0.819
## raceasian:marriagewidowed                     -4.471e-03  4.126e-02  -0.108
## raceother:marriagewidowed                      5.154e-02  9.381e-02   0.549
## raceother hispanic:marriagedivorced            1.807e-02  1.976e-02   0.914
## racewhite:marriagedivorced                     9.473e-03  1.625e-02   0.583
## raceblack:marriagedivorced                     3.226e-03  1.724e-02   0.187
## raceasian:marriagedivorced                     2.153e-02  2.553e-02   0.843
## raceother:marriagedivorced                    -2.077e-02  2.937e-02  -0.707
## raceother hispanic:marriagenever_married       3.994e-02  1.874e-02   2.131
## racewhite:marriagenever_married                1.330e-02  1.453e-02   0.916
## raceblack:marriagenever_married                1.671e-02  1.546e-02   1.081
## raceasian:marriagenever_married               -5.674e-03  1.969e-02  -0.288
## raceother:marriagenever_married                3.760e-03  3.011e-02   0.125
## raceother hispanic:famsize                     1.094e-02  4.356e-03   2.513
## racewhite:famsize                              7.871e-03  3.547e-03   2.219
## raceblack:famsize                              7.003e-03  3.942e-03   1.777
## raceasian:famsize                              3.721e-03  4.924e-03   0.756
## raceother:famsize                              4.237e-03  6.547e-03   0.647
## raceother hispanic:famincome25k~55k           -1.254e-02  1.711e-02  -0.733
## racewhite:famincome25k~55k                    -4.907e-03  1.280e-02  -0.383
## raceblack:famincome25k~55k                     8.030e-03  1.396e-02   0.575
## raceasian:famincome25k~55k                     3.912e-03  2.314e-02   0.169
## raceother:famincome25k~55k                     5.610e-02  3.119e-02   1.799
## raceother hispanic:famincome55k~75k            1.892e-02  2.277e-02   0.831
```

```
## racewhite:famincome55k~75k                      9.852e-03  1.569e-02   0.628
## raceblack:famincome55k~75k                      1.899e-03  1.787e-02   0.106
## raceasian:famincome55k~75k                      6.387e-03  2.878e-02   0.222
## raceother:famincome55k~75k                      2.911e-03  4.488e-02   0.065
## raceother hispanic:famincome75k~100k           -2.818e-02  2.675e-02  -1.053
## racewhite:famincome75k~100k                    -8.851e-03  1.989e-02  -0.445
## raceblack:famincome75k~100k                     4.218e-03  2.207e-02   0.191
## raceasian:famincome75k~100k                    -8.391e-03  2.894e-02  -0.290
## raceother:famincome75k~100k                     3.534e-04  4.124e-02   0.009
## raceother hispanic:famincomeabove 100k          1.308e-02  2.405e-02   0.544
## racewhite:famincomeabove 100k                  -8.274e-03  1.694e-02  -0.488
## raceblack:famincomeabove 100k                   5.341e-03  1.959e-02   0.273
## raceasian:famincomeabove 100k                  -2.525e-03  2.516e-02  -0.100
## raceother:famincomeabove 100k                   2.143e-02  3.854e-02   0.556
## raceother hispanic:alcohol12yrno                7.648e-03  1.944e-02   0.393
## racewhite:alcohol12yrno                         1.266e-02  1.487e-02   0.851
## raceblack:alcohol12yrno                        -9.046e-03  1.573e-02  -0.575
## raceasian:alcohol12yrno                        -1.683e-02  1.805e-02  -0.932
## raceother:alcohol12yrno                         6.253e-02  3.242e-02   1.929
## raceother hispanic:alcoholfrq                   6.159e-05  1.406e-03   0.044
## racewhite:alcoholfrq                            4.861e-04  1.162e-03   0.418
## raceblack:alcoholfrq                           -4.106e-04  1.296e-03  -0.317
## raceasian:alcoholfrq                            1.165e-07  1.397e-03   0.000
## raceother:alcoholfrq                            1.013e-03  1.697e-03   0.597
## raceother hispanic:log.grocery                 -3.479e-03  6.273e-03  -0.555
## racewhite:log.grocery                          -2.736e-03  5.191e-03  -0.527
## raceblack:log.grocery                          -7.925e-03  5.546e-03  -1.429
## raceasian:log.grocery                          -2.603e-03  9.660e-03  -0.269
## raceother:log.grocery                           5.204e-04  8.886e-03   0.059
## raceother hispanic:log.eatout                   1.312e-03  4.420e-03   0.297
## racewhite:log.eatout                            4.829e-03  3.546e-03   1.362
## raceblack:log.eatout                            4.546e-03  3.931e-03   1.156
## raceasian:log.eatout                           -2.726e-03  5.044e-03  -0.540
## raceother:log.eatout                            5.257e-03  7.290e-03   0.721
## raceother hispanic:log.delivery                 4.422e-03  3.601e-03   1.228
## racewhite:log.delivery                         -2.115e-03  2.512e-03  -0.842
## raceblack:log.delivery                         -2.566e-03  2.792e-03  -0.919
## raceasian:log.delivery                         -2.435e-03  3.387e-03  -0.719
## raceother:log.delivery                         -5.075e-03  5.447e-03  -0.932
## raceother hispanic:milkrare                    -1.213e-02  2.231e-02  -0.543
## racewhite:milkrare                             -1.144e-02  1.741e-02  -0.657
## raceblack:milkrare                             -7.230e-03  1.888e-02  -0.383
## raceasian:milkrare                             -1.790e-02  2.156e-02  -0.830
## raceother:milkrare                              5.088e-02  3.985e-02   1.277
## raceother hispanic:milksometimes               -2.896e-03  1.958e-02  -0.148
## racewhite:milksometimes                        -1.436e-02  1.622e-02  -0.886
## raceblack:milksometimes                        -5.488e-03  1.727e-02  -0.318
## raceasian:milksometimes                        -2.587e-02  2.078e-02  -1.245
```

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```
## raceother:milksometimes                      6.357e-02  3.413e-02   1.862
## raceother hispanic:milkoften                 -5.013e-03  1.976e-02  -0.254
## racewhite:milkoften                          -5.214e-03  1.616e-02  -0.323
## raceblack:milkoften                          -1.080e-02  1.779e-02  -0.607
## raceasian:milkoften                          -1.672e-02  1.949e-02  -0.858
## raceother:milkoften                           3.659e-02  3.353e-02   1.091
## raceother hispanic:milkvaried                       NA         NA        NA
## racewhite:milkvaried                          2.039e+00  8.450e-01   2.413
## raceblack:milkvaried                         -8.260e-02  1.035e-01  -0.798
## raceasian:milkvaried                                NA         NA        NA
## raceother:milkvaried                                NA         NA        NA
## raceother hispanic:meals_nothome             -8.632e-04  2.476e-03  -0.349
## racewhite:meals_nothome                       1.447e-04  2.006e-03   0.072
## raceblack:meals_nothome                      -1.014e-03  2.070e-03  -0.490
## raceasian:meals_nothome                       1.262e-03  2.433e-03   0.519
## raceother:meals_nothome                       1.635e-04  4.043e-03   0.040
## raceother hispanic:meals_fastfood             2.881e-03  3.203e-03   0.899
## racewhite:meals_fastfood                      4.729e-04  2.496e-03   0.189
## raceblack:meals_fastfood                     -1.331e-04  2.636e-03  -0.051
## raceasian:meals_fastfood                     -3.691e-04  3.836e-03  -0.096
## raceother:meals_fastfood                     -7.243e-03  5.308e-03  -1.365
## raceother hispanic:depressedsometimes         3.662e-03  1.713e-02   0.214
## racewhite:depressedsometimes                 -8.136e-03  1.286e-02  -0.633
## raceblack:depressedsometimes                 -1.393e-02  1.490e-02  -0.935
## raceasian:depressedsometimes                  7.739e-03  1.977e-02   0.391
## raceother:depressedsometimes                  5.889e-02  2.887e-02   2.040
## raceother hispanic:depressedoften           -7.798e-02  5.045e-02  -1.546
## racewhite:depressedoften                     -4.630e-02  3.302e-02  -1.402
## raceblack:depressedoften                     -1.302e-04  3.731e-02  -0.003
## raceasian:depressedoften                      2.302e-02  4.371e-02   0.527
## raceother:depressedoften                      1.905e-02  5.500e-02   0.346
## raceother hispanic:depressedalwyas          -7.254e-02  4.156e-02  -1.746
## racewhite:depressedalwyas                    -2.064e-02  3.246e-02  -0.636
## raceblack:depressedalwyas                    -6.901e-02  3.639e-02  -1.896
## raceasian:depressedalwyas                     2.452e-02  7.058e-02   0.347
## raceother:depressedalwyas                     7.355e-02  7.181e-02   1.024
## raceother hispanic:sleep_troublesometimes     1.988e-02  1.629e-02   1.220
## racewhite:sleep_troublesometimes              1.644e-02  1.206e-02   1.364
## raceblack:sleep_troublesometimes              2.037e-02  1.376e-02   1.481
## raceasian:sleep_troublesometimes              1.044e-02  1.576e-02   0.662
## raceother:sleep_troublesometimes              3.765e-02  2.537e-02   1.484
## raceother hispanic:sleep_troubleoften         2.718e-02  3.580e-02   0.759
## racewhite:sleep_troubleoften                  3.357e-02  2.343e-02   1.433
## raceblack:sleep_troubleoften                  5.061e-02  2.629e-02   1.925
## raceasian:sleep_troubleoften                  6.761e-02  3.221e-02   2.099
## raceother:sleep_troubleoften                  4.077e-02  5.303e-02   0.769
## raceother hispanic:sleep_troublealways        2.037e-02  2.811e-02   0.725
## racewhite:sleep_troublealways                 5.116e-03  2.201e-02   0.232
```

```
## raceblack:sleep_troublealways          -7.005e-03  2.409e-02  -0.291
## raceasian:sleep_troublealways          -1.818e-02  3.507e-02  -0.519
## raceother:sleep_troublealways          -5.501e-02  4.533e-02  -1.214
## raceother hispanic:activityNo          -3.188e-02  1.284e-02  -2.482
## racewhite:activityNo                   -2.097e-02  9.640e-03  -2.175
## raceblack:activityNo                   -3.629e-02  1.100e-02  -3.300
## raceasian:activityNo                   -2.602e-02  1.327e-02  -1.961
## raceother:activityNo                   -5.677e-03  2.167e-02  -0.262
## raceother hispanic:tv_hrs2~4hrs        -3.857e-03  1.418e-02  -0.272
## racewhite:tv_hrs2~4hrs                 -3.635e-03  1.118e-02  -0.325
## raceblack:tv_hrs2~4hrs                 -1.134e-02  1.351e-02  -0.839
## raceasian:tv_hrs2~4hrs                 -2.337e-02  1.444e-02  -1.618
## raceother:tv_hrs2~4hrs                  2.734e-02  2.303e-02   1.187
## raceother hispanic:tv_hrs5hrs          2.486e-02  2.298e-02   1.082
## racewhite:tv_hrs5hrs                    3.216e-02  1.795e-02   1.791
## raceblack:tv_hrs5hrs                    2.244e-02  1.978e-02   1.134
## raceasian:tv_hrs5hrs                   -9.824e-03  2.601e-02  -0.378
## raceother:tv_hrs5hrs                    1.324e-02  3.770e-02   0.351
## raceother hispanic:tv_hrs0hr           1.327e-01  5.756e-02   2.306
## racewhite:tv_hrs0hr                     1.410e-01  4.564e-02   3.089
## raceblack:tv_hrs0hr                     9.723e-02  5.436e-02   1.789
## raceasian:tv_hrs0hr                     7.855e-02  6.438e-02   1.220
## raceother:tv_hrs0hr                           NA        NA       NA
## raceother hispanic:sleep_hr            4.835e-02  3.682e-02   1.313
## racewhite:sleep_hr                      1.311e-02  2.808e-02   0.467
## raceblack:sleep_hr                      3.748e-03  2.719e-02   0.138
## raceasian:sleep_hr                     -2.295e-02  4.365e-02  -0.526
## raceother:sleep_hr                     -5.060e-02  4.666e-02  -1.084
## raceother hispanic:smokesometimes      -5.236e-02  4.841e-02  -1.082
## racewhite:smokesometimes               -7.140e-03  2.898e-02  -0.246
## raceblack:smokesometimes                3.150e-02  2.997e-02   1.051
## raceasian:smokesometimes                2.070e-02  5.208e-02   0.397
## raceother:smokesometimes               -4.424e-02  4.672e-02  -0.947
## raceother hispanic:smokeno             1.405e-02  2.655e-02   0.529
## racewhite:smokeno                       2.959e-02  1.819e-02   1.627
## raceblack:smokeno                       1.517e-02  2.018e-02   0.751
## raceasian:smokeno                       2.145e-02  3.152e-02   0.681
## raceother:smokeno                       1.335e-02  3.528e-02   0.379
## raceother hispanic:smokemissing        7.085e-03  2.538e-02   0.279
## racewhite:smokemissing                  1.724e-02  1.722e-02   1.001
## raceblack:smokemissing                  2.231e-02  1.853e-02   1.204
## raceasian:smokemissing                  1.145e-02  3.003e-02   0.381
## raceother:smokemissing                 -3.293e-03  2.891e-02  -0.114
## raceother hispanic:sleep_hr2           -3.487e-03  2.664e-03  -1.309
## racewhite:sleep_hr2                    -9.031e-04  2.021e-03  -0.447
## raceblack:sleep_hr2                    -4.768e-04  1.938e-03  -0.246
## raceasian:sleep_hr2                     1.464e-03  3.165e-03   0.462
## raceother:sleep_hr2                     4.089e-03  3.428e-03   1.193
```

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## eduhs:marriagewidowed                    2.027e-02  2.415e-02   0.839
## eduabove hs:marriagewidowed              9.667e-03  2.324e-02   0.416
## eduhs:marriagedivorced                   1.632e-03  1.464e-02   0.112
## eduabove hs:marriagedivorced             1.230e-02  1.400e-02   0.879
## eduhs:marriagenever_married             -2.835e-03  1.471e-02  -0.193
## eduabove hs:marriagenever_married        2.586e-02  1.393e-02   1.856
## eduhs:famsize                            3.170e-03  3.141e-03   1.009
## eduabove hs:famsize                      5.883e-03  2.966e-03   1.983
## eduhs:famincome25k~55k                   2.125e-02  1.140e-02   1.865
## eduabove hs:famincome25k~55k             1.572e-02  1.106e-02   1.422
## eduhs:famincome55k~75k                   1.726e-02  1.799e-02   0.959
## eduabove hs:famincome55k~75k             3.800e-02  1.668e-02   2.278
## eduhs:famincome75k~100k                  1.664e-02  2.356e-02   0.706
## eduabove hs:famincome75k~100k            4.787e-03  2.174e-02   0.220
## eduhs:famincomeabove 100k               -1.852e-02  2.297e-02  -0.806
## eduabove hs:famincomeabove 100k         -1.787e-02  2.164e-02  -0.826
## eduhs:alcohol12yrno                     -7.569e-04  1.421e-02  -0.053
## eduabove hs:alcohol12yrno               -3.591e-03  1.322e-02  -0.272
## eduhs:alcoholfrq                        -3.386e-04  1.139e-03  -0.297
## eduabove hs:alcoholfrq                  -1.003e-03  1.112e-03  -0.902
## eduhs:log.grocery                       -6.661e-04  5.274e-03  -0.126
## eduabove hs:log.grocery                  5.295e-04  4.557e-03   0.116
## eduhs:log.eatout                        -3.440e-03  3.183e-03  -1.081
## eduabove hs:log.eatout                  -8.802e-04  3.039e-03  -0.290
## eduhs:log.delivery                       1.035e-03  2.527e-03   0.410
## eduabove hs:log.delivery                 2.262e-03  2.370e-03   0.954
## eduhs:milkrare                           2.766e-02  1.635e-02   1.692
## eduabove hs:milkrare                     7.348e-03  1.519e-02   0.484
## eduhs:milksometimes                      1.736e-02  1.447e-02   1.200
## eduabove hs:milksometimes                1.385e-02  1.360e-02   1.019
## eduhs:milkoften                          9.863e-03  1.458e-02   0.676
## eduabove hs:milkoften                    2.864e-03  1.364e-02   0.210
## eduhs:milkvaried                         1.323e+00  5.297e-01   2.498
## eduabove hs:milkvaried                  -7.285e-01  3.717e-01  -1.960
## eduhs:meals_nothome                     -2.700e-03  2.123e-03  -1.272
## eduabove hs:meals_nothome               -2.507e-03  1.864e-03  -1.345
## eduhs:meals_fastfood                     4.392e-03  2.671e-03   1.644
## eduabove hs:meals_fastfood               3.064e-03  2.449e-03   1.251
## eduhs:depressedsometimes                -1.643e-03  1.318e-02  -0.125
## eduabove hs:depressedsometimes          -5.618e-03  1.237e-02  -0.454
## eduhs:depressedoften                    -5.570e-02  2.841e-02  -1.961
## eduabove hs:depressedoften              -1.483e-03  2.782e-02  -0.053
## eduhs:depressedalwyas                   -1.005e-02  2.658e-02  -0.378
## eduabove hs:depressedalwyas             -2.127e-02  2.808e-02  -0.758
## eduhs:sleep_troublesometimes            -8.361e-03  1.289e-02  -0.649
## eduabove hs:sleep_troublesometimes      -1.887e-02  1.218e-02  -1.550
## eduhs:sleep_troubleoften                 7.837e-03  2.075e-02   0.378
## eduabove hs:sleep_troubleoften          -2.708e-02  2.118e-02  -1.279
```

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## eduhs:sleep_troublealways                         -1.301e-02  1.774e-02  -0.733
## eduabove hs:sleep_troublealways                    -1.268e-02  1.678e-02  -0.756
## eduhs:activityNo                                     8.009e-03  1.038e-02   0.772
## eduabove hs:activityNo                               1.696e-02  9.807e-03   1.729
## eduhs:tv_hrs2~4hrs                                   3.531e-02  1.248e-02   2.829
## eduabove hs:tv_hrs2~4hrs                             2.062e-02  1.130e-02   1.825
## eduhs:tv_hrs5hrs                                     7.165e-03  1.585e-02   0.452
## eduabove hs:tv_hrs5hrs                               1.042e-02  1.506e-02   0.692
## eduhs:tv_hrs0hr                                     -4.975e-02  4.714e-02  -1.055
## eduabove hs:tv_hrs0hr                               -3.247e-02  4.292e-02  -0.756
## eduhs:sleep_hr                                      -3.928e-02  2.070e-02  -1.897
## eduabove hs:sleep_hr                                -3.483e-02  2.059e-02  -1.692
## eduhs:smokesometimes                                 4.325e-02  2.740e-02   1.579
## eduabove hs:smokesometimes                           2.758e-02  2.697e-02   1.022
## eduhs:smokeno                                        3.879e-03  1.410e-02   0.275
## eduabove hs:smokeno                                  1.221e-02  1.378e-02   0.886
## eduhs:smokemissing                                  -7.588e-04  1.359e-02  -0.056
## eduabove hs:smokemissing                             3.356e-03  1.304e-02   0.257
## eduhs:sleep_hr2                                      2.599e-03  1.487e-03   1.747
## eduabove hs:sleep_hr2                                2.250e-03  1.505e-03   1.495
## marriagewidowed:famsize                              6.605e-03  6.384e-03   1.035
## marriagedivorced:famsize                             6.677e-04  3.408e-03   0.196
## marriagenever_married:famsize                        1.728e-03  2.814e-03   0.614
## marriagewidowed:famincome25k~55k                     7.856e-03  1.689e-02   0.465
## marriagedivorced:famincome25k~55k                   -9.397e-03  1.112e-02  -0.845
## marriagenever_married:famincome25k~55k               1.790e-02  1.074e-02   1.666
## marriagewidowed:famincome55k~75k                    -2.285e-02  2.767e-02  -0.826
## marriagedivorced:famincome55k~75k                   -5.480e-03  1.615e-02  -0.339
## marriagenever_married:famincome55k~75k               3.059e-02  1.571e-02   1.947
## marriagewidowed:famincome75k~100k                   -1.063e-02  4.912e-02  -0.216
## marriagedivorced:famincome75k~100k                  -7.537e-03  2.054e-02  -0.367
## marriagenever_married:famincome75k~100k              1.537e-02  1.696e-02   0.906
## marriagewidowed:famincomeabove 100k                 -4.691e-02  3.157e-02  -1.486
## marriagedivorced:famincomeabove 100k                -2.302e-02  1.863e-02  -1.236
## marriagenever_married:famincomeabove 100k            2.210e-02  1.461e-02   1.513
## marriagewidowed:alcohol12yrno                       -5.583e-03  1.771e-02  -0.315
## marriagedivorced:alcohol12yrno                       3.593e-02  1.313e-02   2.737
## marriagenever_married:alcohol12yrno                  2.203e-03  1.334e-02   0.165
## marriagewidowed:alcoholfrq                          -4.278e-04  1.665e-03  -0.257
## marriagedivorced:alcoholfrq                         -6.569e-04  8.444e-04  -0.778
## marriagenever_married:alcoholfrq                     6.565e-04  1.063e-03   0.617
## marriagewidowed:log.grocery                          3.082e-03  7.425e-03   0.415
## marriagedivorced:log.grocery                        -5.834e-03  5.642e-03  -1.034
## marriagenever_married:log.grocery                   -5.703e-03  4.493e-03  -1.269
## marriagewidowed:log.eatout                           1.970e-03  5.205e-03   0.379
## marriagedivorced:log.eatout                          1.166e-03  3.184e-03   0.366
## marriagenever_married:log.eatout                     1.293e-03  3.199e-03   0.404
## marriagewidowed:log.delivery                        -3.831e-03  5.304e-03  -0.722
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## marriagedivorced:log.delivery                   -3.312e-03  2.428e-03  -1.364
## marriagenever_married:log.delivery               3.008e-03   2.165e-03   1.389
## marriagewidowed:milkrare                         6.110e-03   2.897e-02   0.211
## marriagedivorced:milkrare                        -9.086e-04  1.526e-02  -0.060
## marriagenever_married:milkrare                   1.147e-02   1.368e-02   0.839
## marriagewidowed:milksometimes                    -2.726e-02  2.072e-02  -1.316
## marriagedivorced:milksometimes                   -1.687e-02  1.303e-02  -1.295
## marriagenever_married:milksometimes              7.299e-03   1.265e-02   0.577
## marriagewidowed:milkoften                        -6.601e-03  2.105e-02  -0.314
## marriagedivorced:milkoften                       1.210e-03   1.310e-02   0.092
## marriagenever_married:milkoften                  7.196e-03   1.253e-02   0.574
## marriagewidowed:milkvaried                       -7.843e-02  1.156e-01  -0.679
## marriagedivorced:milkvaried                      -2.154e+00  9.206e-01  -2.340
## marriagenever_married:milkvaried                        NA         NA        NA
## marriagewidowed:meals_nothome                    -2.458e-03  3.029e-03  -0.812
## marriagedivorced:meals_nothome                   -1.036e-03  1.667e-03  -0.622
## marriagenever_married:meals_nothome              -5.437e-05  1.495e-03  -0.036
## marriagewidowed:meals_fastfood                   4.031e-04   5.808e-03   0.069
## marriagedivorced:meals_fastfood                  1.796e-03   2.254e-03   0.797
## marriagenever_married:meals_fastfood             4.247e-04   1.851e-03   0.229
## marriagewidowed:depressedsometimes               -3.263e-02  1.896e-02  -1.721
## marriagedivorced:depressedsometimes              -6.256e-03  1.174e-02  -0.533
## marriagenever_married:depressedsometimes         -2.275e-03  1.167e-02  -0.195
## marriagewidowed:depressedoften                   4.701e-03   4.635e-02   0.101
## marriagedivorced:depressedoften                  3.791e-02   2.414e-02   1.570
## marriagenever_married:depressedoften             2.151e-02   2.813e-02   0.765
## marriagewidowed:depressedalwyas                  1.191e-02   4.455e-02   0.267
## marriagedivorced:depressedalwyas                 -3.297e-02  2.746e-02  -1.201
## marriagenever_married:depressedalwyas            -9.033e-03  3.168e-02  -0.285
## marriagewidowed:sleep_troublesometimes           -1.138e-03  1.765e-02  -0.064
## marriagedivorced:sleep_troublesometimes          5.700e-03   1.127e-02   0.506
## marriagenever_married:sleep_troublesometimes     5.531e-03   1.018e-02   0.543
## marriagewidowed:sleep_troubleoften               2.465e-02   2.852e-02   0.864
## marriagedivorced:sleep_troubleoften              -1.284e-02  1.649e-02  -0.779
## marriagenever_married:sleep_troubleoften         6.305e-03   1.939e-02   0.325
## marriagewidowed:sleep_troublealways              9.126e-03   2.821e-02   0.324
## marriagedivorced:sleep_troublealways             2.826e-05   1.602e-02   0.002
## marriagenever_married:sleep_troublealways        7.919e-03   1.788e-02   0.443
## marriagewidowed:activityNo                       -2.622e-03  1.436e-02  -0.183
## marriagedivorced:activityNo                      -1.433e-02  9.238e-03  -1.551
## marriagenever_married:activityNo                 -2.638e-03  8.600e-03  -0.307
## marriagewidowed:tv_hrs2~4hrs                     8.526e-03   1.962e-02   0.434
## marriagedivorced:tv_hrs2~4hrs                    -4.054e-03  1.045e-02  -0.388
## marriagenever_married:tv_hrs2~4hrs               -4.892e-03  9.764e-03  -0.501
## marriagewidowed:tv_hrs5hrs                       -1.223e-03  2.303e-02  -0.053
## marriagedivorced:tv_hrs5hrs                      6.923e-03   1.413e-02   0.490
## marriagenever_married:tv_hrs5hrs                 -1.085e-02  1.576e-02  -0.689
## marriagewidowed:tv_hrs0hr                        -9.753e-02  1.279e-01  -0.762
```

```
## marriagedivorced:tv_hrs0hr             5.269e-03   4.951e-02    0.106
## marriagenever_married:tv_hrs0hr       -2.293e-02   3.723e-02   -0.616
## marriagewidowed:sleep_hr              2.194e-02   4.090e-02    0.537
## marriagedivorced:sleep_hr             3.433e-02   1.985e-02    1.729
## marriagenever_married:sleep_hr        2.202e-02   2.068e-02    1.065
## marriagewidowed:smokesometimes        1.143e-01   5.481e-02    2.086
## marriagedivorced:smokesometimes       3.221e-02   2.499e-02    1.289
## marriagenever_married:smokesometimes  2.722e-02   2.189e-02    1.244
## marriagewidowed:smokeno              -1.321e-02   2.934e-02   -0.450
## marriagedivorced:smokeno             -5.800e-03   1.379e-02   -0.421
## marriagenever_married:smokeno         2.763e-03   1.405e-02    0.197
## marriagewidowed:smokemissing          1.837e-02   2.924e-02    0.628
## marriagedivorced:smokemissing        -2.463e-02   1.293e-02   -1.905
## marriagenever_married:smokemissing   -2.879e-02   1.162e-02   -2.477
## marriagewidowed:sleep_hr2            -2.136e-03   2.827e-03   -0.756
## marriagedivorced:sleep_hr2           -2.667e-03   1.468e-03   -1.817
## marriagenever_married:sleep_hr2      -1.369e-03   1.528e-03   -0.896
## famsize:famincome25k~55k             -1.039e-03   2.738e-03   -0.380
## famsize:famincome55k~75k             -1.557e-04   3.904e-03   -0.040
## famsize:famincome75k~100k            -2.099e-03   4.084e-03   -0.514
## famsize:famincomeabove 100k          -5.598e-03   3.569e-03   -1.568
## famsize:alcohol12yrno                -4.599e-05   3.205e-03   -0.014
## famsize:alcoholfrq                    8.547e-05   2.712e-04    0.315
## famsize:log.grocery                  -5.372e-04   1.097e-03   -0.490
## famsize:log.eatout                   -2.933e-04   7.098e-04   -0.413
## famsize:log.delivery                  8.970e-04   5.123e-04    1.751
## famsize:milkrare                     -1.585e-03   3.300e-03   -0.480
## famsize:milksometimes                -3.569e-03   2.926e-03   -1.220
## famsize:milkoften                    -8.114e-04   2.867e-03   -0.283
## famsize:milkvaried                          NA          NA          NA
## famsize:meals_nothome                -2.710e-04   3.758e-04   -0.721
## famsize:meals_fastfood                2.092e-04   4.954e-04    0.422
## famsize:depressedsometimes           -9.137e-03   2.855e-03   -3.200
## famsize:depressedoften               -1.641e-02   7.953e-03   -2.063
## famsize:depressedalwyas              -1.824e-02   7.220e-03   -2.527
## famsize:sleep_troublesometimes        1.442e-03   2.465e-03    0.585
## famsize:sleep_troubleoften            4.629e-03   4.740e-03    0.977
## famsize:sleep_troublealways           7.703e-04   4.299e-03    0.179
## famsize:activityNo                   -2.924e-03   2.049e-03   -1.427
## famsize:tv_hrs2~4hrs                 -4.151e-03   2.277e-03   -1.823
## famsize:tv_hrs5hrs                   -5.664e-03   3.559e-03   -1.591
## famsize:tv_hrs0hr                    -6.277e-03   1.108e-02   -0.566
## famsize:sleep_hr                      4.513e-03   4.556e-03    0.991
## famsize:smokesometimes                1.612e-02   5.756e-03    2.801
## famsize:smokeno                       2.689e-03   3.198e-03    0.841
## famsize:smokemissing                  2.915e-03   2.964e-03    0.984
## famsize:sleep_hr2                    -3.634e-04   3.430e-04   -1.059
## famincome25k~55k:alcohol12yrno       -6.801e-04   1.132e-02   -0.060
```

```
## famincome55k~75k:alcohol12yrno            1.600e-02  1.634e-02   0.979
## famincome75k~100k:alcohol12yrno           3.567e-02  1.727e-02   2.065
## famincomeabove 100k:alcohol12yrno         3.750e-02  1.521e-02   2.466
## famincome25k~55k:alcoholfrq               9.060e-04  9.510e-04   0.953
## famincome55k~75k:alcoholfrq               1.482e-03  1.289e-03   1.150
## famincome75k~100k:alcoholfrq              1.091e-03  1.392e-03   0.784
## famincomeabove 100k:alcoholfrq            1.447e-03  1.158e-03   1.250
## famincome25k~55k:log.grocery             -1.138e-03  3.750e-03  -0.304
## famincome55k~75k:log.grocery              1.273e-03  6.923e-03   0.184
## famincome75k~100k:log.grocery            -1.132e-02  6.694e-03  -1.691
## famincomeabove 100k:log.grocery          -4.621e-03  5.448e-03  -0.848
## famincome25k~55k:log.eatout               3.939e-03  2.641e-03   1.491
## famincome55k~75k:log.eatout               2.341e-03  4.055e-03   0.577
## famincome75k~100k:log.eatout             -4.566e-04  5.140e-03  -0.089
## famincomeabove 100k:log.eatout           -5.201e-04  4.089e-03  -0.127
## famincome25k~55k:log.delivery            -1.934e-03  2.088e-03  -0.926
## famincome55k~75k:log.delivery            -1.434e-03  2.698e-03  -0.532
## famincome75k~100k:log.delivery           -1.428e-04  2.955e-03  -0.048
## famincomeabove 100k:log.delivery         -1.095e-03  2.547e-03  -0.430
## famincome25k~55k:milkrare                 1.071e-02  1.329e-02   0.806
## famincome55k~75k:milkrare                -3.713e-03  1.810e-02  -0.205
## famincome75k~100k:milkrare                3.799e-02  1.928e-02   1.970
## famincomeabove 100k:milkrare              1.859e-02  1.653e-02   1.125
## famincome25k~55k:milksometimes            7.153e-03  1.184e-02   0.604
## famincome55k~75k:milksometimes           -2.549e-02  1.519e-02  -1.678
## famincome75k~100k:milksometimes          -9.202e-03  1.734e-02  -0.531
## famincomeabove 100k:milksometimes        -4.350e-03  1.470e-02  -0.296
## famincome25k~55k:milkoften                6.927e-03  1.182e-02   0.586
## famincome55k~75k:milkoften               -2.397e-02  1.538e-02  -1.558
## famincome75k~100k:milkoften               2.040e-03  1.681e-02   0.121
## famincomeabove 100k:milkoften            -3.651e-03  1.437e-02  -0.254
## famincome25k~55k:milkvaried                      NA         NA         NA
## famincome55k~75k:milkvaried                      NA         NA         NA
## famincome75k~100k:milkvaried                     NA         NA         NA
## famincomeabove 100k:milkvaried                   NA         NA         NA
## famincome25k~55k:meals_nothome           -2.751e-04  1.614e-03  -0.170
## famincome55k~75k:meals_nothome           -3.312e-03  2.007e-03  -1.650
## famincome75k~100k:meals_nothome           3.543e-04  2.237e-03   0.158
## famincomeabove 100k:meals_nothome         8.878e-04  1.832e-03   0.485
## famincome25k~55k:meals_fastfood          -3.429e-04  1.945e-03  -0.176
## famincome55k~75k:meals_fastfood           1.410e-03  2.594e-03   0.544
## famincome75k~100k:meals_fastfood         -1.389e-03  2.906e-03  -0.478
## famincomeabove 100k:meals_fastfood       -1.282e-03  2.406e-03  -0.533
## famincome25k~55k:depressedsometimes      -5.262e-03  1.013e-02  -0.520
## famincome55k~75k:depressedsometimes      -1.262e-02  1.384e-02  -0.912
## famincome75k~100k:depressedsometimes      1.608e-03  1.632e-02   0.099
## famincomeabove 100k:depressedsometimes    9.808e-03  1.472e-02   0.666
## famincome25k~55k:depressedoften          -2.122e-02  2.368e-02  -0.896
```

```
## famincome55k~75k:depressedoften               -1.085e-01  4.328e-02  -2.507
## famincome75k~100k:depressedoften               5.417e-02  5.845e-02   0.927
## famincomeabove 100k:depressedoften             -6.691e-02  3.681e-02  -1.818
## famincome25k~55k:depressedalwyas               -3.359e-02  2.607e-02  -1.289
## famincome55k~75k:depressedalwyas               -1.126e-02  4.167e-02  -0.270
## famincome75k~100k:depressedalwyas               3.073e-02  5.232e-02   0.587
## famincomeabove 100k:depressedalwyas            -1.424e-01  5.677e-02  -2.509
## famincome25k~55k:sleep_troublesometimes        -6.471e-03  9.526e-03  -0.679
## famincome55k~75k:sleep_troublesometimes         5.404e-03  1.335e-02   0.405
## famincome75k~100k:sleep_troublesometimes        1.046e-02  1.357e-02   0.771
## famincomeabove 100k:sleep_troublesometimes      2.221e-03  1.232e-02   0.180
## famincome25k~55k:sleep_troubleoften             9.991e-03  1.687e-02   0.592
## famincome55k~75k:sleep_troubleoften            -9.866e-03  2.215e-02  -0.445
## famincome75k~100k:sleep_troubleoften           -1.912e-02  2.647e-02  -0.722
## famincomeabove 100k:sleep_troubleoften          3.448e-03  2.304e-02   0.150
## famincome25k~55k:sleep_troublealways            2.405e-02  1.422e-02   1.692
## famincome55k~75k:sleep_troublealways            2.619e-02  2.090e-02   1.253
## famincome75k~100k:sleep_troublealways          -2.600e-04  3.358e-02  -0.008
## famincomeabove 100k:sleep_troublealways         4.098e-02  2.023e-02   2.026
## famincome25k~55k:activityNo                     6.644e-04  7.830e-03   0.085
## famincome55k~75k:activityNo                    -1.966e-03  1.100e-02  -0.179
## famincome75k~100k:activityNo                   -8.223e-03  1.123e-02  -0.732
## famincomeabove 100k:activityNo                 -1.669e-03  9.825e-03  -0.170
## famincome25k~55k:tv_hrs2~4hrs                   1.493e-03  9.348e-03   0.160
## famincome55k~75k:tv_hrs2~4hrs                  -9.259e-03  1.256e-02  -0.737
## famincome75k~100k:tv_hrs2~4hrs                  1.274e-02  1.257e-02   1.014
## famincomeabove 100k:tv_hrs2~4hrs                2.374e-02  1.127e-02   2.106
## famincome25k~55k:tv_hrs5hrs                    -5.774e-03  1.303e-02  -0.443
## famincome55k~75k:tv_hrs5hrs                     1.084e-02  1.808e-02   0.600
## famincome75k~100k:tv_hrs5hrs                    1.854e-02  1.893e-02   0.980
## famincomeabove 100k:tv_hrs5hrs                  1.047e-02  1.844e-02   0.568
## famincome25k~55k:tv_hrs0hr                     -2.798e-02  3.776e-02  -0.741
## famincome55k~75k:tv_hrs0hr                     -7.834e-02  4.260e-02  -1.839
## famincome75k~100k:tv_hrs0hr                     2.420e-02  4.714e-02   0.513
## famincomeabove 100k:tv_hrs0hr                  -3.813e-02  4.736e-02  -0.805
## famincome25k~55k:sleep_hr                       3.526e-02  1.840e-02   1.916
## famincome55k~75k:sleep_hr                       3.167e-02  3.046e-02   1.040
## famincome75k~100k:sleep_hr                      3.878e-02  3.298e-02   1.176
## famincomeabove 100k:sleep_hr                    4.488e-02  2.853e-02   1.573
## famincome25k~55k:smokesometimes                 2.628e-03  1.989e-02   0.132
## famincome55k~75k:smokesometimes                -2.574e-02  3.273e-02  -0.786
## famincome75k~100k:smokesometimes               -8.653e-02  4.307e-02  -2.009
## famincomeabove 100k:smokesometimes             -3.609e-02  2.914e-02  -1.238
## famincome25k~55k:smokeno                        6.296e-03  1.155e-02   0.545
## famincome55k~75k:smokeno                       -2.579e-02  1.706e-02  -1.512
## famincome75k~100k:smokeno                      -2.668e-02  2.118e-02  -1.260
## famincomeabove 100k:smokeno                    -2.284e-02  1.816e-02  -1.258
## famincome25k~55k:smokemissing                  -1.668e-03  1.090e-02  -0.153
```

```
## famincome55k~75k:smokemissing          -1.706e-02  1.578e-02  -1.081
## famincome75k~100k:smokemissing         -2.085e-02  2.019e-02  -1.033
## famincomeabove 100k:smokemissing       -2.917e-02  1.710e-02  -1.706
## famincome25k~55k:sleep_hr2             -2.610e-03  1.354e-03  -1.928
## famincome55k~75k:sleep_hr2             -2.117e-03  2.212e-03  -0.957
## famincome75k~100k:sleep_hr2            -2.715e-03  2.417e-03  -1.123
## famincomeabove 100k:sleep_hr2          -3.467e-03  2.092e-03  -1.657
## alcohol12yrno:alcoholfrq               -4.220e-03  1.902e-03  -2.219
## alcohol12yrno:log.grocery              -1.794e-03  4.205e-03  -0.427
## alcohol12yrno:log.eatout                2.831e-03  3.216e-03   0.880
## alcohol12yrno:log.delivery              4.475e-04  2.321e-03   0.193
## alcohol12yrno:milkrare                  2.339e-02  1.492e-02   1.568
## alcohol12yrno:milksometimes             2.898e-03  1.301e-02   0.223
## alcohol12yrno:milkoften                 7.820e-03  1.275e-02   0.613
## alcohol12yrno:milkvaried                       NA         NA         NA
## alcohol12yrno:meals_nothome             2.714e-03  1.699e-03   1.597
## alcohol12yrno:meals_fastfood           -5.313e-03  2.363e-03  -2.248
## alcohol12yrno:depressedsometimes       -2.187e-02  1.114e-02  -1.964
## alcohol12yrno:depressedoften           -7.178e-02  2.999e-02  -2.394
## alcohol12yrno:depressedalwyas          -8.319e-02  2.913e-02  -2.856
## alcohol12yrno:sleep_troublesometimes   -1.697e-02  1.031e-02  -1.646
## alcohol12yrno:sleep_troubleoften       -1.797e-03  1.877e-02  -0.096
## alcohol12yrno:sleep_troublealways       2.239e-03  1.684e-02   0.133
## alcohol12yrno:activityNo                4.059e-03  8.701e-03   0.467
## alcohol12yrno:tv_hrs2~4hrs             -5.138e-03  1.016e-02  -0.506
## alcohol12yrno:tv_hrs5hrs                1.629e-03  1.428e-02   0.114
## alcohol12yrno:tv_hrs0hr                -8.367e-03  4.419e-02  -0.189
## alcohol12yrno:sleep_hr                  1.588e-03  2.210e-02   0.072
## alcohol12yrno:smokesometimes            5.222e-02  3.716e-02   1.405
## alcohol12yrno:smokeno                  -1.240e-02  1.681e-02  -0.738
## alcohol12yrno:smokemissing             -5.941e-03  1.495e-02  -0.397
## alcohol12yrno:sleep_hr2                 3.374e-04  1.638e-03   0.206
## alcoholfrq:log.grocery                 -7.422e-04  4.144e-04  -1.791
## alcoholfrq:log.eatout                  -9.257e-05  2.290e-04  -0.404
## alcoholfrq:log.delivery                -8.748e-05  1.726e-04  -0.507
## alcoholfrq:milkrare                     7.871e-04  9.481e-04   0.830
## alcoholfrq:milksometimes               -1.938e-04  8.947e-04  -0.217
## alcoholfrq:milkoften                    7.885e-04  7.287e-04   1.082
## alcoholfrq:milkvaried                          NA         NA         NA
## alcoholfrq:meals_nothome               -3.119e-05  1.178e-04  -0.265
## alcoholfrq:meals_fastfood              -9.337e-06  1.799e-04  -0.052
## alcoholfrq:depressedsometimes           1.652e-03  9.713e-04   1.701
## alcoholfrq:depressedoften               2.783e-03  1.973e-03   1.411
## alcoholfrq:depressedalwyas             -1.269e-03  2.449e-03  -0.518
## alcoholfrq:sleep_troublesometimes      -3.949e-05  8.325e-04  -0.047
## alcoholfrq:sleep_troubleoften          -6.606e-04  1.131e-03  -0.584
## alcoholfrq:sleep_troublealways         -1.766e-03  2.082e-03  -0.848
## alcoholfrq:activityNo                  -5.914e-04  6.343e-04  -0.932
```

```
## alcoholfrq:tv_hrs2~4hrs             -1.626e-04  7.488e-04  -0.217
## alcoholfrq:tv_hrs5hrs              -9.025e-04  1.267e-03  -0.712
## alcoholfrq:tv_hrs0hr                1.267e-03  2.549e-03   0.497
## alcoholfrq:sleep_hr                -1.813e-03  1.636e-03  -1.108
## alcoholfrq:smokesometimes           1.432e-03  1.871e-03   0.765
## alcoholfrq:smokeno                  1.507e-03  1.060e-03   1.422
## alcoholfrq:smokemissing             2.003e-03  1.101e-03   1.820
## alcoholfrq:sleep_hr2                1.578e-04  1.180e-04   1.338
## log.grocery:log.eatout             -9.214e-05  1.042e-03  -0.088
## log.grocery:log.delivery            2.214e-06  8.495e-04   0.003
## log.grocery:milkrare                2.002e-03  5.515e-03   0.363
## log.grocery:milksometimes           1.480e-03  4.696e-03   0.315
## log.grocery:milkoften               6.719e-04  4.567e-03   0.147
## log.grocery:milkvaried                     NA         NA        NA
## log.grocery:meals_nothome          -2.572e-04  4.941e-04  -0.521
## log.grocery:meals_fastfood          6.839e-04  6.674e-04   1.025
## log.grocery:depressedsometimes      3.157e-03  4.313e-03   0.732
## log.grocery:depressedoften         -4.872e-04  8.027e-03  -0.061
## log.grocery:depressedalwyas        -2.164e-03  1.105e-02  -0.196
## log.grocery:sleep_troublesometimes  2.820e-03  4.004e-03   0.704
## log.grocery:sleep_troubleoften     -1.093e-02  7.697e-03  -1.420
## log.grocery:sleep_troublealways     3.988e-03  6.752e-03   0.591
## log.grocery:activityNo             -8.970e-04  3.208e-03  -0.280
## log.grocery:tv_hrs2~4hrs            5.036e-04  3.553e-03   0.142
## log.grocery:tv_hrs5hrs              5.530e-03  4.637e-03   1.193
## log.grocery:tv_hrs0hr               3.153e-02  2.568e-02   1.228
## log.grocery:sleep_hr               -3.783e-03  6.879e-03  -0.550
## log.grocery:smokesometimes         -1.349e-03  8.743e-03  -0.154
## log.grocery:smokeno                -3.280e-03  5.263e-03  -0.623
## log.grocery:smokemissing            3.880e-03  4.292e-03   0.904
## log.grocery:sleep_hr2               2.524e-04  5.404e-04   0.467
## log.eatout:log.delivery            -1.646e-04  5.478e-04  -0.300
## log.eatout:milkrare                 1.654e-03  3.758e-03   0.440
## log.eatout:milksometimes           -2.144e-03  3.136e-03  -0.684
## log.eatout:milkoften                1.470e-03  3.092e-03   0.476
## log.eatout:milkvaried                      NA         NA        NA
## log.eatout:meals_nothome           -3.472e-04  3.752e-04  -0.925
## log.eatout:meals_fastfood           6.128e-05  5.445e-04   0.113
## log.eatout:depressedsometimes      -1.587e-03  2.736e-03  -0.580
## log.eatout:depressedoften           1.938e-03  7.274e-03   0.266
## log.eatout:depressedalwyas          9.774e-03  6.830e-03   1.431
## log.eatout:sleep_troublesometimes   1.791e-03  2.645e-03   0.677
## log.eatout:sleep_troubleoften       3.084e-03  4.954e-03   0.623
## log.eatout:sleep_troublealways     -6.214e-03  4.167e-03  -1.491
## log.eatout:activityNo               9.465e-04  2.257e-03   0.419
## log.eatout:tv_hrs2~4hrs            -4.240e-03  2.493e-03  -1.701
## log.eatout:tv_hrs5hrs               3.495e-03  3.511e-03   0.995
## log.eatout:tv_hrs0hr                9.212e-04  1.179e-02   0.078
```

```
## log.eatout:sleep_hr                         -4.551e-03  4.654e-03  -0.978
## log.eatout:smokesometimes                     5.257e-05  6.306e-03   0.008
## log.eatout:smokeno                            4.068e-03  3.056e-03   1.331
## log.eatout:smokemissing                      -5.613e-04  2.964e-03  -0.189
## log.eatout:sleep_hr2                          2.826e-04  3.398e-04   0.831
## log.delivery:milkrare                         2.506e-03  2.325e-03   1.078
## log.delivery:milksometimes                    1.701e-03  2.121e-03   0.802
## log.delivery:milkoften                        3.455e-03  2.098e-03   1.647
## log.delivery:milkvaried                             NA         NA         NA
## log.delivery:meals_nothome                    1.474e-04  2.401e-04   0.614
## log.delivery:meals_fastfood                   2.261e-05  3.346e-04   0.068
## log.delivery:depressedsometimes              -9.184e-04  2.054e-03  -0.447
## log.delivery:depressedoften                   4.831e-03  4.675e-03   1.033
## log.delivery:depressedalwyas                  7.315e-03  5.233e-03   1.398
## log.delivery:sleep_troublesometimes          -8.172e-04  1.766e-03  -0.463
## log.delivery:sleep_troubleoften               6.353e-03  3.437e-03   1.848
## log.delivery:sleep_troublealways              6.113e-04  2.916e-03   0.210
## log.delivery:activityNo                      -2.593e-05  1.480e-03  -0.018
## log.delivery:tv_hrs2~4hrs                     1.202e-03  1.645e-03   0.731
## log.delivery:tv_hrs5hrs                      -2.239e-03  2.543e-03  -0.880
## log.delivery:tv_hrs0hr                       -1.848e-02  9.008e-03  -2.052
## log.delivery:sleep_hr                         6.689e-04  3.900e-03   0.171
## log.delivery:smokesometimes                   1.657e-03  4.135e-03   0.401
## log.delivery:smokeno                          1.670e-03  2.409e-03   0.693
## log.delivery:smokemissing                     1.434e-03  2.264e-03   0.634
## log.delivery:sleep_hr2                       -8.941e-06  2.850e-04  -0.031
## milkrare:meals_nothome                       -2.291e-03  1.593e-03  -1.438
## milksometimes:meals_nothome                  -2.035e-04  1.489e-03  -0.137
## milkoften:meals_nothome                      -1.146e-04  1.421e-03  -0.081
## milkvaried:meals_nothome                            NA         NA         NA
## milkrare:meals_fastfood                       2.709e-03  2.167e-03   1.250
## milksometimes:meals_fastfood                  1.399e-03  1.972e-03   0.709
## milkoften:meals_fastfood                     -7.584e-04  1.995e-03  -0.380
## milkvaried:meals_fastfood                           NA         NA         NA
## milkrare:depressedsometimes                   2.144e-02  1.307e-02   1.641
## milksometimes:depressedsometimes              1.270e-03  1.185e-02   0.107
## milkoften:depressedsometimes                  8.440e-03  1.153e-02   0.732
## milkvaried:depressedsometimes                       NA         NA         NA
## milkrare:depressedoften                      -4.585e-02  2.901e-02  -1.580
## milksometimes:depressedoften                  1.203e-02  2.879e-02   0.418
## milkoften:depressedoften                      1.630e-02  2.671e-02   0.610
## milkvaried:depressedoften                           NA         NA         NA
## milkrare:depressedalwyas                      2.820e-02  3.180e-02   0.887
## milksometimes:depressedalwyas                -2.410e-02  3.125e-02  -0.771
## milkoften:depressedalwyas                     3.596e-02  3.091e-02   1.163
## milkvaried:depressedalwyas                          NA         NA         NA
## milkrare:sleep_troublesometimes              -1.080e-02  1.137e-02  -0.949
## milksometimes:sleep_troublesometimes          7.177e-04  1.019e-02   0.070
```

```
## milkoften:sleep_troublesometimes           -4.097e-03  1.007e-02  -0.407
## milkvaried:sleep_troublesometimes                   NA         NA       NA
## milkrare:sleep_troubleoften                 1.501e-02  2.328e-02   0.645
## milksometimes:sleep_troubleoften            2.192e-02  1.900e-02   1.154
## milkoften:sleep_troubleoften                2.081e-02  1.809e-02   1.151
## milkvaried:sleep_troubleoften                      NA         NA       NA
## milkrare:sleep_troublealways                1.597e-02  1.827e-02   0.874
## milksometimes:sleep_troublealways           1.285e-02  1.718e-02   0.748
## milkoften:sleep_troublealways               1.749e-02  1.741e-02   1.005
## milkvaried:sleep_troublealways                     NA         NA       NA
## milkrare:activityNo                         -4.848e-03  9.486e-03  -0.511
## milksometimes:activityNo                    -8.716e-03  8.540e-03  -1.021
## milkoften:activityNo                        -4.256e-03  8.339e-03  -0.510
## milkvaried:activityNo                              NA         NA       NA
## milkrare:tv_hrs2~4hrs                        1.768e-03  1.058e-02   0.167
## milksometimes:tv_hrs2~4hrs                   5.620e-03  9.722e-03   0.578
## milkoften:tv_hrs2~4hrs                      -3.060e-03  9.356e-03  -0.327
## milkvaried:tv_hrs2~4hrs                            NA         NA       NA
## milkrare:tv_hrs5hrs                          8.602e-03  1.611e-02   0.534
## milksometimes:tv_hrs5hrs                    -1.605e-02  1.465e-02  -1.096
## milkoften:tv_hrs5hrs                        -1.614e-02  1.446e-02  -1.116
## milkvaried:tv_hrs5hrs                              NA         NA       NA
## milkrare:tv_hrs0hr                           6.692e-04  4.058e-02   0.016
## milksometimes:tv_hrs0hr                      1.079e-02  4.044e-02   0.267
## milkoften:tv_hrs0hr                          3.016e-02  3.830e-02   0.787
## milkvaried:tv_hrs0hr                               NA         NA       NA
## milkrare:sleep_hr                            3.984e-02  2.508e-02   1.589
## milksometimes:sleep_hr                       1.636e-02  2.231e-02   0.733
## milkoften:sleep_hr                          -1.742e-04  2.303e-02  -0.008
## milkvaried:sleep_hr                                NA         NA       NA
## milkrare:smokesometimes                      1.408e-02  2.585e-02   0.545
## milksometimes:smokesometimes                 1.488e-02  2.500e-02   0.595
## milkoften:smokesometimes                     5.366e-03  2.531e-02   0.212
## milkvaried:smokesometimes                          NA         NA       NA
## milkrare:smokeno                            -7.311e-03  1.512e-02  -0.484
## milksometimes:smokeno                        1.340e-02  1.373e-02   0.976
## milkoften:smokeno                            5.687e-03  1.380e-02   0.412
## milkvaried:smokeno                                 NA         NA       NA
## milkrare:smokemissing                        1.324e-03  1.397e-02   0.095
## milksometimes:smokemissing                   1.149e-02  1.275e-02   0.901
## milkoften:smokemissing                      -1.988e-03  1.293e-02  -0.154
## milkvaried:smokemissing                            NA         NA       NA
## milkrare:sleep_hr2                          -2.608e-03  1.835e-03  -1.421
## milksometimes:sleep_hr2                     -1.084e-03  1.632e-03  -0.664
## milkoften:sleep_hr2                          5.745e-05  1.689e-03   0.034
## milkvaried:sleep_hr2                               NA         NA       NA
## meals_nothome:meals_fastfood                4.663e-06  1.135e-04   0.041
## meals_nothome:depressedsometimes           -2.703e-04  1.335e-03  -0.202
```

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## meals_nothome:depressedoften                 -8.718e-03   4.572e-03   -1.907
## meals_nothome:depressedalwyas                 -4.250e-03   4.699e-03   -0.904
## meals_nothome:sleep_troublesometimes           1.732e-04   1.148e-03    0.151
## meals_nothome:sleep_troubleoften               3.606e-03   2.671e-03    1.350
## meals_nothome:sleep_troublealways              9.006e-04   2.288e-03    0.394
## meals_nothome:activityNo                      -5.537e-04   1.001e-03   -0.553
## meals_nothome:tv_hrs2~4hrs                     -9.301e-04   1.149e-03   -0.809
## meals_nothome:tv_hrs5hrs                       -3.037e-03   1.968e-03   -1.543
## meals_nothome:tv_hrs0hr                        -7.122e-03   8.286e-03   -0.859
## meals_nothome:sleep_hr                          7.737e-04   2.882e-03    0.268
## meals_nothome:smokesometimes                    5.760e-04   3.217e-03    0.179
## meals_nothome:smokeno                           1.624e-04   1.865e-03    0.087
## meals_nothome:smokemissing                     -1.300e-03   1.704e-03   -0.763
## meals_nothome:sleep_hr2                        -5.591e-05   2.097e-04   -0.267
## meals_fastfood:depressedsometimes              -1.465e-03   2.015e-03   -0.727
## meals_fastfood:depressedoften                   9.482e-04   5.232e-03    0.181
## meals_fastfood:depressedalwyas                  1.702e-03   5.427e-03    0.314
## meals_fastfood:sleep_troublesometimes           1.739e-03   1.664e-03    1.045
## meals_fastfood:sleep_troubleoften              -3.129e-03   3.554e-03   -0.881
## meals_fastfood:sleep_troublealways              5.764e-03   3.060e-03    1.884
## meals_fastfood:activityNo                       2.342e-03   1.417e-03    1.653
## meals_fastfood:tv_hrs2~4hrs                     7.511e-04   1.597e-03    0.470
## meals_fastfood:tv_hrs5hrs                       3.330e-03   2.515e-03    1.324
## meals_fastfood:tv_hrs0hr                        1.951e-02   9.786e-03    1.994
## meals_fastfood:sleep_hr                         1.940e-04   3.648e-03    0.053
## meals_fastfood:smokesometimes                   4.675e-03   4.560e-03    1.025
## meals_fastfood:smokeno                          1.785e-03   2.373e-03    0.752
## meals_fastfood:smokemissing                     2.180e-03   2.106e-03    1.035
## meals_fastfood:sleep_hr2                        1.545e-05   2.687e-04    0.058
## depressedsometimes:sleep_troublesometimes      -1.624e-02   8.720e-03   -1.862
## depressedoften:sleep_troublesometimes           1.569e-02   2.268e-02    0.692
## depressedalwyas:sleep_troublesometimes         -1.369e-02   3.469e-02   -0.395
## depressedsometimes:sleep_troubleoften           6.567e-03   1.335e-02    0.492
## depressedoften:sleep_troubleoften               2.012e-02   3.231e-02    0.623
## depressedalwyas:sleep_troubleoften              6.075e-03   3.013e-02    0.202
## depressedsometimes:sleep_troublealways          1.387e-03   1.353e-02    0.103
## depressedoften:sleep_troublealways              4.152e-02   2.707e-02    1.534
## depressedalwyas:sleep_troublealways            -1.919e-02   2.771e-02   -0.692
## depressedsometimes:activityNo                   8.105e-03   7.973e-03    1.016
## depressedoften:activityNo                       6.861e-05   2.228e-02    0.003
## depressedalwyas:activityNo                      9.185e-03   2.198e-02    0.418
## depressedsometimes:tv_hrs2~4hrs                 1.066e-02   9.171e-03    1.162
## depressedoften:tv_hrs2~4hrs                    -2.578e-02   2.679e-02   -0.962
## depressedalwyas:tv_hrs2~4hrs                   -1.657e-02   2.662e-02   -0.623
## depressedsometimes:tv_hrs5hrs                   1.229e-02   1.291e-02    0.953
## depressedoften:tv_hrs5hrs                       1.289e-02   3.468e-02    0.372
## depressedalwyas:tv_hrs5hrs                     -4.504e-02   2.807e-02   -1.604
## depressedsometimes:tv_hrs0hr                    2.116e-02   3.961e-02    0.534
```

```
## depressedoften:tv_hrs0hr                      8.198e-02   5.900e-02    1.389
## depressedalwyas:tv_hrs0hr                     -3.032e-01   1.585e-01   -1.913
## depressedsometimes:sleep_hr                    2.480e-02   1.901e-02    1.305
## depressedoften:sleep_hr                        5.837e-03   2.888e-02    0.202
## depressedalwyas:sleep_hr                       2.687e-03   3.538e-02    0.076
## depressedsometimes:smokesometimes             -1.139e-02   2.380e-02   -0.478
## depressedoften:smokesometimes                 -3.912e-02   6.230e-02   -0.628
## depressedalwyas:smokesometimes                 5.641e-04   4.358e-02    0.013
## depressedsometimes:smokeno                     1.892e-02   1.199e-02    1.578
## depressedoften:smokeno                        -3.357e-02   2.658e-02   -1.263
## depressedalwyas:smokeno                        8.462e-03   2.794e-02    0.303
## depressedsometimes:smokemissing                7.290e-03   1.105e-02    0.660
## depressedoften:smokemissing                   -3.499e-02   2.413e-02   -1.450
## depressedalwyas:smokemissing                   3.684e-02   2.485e-02    1.483
## depressedsometimes:sleep_hr2                  -1.900e-03   1.416e-03   -1.341
## depressedoften:sleep_hr2                      -1.305e-03   2.078e-03   -0.628
## depressedalwyas:sleep_hr2                     -7.395e-05   2.628e-03   -0.028
## sleep_troublesometimes:activityNo              1.088e-02   6.871e-03    1.584
## sleep_troubleoften:activityNo                  1.466e-03   1.370e-02    0.107
## sleep_troublealways:activityNo                -6.823e-03   1.205e-02   -0.566
## sleep_troublesometimes:tv_hrs2~4hrs           -7.819e-05   8.020e-03   -0.010
## sleep_troubleoften:tv_hrs2~4hrs                1.243e-02   1.553e-02    0.800
## sleep_troublealways:tv_hrs2~4hrs              -1.230e-02   1.408e-02   -0.874
## sleep_troublesometimes:tv_hrs5hrs              8.499e-03   1.184e-02    0.718
## sleep_troubleoften:tv_hrs5hrs                  2.874e-02   2.182e-02    1.317
## sleep_troublealways:tv_hrs5hrs                 4.948e-03   1.744e-02    0.284
## sleep_troublesometimes:tv_hrs0hr              4.537e-02   4.518e-02    1.004
## sleep_troubleoften:tv_hrs0hr                  -1.178e-01   8.666e-02   -1.359
## sleep_troublealways:tv_hrs0hr                  9.388e-02   5.830e-02    1.610
## sleep_troublesometimes:sleep_hr              -1.456e-02   1.852e-02   -0.786
## sleep_troubleoften:sleep_hr                    2.039e-03   2.775e-02    0.073
## sleep_troublealways:sleep_hr                  -5.716e-03   2.325e-02   -0.246
## sleep_troublesometimes:smokesometimes         4.435e-02   2.049e-02    2.165
## sleep_troubleoften:smokesometimes            -3.130e-02   3.705e-02   -0.845
## sleep_troublealways:smokesometimes            5.419e-02   3.181e-02    1.703
## sleep_troublesometimes:smokeno                1.083e-02   1.164e-02    0.930
## sleep_troubleoften:smokeno                    3.716e-02   2.010e-02    1.849
## sleep_troublealways:smokeno                   1.933e-02   1.714e-02    1.128
## sleep_troublesometimes:smokemissing           1.597e-02   1.087e-02    1.469
## sleep_troubleoften:smokemissing               1.285e-02   1.914e-02    0.671
## sleep_troublealways:smokemissing              2.301e-02   1.591e-02    1.447
## sleep_troublesometimes:sleep_hr2              1.264e-03   1.349e-03    0.937
## sleep_troubleoften:sleep_hr2                  3.518e-04   2.145e-03    0.164
## sleep_troublealways:sleep_hr2                 7.963e-04   1.771e-03    0.450
## activityNo:tv_hrs2~4hrs                       -5.177e-03   6.408e-03   -0.808
## activityNo:tv_hrs5hrs                          8.528e-04   1.025e-02    0.083
## activityNo:tv_hrs0hr                           2.857e-02   3.632e-02    0.786
## activityNo:sleep_hr                           -6.784e-03   1.517e-02   -0.447
```

```
## activityNo:smokesometimes        -4.661e-03  1.696e-02  -0.275
## activityNo:smokeno               -1.125e-02  9.754e-03  -1.153
## activityNo:smokemissing          -1.381e-02  8.920e-03  -1.549
## activityNo:sleep_hr2              5.763e-04  1.107e-03   0.520
## tv_hrs2~4hrs:sleep_hr             1.771e-02  1.790e-02   0.989
## tv_hrs5hrs:sleep_hr               2.416e-02  2.296e-02   1.052
## tv_hrs0hr:sleep_hr                2.302e-02  6.015e-02   0.383
## tv_hrs2~4hrs:smokesometimes      -4.369e-02  2.035e-02  -2.147
## tv_hrs5hrs:smokesometimes        -5.807e-02  3.643e-02  -1.594
## tv_hrs0hr:smokesometimes         -2.960e-02  1.563e-01  -0.189
## tv_hrs2~4hrs:smokeno             -5.010e-03  1.148e-02  -0.436
## tv_hrs5hrs:smokeno               -1.572e-02  1.512e-02  -1.040
## tv_hrs0hr:smokeno                 1.609e-02  5.520e-02   0.291
## tv_hrs2~4hrs:smokemissing        -1.136e-02  1.071e-02  -1.061
## tv_hrs5hrs:smokemissing          -6.590e-03  1.381e-02  -0.477
## tv_hrs0hr:smokemissing            8.270e-02  4.310e-02   1.918
## tv_hrs2~4hrs:sleep_hr2           -1.640e-03  1.317e-03  -1.245
## tv_hrs5hrs:sleep_hr2             -1.881e-03  1.705e-03  -1.103
## tv_hrs0hr:sleep_hr2              -2.186e-03  4.834e-03  -0.452
## sleep_hr:smokesometimes           5.382e-02  3.982e-02   1.351
## sleep_hr:smokeno                 -1.150e-02  2.061e-02  -0.558
## sleep_hr:smokemissing            -1.228e-02  1.884e-02  -0.652
## sleep_hr:sleep_hr2                5.796e-05  2.075e-04   0.279
## smokesometimes:sleep_hr2         -3.433e-03  2.949e-03  -1.164
## smokeno:sleep_hr2                 1.390e-03  1.505e-03   0.923
## smokemissing:sleep_hr2            1.319e-03  1.391e-03   0.948
##                                  Pr(>|t|)
## (Intercept)                      1.15e-07 ***
## genderfemale                     0.043653 *
## age                              0.182733
## raceother hispanic               0.083097 .
## racewhite                        0.311530
## raceblack                        0.980821
## raceasian                        0.669972
## raceother                        0.754170
## eduhs                            0.153153
## eduabove hs                      0.478009
## marriagewidowed                  0.445392
## marriagedivorced                 0.733974
## marriagenever_married            0.109491
## famsize                          0.333473
## famincome25k~55k                 0.083320 .
## famincome55k~75k                 0.253303
## famincome75k~100k                0.762575
## famincomeabove 100k              0.585984
## alcohol12yrno                    0.802548
## alcoholfrq                       0.188894
## log.grocery                      0.285266
```

```
## log.eatout                             0.171153
## log.delivery                           0.248453
## milkrare                               0.087453 .
## milksometimes                          0.510722
## milkoften                              0.973431
## milkvaried                             0.015828 *
## meals_nothome                          0.723138
## meals_fastfood                         0.219452
## depressedsometimes                     0.386707
## depressedoften                         0.117882
## depressedalwyas                        0.583606
## sleep_troublesometimes                 0.861305
## sleep_troubleoften                     0.459527
## sleep_troublealways                    0.483751
## activityNo                             0.453222
## tv_hrs2~4hrs                           0.829030
## tv_hrs5hrs                             0.427474
## tv_hrs0hr                              0.144528
## sleep_hr                               0.583328
## smokesometimes                         0.101603
## smokeno                                0.962167
## smokemissing                           0.761782
## sleep_hr2                              0.767670
## genderfemale:age                       0.024500 *
## genderfemale:raceother hispanic        0.292835
## genderfemale:racewhite                 0.065089 .
## genderfemale:raceblack                 0.713819
## genderfemale:raceasian                 0.043182 *
## genderfemale:raceother                 0.465580
## genderfemale:eduhs                     0.820373
## genderfemale:eduabove hs               0.928307
## genderfemale:marriagewidowed           0.584063
## genderfemale:marriagedivorced          0.620436
## genderfemale:marriagenever_married     0.982055
## genderfemale:famsize                   0.557143
## genderfemale:famincome25k~55k          0.402132
## genderfemale:famincome55k~75k          0.534824
## genderfemale:famincome75k~100k         0.524352
## genderfemale:famincomeabove 100k       0.198072
## genderfemale:alcohol12yrno             0.192978
## genderfemale:alcoholfrq                0.095641 .
## genderfemale:log.grocery               0.675800
## genderfemale:log.eatout                0.296953
## genderfemale:log.delivery              0.103965
## genderfemale:milkrare                  0.184740
## genderfemale:milksometimes             0.891149
## genderfemale:milkoften                 0.505325
## genderfemale:milkvaried                0.051767 .
```

```
## genderfemale:meals_nothome              0.892310
## genderfemale:meals_fastfood             0.270767
## genderfemale:depressedsometimes         0.663291
## genderfemale:depressedoften             0.527583
## genderfemale:depressedalwyas            0.629287
## genderfemale:sleep_troublesometimes     0.270232
## genderfemale:sleep_troubleoften         0.017771 *
## genderfemale:sleep_troublealways        0.095010 .
## genderfemale:activityNo                 0.595421
## genderfemale:tv_hrs2~4hrs               0.574119
## genderfemale:tv_hrs5hrs                 0.737836
## genderfemale:tv_hrs0hr                  0.659920
## genderfemale:sleep_hr                   0.049497 *
## genderfemale:smokesometimes             0.750046
## genderfemale:smokeno                    0.085695 .
## genderfemale:smokemissing               0.004565 **
## genderfemale:sleep_hr2                  0.034401 *
## age:raceother hispanic                  0.094691 .
## age:racewhite                           0.491917
## age:raceblack                           0.265568
## age:raceasian                           0.236777
## age:raceother                           0.566652
## age:eduhs                               0.658743
## age:eduabove hs                         0.258802
## age:marriagewidowed                     0.638486
## age:marriagedivorced                    0.079393 .
## age:marriagenever_married               0.027016 *
## age:famsize                             0.278810
## age:famincome25k~55k                    0.612087
## age:famincome55k~75k                    0.438910
## age:famincome75k~100k                   0.494841
## age:famincomeabove 100k                 0.469245
## age:alcohol12yrno                       0.857826
## age:alcoholfrq                          0.162525
## age:log.grocery                         0.347664
## age:log.eatout                          0.246757
## age:log.delivery                        0.029537 *
## age:milkrare                            0.928997
## age:milksometimes                       0.432839
## age:milkoften                           0.681117
## age:milkvaried                          0.012743 *
## age:meals_nothome                       0.206191
## age:meals_fastfood                      0.245302
## age:depressedsometimes                  0.587324
## age:depressedoften                      0.335978
## age:depressedalwyas                     0.875455
## age:sleep_troublesometimes              0.889520
## age:sleep_troubleoften                  0.690612
```

```
## age:sleep_troublealways                     0.364637
## age:activityNo                              0.086887 .
## age:tv_hrs2~4hrs                            0.022462 *
## age:tv_hrs5hrs                              0.170860
## age:tv_hrs0hr                               0.687016
## age:sleep_hr                                0.169045
## age:smokesometimes                          0.378330
## age:smokeno                                 0.900633
## age:smokemissing                            0.875829
## age:sleep_hr2                               0.218354
## raceother hispanic:eduhs                    0.570167
## racewhite:eduhs                             0.541946
## raceblack:eduhs                             0.254402
## raceasian:eduhs                             0.442323
## raceother:eduhs                             0.123487
## raceother hispanic:eduabove hs              0.472414
## racewhite:eduabove hs                       0.427017
## raceblack:eduabove hs                       0.386620
## raceasian:eduabove hs                       0.730624
## raceother:eduabove hs                       0.845799
## raceother hispanic:marriagewidowed          0.591936
## racewhite:marriagewidowed                   0.722901
## raceblack:marriagewidowed                   0.412984
## raceasian:marriagewidowed                   0.913730
## raceother:marriagewidowed                   0.582727
## raceother hispanic:marriagedivorced         0.360596
## racewhite:marriagedivorced                  0.560029
## raceblack:marriagedivorced                  0.851597
## raceasian:marriagedivorced                  0.399227
## raceother:marriagedivorced                  0.479616
## raceother hispanic:marriagenever_married    0.033209 *
## racewhite:marriagenever_married             0.359974
## raceblack:marriagenever_married             0.279714
## raceasian:marriagenever_married             0.773258
## raceother:marriagenever_married             0.900612
## raceother hispanic:famsize                  0.012055 *
## racewhite:famsize                           0.026572 *
## raceblack:famsize                           0.075782 .
## raceasian:famsize                           0.449961
## raceother:famsize                           0.517658
## raceother hispanic:famincome25k~55k         0.463758
## racewhite:famincome25k~55k                  0.701526
## raceblack:famincome25k~55k                  0.565093
## raceasian:famincome25k~55k                  0.865801
## raceother:famincome25k~55k                  0.072201 .
## raceother hispanic:famincome55k~75k         0.406147
## racewhite:famincome55k~75k                  0.530035
## raceblack:famincome55k~75k                  0.915359
```

```
## raceasian:famincome55k~75k                0.824368
## raceother:famincome55k~75k                0.948290
## raceother hispanic:famincome75k~100k      0.292288
## racewhite:famincome75k~100k               0.656420
## raceblack:famincome75k~100k               0.848478
## raceasian:famincome75k~100k               0.771925
## raceother:famincome75k~100k               0.993163
## raceother hispanic:famincomeabove 100k    0.586596
## racewhite:famincomeabove 100k             0.625280
## raceblack:famincomeabove 100k             0.785178
## raceasian:famincomeabove 100k             0.920071
## raceother:famincomeabove 100k             0.578261
## raceother hispanic:alcohol12yrno          0.694018
## racewhite:alcohol12yrno                   0.394685
## raceblack:alcohol12yrno                   0.565224
## raceasian:alcohol12yrno                   0.351420
## raceother:alcohol12yrno                   0.053870 .
## raceother hispanic:alcoholfrq             0.965067
## racewhite:alcoholfrq                      0.675833
## raceblack:alcoholfrq                      0.751333
## raceasian:alcoholfrq                      0.999933
## raceother:alcoholfrq                      0.550715
## raceother hispanic:log.grocery            0.579284
## racewhite:log.grocery                     0.598264
## raceblack:log.grocery                     0.153104
## raceasian:log.grocery                     0.787572
## raceother:log.grocery                     0.953306
## raceother hispanic:log.eatout             0.766610
## racewhite:log.eatout                      0.173401
## raceblack:log.eatout                      0.247609
## raceasian:log.eatout                      0.588962
## raceother:log.eatout                      0.470897
## raceother hispanic:log.delivery           0.219503
## racewhite:log.delivery                    0.399971
## raceblack:log.delivery                    0.358198
## raceasian:log.delivery                    0.472183
## raceother:log.delivery                    0.351611
## raceother hispanic:milkrare               0.586913
## racewhite:milkrare                        0.511164
## raceblack:milkrare                        0.701839
## raceasian:milkrare                        0.406500
## raceother:milkrare                        0.201821
## raceother hispanic:milksometimes          0.882392
## racewhite:milksometimes                   0.375983
## raceblack:milksometimes                   0.750641
## raceasian:milksometimes                   0.213124
## raceother:milksometimes                   0.062676 .
## raceother hispanic:milkoften              0.799750
```

```
## racewhite:milkoften                        0.747042
## raceblack:milkoften                        0.543768
## raceasian:milkoften                        0.391112
## raceother:milkoften                        0.275257
## raceother hispanic:milkvaried                    NA
## racewhite:milkvaried                       0.015904 *
## raceblack:milkvaried                       0.425032
## raceasian:milkvaried                             NA
## raceother:milkvaried                             NA
## raceother hispanic:meals_nothome           0.727399
## racewhite:meals_nothome                    0.942490
## raceblack:meals_nothome                    0.624341
## raceasian:meals_nothome                    0.603835
## raceother:meals_nothome                    0.967756
## raceother hispanic:meals_fastfood          0.368577
## racewhite:meals_fastfood                   0.849753
## raceblack:meals_fastfood                   0.959715
## raceasian:meals_fastfood                   0.923356
## raceother:meals_fastfood                   0.172538
## raceother hispanic:depressedsometimes      0.830739
## racewhite:depressedsometimes               0.527051
## raceblack:depressedsometimes               0.350036
## raceasian:depressedsometimes               0.695505
## raceother:depressedsometimes               0.041502 *
## raceother hispanic:depressedoften          0.122351
## racewhite:depressedoften                   0.161046
## raceblack:depressedoften                   0.997215
## raceasian:depressedoften                   0.598524
## raceother:depressedoften                   0.729068
## raceother hispanic:depressedalwyas         0.081027 .
## racewhite:depressedalwyas                  0.524941
## raceblack:depressedalwyas                  0.058049 .
## raceasian:depressedalwyas                  0.728323
## raceother:depressedalwyas                  0.305856
## raceother hispanic:sleep_troublesometimes  0.222567
## racewhite:sleep_troublesometimes           0.172852
## raceblack:sleep_troublesometimes           0.138825
## raceasian:sleep_troublesometimes           0.507838
## raceother:sleep_troublesometimes           0.137943
## raceother hispanic:sleep_troubleoften      0.447785
## racewhite:sleep_troubleoften               0.152072
## raceblack:sleep_troubleoften               0.054370 .
## raceasian:sleep_troubleoften               0.035959 *
## raceother:sleep_troubleoften               0.442075
## raceother hispanic:sleep_troublealways     0.468714
## racewhite:sleep_troublealways              0.816188
## raceblack:sleep_troublealways              0.771249
## raceasian:sleep_troublealways              0.604139
```

```
## raceother:sleep_troublealways            0.225011
## raceother hispanic:activityNo             0.013130 *
## racewhite:activityNo                       0.029707 *
## raceblack:activityNo                       0.000981 ***
## raceasian:activityNo                       0.049988 *
## raceother:activityNo                        0.793398
## raceother hispanic:tv_hrs2~4hrs            0.785690
## racewhite:tv_hrs2~4hrs                      0.745063
## raceblack:tv_hrs2~4hrs                      0.401311
## raceasian:tv_hrs2~4hrs                      0.105797
## raceother:tv_hrs2~4hrs                      0.235385
## raceother hispanic:tv_hrs5hrs             0.279418
## racewhite:tv_hrs5hrs                        0.073391 .
## raceblack:tv_hrs5hrs                        0.256773
## raceasian:tv_hrs5hrs                        0.705736
## raceother:tv_hrs5hrs                        0.725532
## raceother hispanic:tv_hrs0hr              0.021233 *
## racewhite:tv_hrs0hr                         0.002035 **
## raceblack:tv_hrs0hr                         0.073805 .
## raceasian:tv_hrs0hr                         0.222547
## raceother:tv_hrs0hr                               NA
## raceother hispanic:sleep_hr              0.189199
## racewhite:sleep_hr                          0.640678
## raceblack:sleep_hr                          0.890358
## raceasian:sleep_hr                          0.599038
## raceother:sleep_hr                          0.278274
## raceother hispanic:smokesometimes        0.279574
## racewhite:smokesometimes                    0.805447
## raceblack:smokesometimes                    0.293364
## raceasian:smokesometimes                    0.691041
## raceother:smokesometimes                    0.343869
## raceother hispanic:smokeno               0.596724
## racewhite:smokeno                           0.103989
## raceblack:smokeno                           0.452441
## raceasian:smokeno                           0.496245
## raceother:smokeno                           0.705059
## raceother hispanic:smokemissing          0.780192
## racewhite:smokemissing                      0.316737
## raceblack:smokemissing                      0.228894
## raceasian:smokemissing                      0.702919
## raceother:smokemissing                      0.909321
## raceother hispanic:sleep_hr2             0.190746
## racewhite:sleep_hr2                         0.655071
## raceblack:sleep_hr2                         0.805680
## raceasian:sleep_hr2                         0.643872
## raceother:sleep_hr2                         0.233151
## eduhs:marriagewidowed                       0.401459
## eduabove hs:marriagewidowed                 0.677442
```

```
## eduhs:marriagedivorced                  0.911205
## eduabove hs:marriagedivorced             0.379754
## eduhs:marriagenever_married              0.847201
## eduabove hs:marriagenever_married        0.063590 .
## eduhs:famsize                            0.312994
## eduabove hs:famsize                      0.047462 *
## eduhs:famincome25k~55k                   0.062364 .
## eduabove hs:famincome25k~55k             0.155294
## eduhs:famincome55k~75k                   0.337448
## eduabove hs:famincome55k~75k             0.022798 *
## eduhs:famincome75k~100k                  0.480050
## eduabove hs:famincome75k~100k            0.825753
## eduhs:famincomeabove 100k                0.420097
## eduabove hs:famincomeabove 100k          0.409102
## eduhs:alcohol12yrno                      0.957539
## eduabove hs:alcohol12yrno                0.785928
## eduhs:alcoholfrq                         0.766388
## eduabove hs:alcoholfrq                   0.367066
## eduhs:log.grocery                        0.899508
## eduabove hs:log.grocery                  0.907507
## eduhs:log.eatout                         0.279901
## eduabove hs:log.eatout                   0.772091
## eduhs:log.delivery                       0.682128
## eduabove hs:log.delivery                 0.339979
## eduhs:milkrare                           0.090780 .
## eduabove hs:milkrare                     0.628645
## eduhs:milksometimes                      0.230392
## eduabove hs:milksometimes                0.308516
## eduhs:milkoften                          0.498901
## eduabove hs:milkoften                    0.833669
## eduhs:milkvaried                         0.012557 *
## eduabove hs:milkvaried                   0.050141 .
## eduhs:meals_nothome                      0.203647
## eduabove hs:meals_nothome                0.178866
## eduhs:meals_fastfood                     0.100264
## eduabove hs:meals_fastfood               0.210987
## eduhs:depressedsometimes                 0.900787
## eduabove hs:depressedsometimes           0.649784
## eduhs:depressedoften                     0.050043 .
## eduabove hs:depressedoften               0.957492
## eduhs:depressedalwyas                    0.705247
## eduabove hs:depressedalwyas              0.448757
## eduhs:sleep_troublesometimes             0.516608
## eduabove hs:sleep_troublesometimes       0.121338
## eduhs:sleep_troubleoften                 0.705660
## eduabove hs:sleep_troubleoften           0.201156
## eduhs:sleep_troublealways                0.463392
## eduabove hs:sleep_troublealways          0.449901
```

```
## eduhs:activityNo                               0.440495
## eduabove hs:activityNo                         0.083916 .
## eduhs:tv_hrs2~4hrs                             0.004711 **
## eduabove hs:tv_hrs2~4hrs                       0.068069 .
## eduhs:tv_hrs5hrs                               0.651217
## eduabove hs:tv_hrs5hrs                         0.489210
## eduhs:tv_hrs0hr                                0.291328
## eduabove hs:tv_hrs0hr                          0.449508
## eduhs:sleep_hr                                 0.057962 .
## eduabove hs:sleep_hr                           0.090848 .
## eduhs:smokesometimes                           0.114584
## eduabove hs:smokesometimes                     0.306677
## eduhs:smokeno                                  0.783206
## eduabove hs:smokeno                            0.375887
## eduhs:smokemissing                             0.955469
## eduabove hs:smokemissing                       0.796930
## eduhs:sleep_hr2                                0.080744 .
## eduabove hs:sleep_hr2                          0.135054
## marriagewidowed:famsize                        0.300935
## marriagedivorced:famsize                       0.844683
## marriagenever_married:famsize                  0.539367
## marriagewidowed:famincome25k~55k               0.641805
## marriagedivorced:famincome25k~55k              0.398275
## marriagenever_married:famincome25k~55k         0.095907 .
## marriagewidowed:famincome55k~75k               0.408973
## marriagedivorced:famincome55k~75k              0.734376
## marriagenever_married:famincome55k~75k         0.051661 .
## marriagewidowed:famincome75k~100k              0.828628
## marriagedivorced:famincome75k~100k             0.713753
## marriagenever_married:famincome75k~100k        0.365069
## marriagewidowed:famincomeabove 100k            0.137454
## marriagedivorced:famincomeabove 100k           0.216728
## marriagenever_married:famincomeabove 100k      0.130373
## marriagewidowed:alcohol12yrno                  0.752624
## marriagedivorced:alcohol12yrno                 0.006259 **
## marriagenever_married:alcohol12yrno            0.868852
## marriagewidowed:alcoholfrq                     0.797310
## marriagedivorced:alcoholfrq                    0.436668
## marriagenever_married:alcoholfrq               0.537079
## marriagewidowed:log.grocery                    0.678092
## marriagedivorced:log.grocery                   0.301207
## marriagenever_married:log.grocery              0.204468
## marriagewidowed:log.eatout                     0.705084
## marriagedivorced:log.eatout                    0.714223
## marriagenever_married:log.eatout               0.686211
## marriagewidowed:log.delivery                   0.470217
## marriagedivorced:log.delivery                  0.172780
## marriagenever_married:log.delivery             0.164869
```

```
## marriagewidowed:milkrare                           0.832984
## marriagedivorced:milkrare                          0.952518
## marriagenever_married:milkrare                     0.401839
## marriagewidowed:milksometimes                      0.188461
## marriagedivorced:milksometimes                     0.195433
## marriagenever_married:milksometimes                0.564072
## marriagewidowed:milkoften                          0.753891
## marriagedivorced:milkoften                         0.926413
## marriagenever_married:milkoften                    0.565748
## marriagewidowed:milkvaried                         0.497472
## marriagedivorced:milkvaried                        0.019363 *
## marriagenever_married:milkvaried                         NA
## marriagewidowed:meals_nothome                      0.417090
## marriagedivorced:meals_nothome                     0.534316
## marriagenever_married:meals_nothome                0.970991
## marriagewidowed:meals_fastfood                     0.944674
## marriagedivorced:meals_fastfood                    0.425619
## marriagenever_married:meals_fastfood               0.818558
## marriagewidowed:depressedsometimes                 0.085327 .
## marriagedivorced:depressedsometimes                0.594200
## marriagenever_married:depressedsometimes           0.845546
## marriagewidowed:depressedoften                     0.919221
## marriagedivorced:depressedoften                    0.116478
## marriagenever_married:depressedoften               0.444547
## marriagewidowed:depressedalwyas                    0.789297
## marriagedivorced:depressedalwyas                   0.230025
## marriagenever_married:depressedalwyas              0.775567
## marriagewidowed:sleep_troublesometimes             0.948593
## marriagedivorced:sleep_troublesometimes            0.612988
## marriagenever_married:sleep_troublesometimes 0.587112
## marriagewidowed:sleep_troubleoften                 0.387533
## marriagedivorced:sleep_troubleoften                0.436265
## marriagenever_married:sleep_troubleoften           0.745071
## marriagewidowed:sleep_troublealways                0.746337
## marriagedivorced:sleep_troublealways               0.998593
## marriagenever_married:sleep_troublealways          0.657968
## marriagewidowed:activityNo                         0.855080
## marriagedivorced:activityNo                        0.121055
## marriagenever_married:activityNo                   0.759044
## marriagewidowed:tv_hrs2~4hrs                       0.663975
## marriagedivorced:tv_hrs2~4hrs                      0.698080
## marriagenever_married:tv_hrs2~4hrs                 0.616422
## marriagewidowed:tv_hrs5hrs                         0.957656
## marriagedivorced:tv_hrs5hrs                        0.624146
## marriagenever_married:tv_hrs5hrs                   0.491120
## marriagewidowed:tv_hrs0hr                          0.445872
## marriagedivorced:tv_hrs0hr                         0.915257
## marriagenever_married:tv_hrs0hr                    0.538073
```

```
## marriagewidowed:sleep_hr                     0.591660
## marriagedivorced:sleep_hr                    0.083924 .
## marriagenever_married:sleep_hr               0.287072
## marriagewidowed:smokesometimes               0.037118 *
## marriagedivorced:smokesometimes              0.197613
## marriagenever_married:smokesometimes         0.213762
## marriagewidowed:smokeno                      0.652534
## marriagedivorced:smokeno                     0.674080
## marriagenever_married:smokeno                0.844121
## marriagewidowed:smokemissing                 0.529939
## marriagedivorced:smokemissing                0.056874 .
## marriagenever_married:smokemissing           0.013331 *
## marriagewidowed:sleep_hr2                     0.449990
## marriagedivorced:sleep_hr2                    0.069378 .
## marriagenever_married:sleep_hr2               0.370353
## famsize:famincome25k~55k                     0.704250
## famsize:famincome55k~75k                     0.968185
## famsize:famincome75k~100k                    0.607367
## famsize:famincomeabove 100k                  0.116929
## famsize:alcohol12yrno                        0.988552
## famsize:alcoholfrq                           0.752697
## famsize:log.grocery                          0.624298
## famsize:log.eatout                           0.679538
## famsize:log.delivery                         0.080109 .
## famsize:milkrare                             0.631031
## famsize:milksometimes                        0.222668
## famsize:milkoften                            0.777190
## famsize:milkvaried                                 NA
## famsize:meals_nothome                        0.470921
## famsize:meals_fastfood                       0.672898
## famsize:depressedsometimes                   0.001392 **
## famsize:depressedoften                       0.039192 *
## famsize:depressedalwyas                      0.011586 *
## famsize:sleep_troublesometimes               0.558593
## famsize:sleep_troubleoften                   0.328865
## famsize:sleep_troublealways                  0.857796
## famsize:activityNo                           0.153734
## famsize:tv_hrs2~4hrs                         0.068502 .
## famsize:tv_hrs5hrs                           0.111659
## famsize:tv_hrs0hr                            0.571160
## famsize:sleep_hr                             0.321942
## famsize:smokesometimes                       0.005136 **
## famsize:smokeno                              0.400424
## famsize:smokemissing                         0.325377
## famsize:sleep_hr2                            0.289562
## famincome25k~55k:alcohol12yrno               0.952100
## famincome55k~75k:alcohol12yrno               0.327625
## famincome75k~100k:alcohol12yrno              0.039027 *
```

```
## famincomeabove 100k:alcohol12yrno        0.013750 *
## famincome25k~55k:alcoholfrq              0.340871
## famincome55k~75k:alcoholfrq              0.250371
## famincome75k~100k:alcoholfrq             0.433150
## famincomeabove 100k:alcoholfrq           0.211388
## famincome25k~55k:log.grocery             0.761449
## famincome55k~75k:log.grocery             0.854108
## famincome75k~100k:log.grocery            0.090939 .
## famincomeabove 100k:log.grocery          0.396431
## famincome25k~55k:log.eatout              0.136009
## famincome55k~75k:log.eatout              0.563777
## famincome75k~100k:log.eatout             0.929222
## famincomeabove 100k:log.eatout           0.898813
## famincome25k~55k:log.delivery            0.354433
## famincome55k~75k:log.delivery            0.595119
## famincome75k~100k:log.delivery           0.961452
## famincomeabove 100k:log.delivery         0.667419
## famincome25k~55k:milkrare                0.420171
## famincome55k~75k:milkrare                0.837464
## famincome75k~100k:milkrare               0.048942 *
## famincomeabove 100k:milkrare             0.260831
## famincome25k~55k:milksometimes           0.545775
## famincome55k~75k:milksometimes           0.093535 .
## famincome75k~100k:milksometimes          0.595657
## famincomeabove 100k:milksometimes        0.767287
## famincome25k~55k:milkoften               0.557776
## famincome55k~75k:milkoften               0.119329
## famincome75k~100k:milkoften              0.903423
## famincomeabove 100k:milkoften            0.799385
## famincome25k~55k:milkvaried                    NA
## famincome55k~75k:milkvaried                    NA
## famincome75k~100k:milkvaried                   NA
## famincomeabove 100k:milkvaried                 NA
## famincome25k~55k:meals_nothome           0.864658
## famincome55k~75k:meals_nothome           0.099116 .
## famincome75k~100k:meals_nothome          0.874198
## famincomeabove 100k:meals_nothome        0.628002
## famincome25k~55k:meals_fastfood          0.860110
## famincome55k~75k:meals_fastfood          0.586840
## famincome75k~100k:meals_fastfood         0.632599
## famincomeabove 100k:meals_fastfood       0.594050
## famincome25k~55k:depressedsometimes      0.603342
## famincome55k~75k:depressedsometimes      0.361781
## famincome75k~100k:depressedsometimes     0.921506
## famincomeabove 100k:depressedsometimes   0.505317
## famincome25k~55k:depressedoften          0.370220
## famincome55k~75k:depressedoften          0.012234 *
## famincome75k~100k:depressedoften         0.354085
```

```
## famincomeabove 100k:depressedoften            0.069269 .
## famincome25k~55k:depressedalwyas              0.197636
## famincome55k~75k:depressedalwyas              0.787061
## famincome75k~100k:depressedalwyas             0.557006
## famincomeabove 100k:depressedalwyas           0.012179 *
## famincome25k~55k:sleep_troublesometimes       0.497038
## famincome55k~75k:sleep_troublesometimes       0.685581
## famincome75k~100k:sleep_troublesometimes      0.440975
## famincomeabove 100k:sleep_troublesometimes    0.856889
## famincome25k~55k:sleep_troubleoften           0.553689
## famincome55k~75k:sleep_troubleoften           0.656038
## famincome75k~100k:sleep_troubleoften          0.470229
## famincomeabove 100k:sleep_troubleoften        0.881023
## famincome25k~55k:sleep_troublealways          0.090821 .
## famincome55k~75k:sleep_troublealways          0.210265
## famincome75k~100k:sleep_troublealways         0.993824
## famincomeabove 100k:sleep_troublealways       0.042936 *
## famincome25k~55k:activityNo                   0.932388
## famincome55k~75k:activityNo                   0.858140
## famincome75k~100k:activityNo                  0.464257
## famincomeabove 100k:activityNo                0.865132
## famincome25k~55k:tv_hrs2~4hrs                 0.873106
## famincome55k~75k:tv_hrs2~4hrs                 0.461016
## famincome75k~100k:tv_hrs2~4hrs                0.310876
## famincomeabove 100k:tv_hrs2~4hrs              0.035334 *
## famincome25k~55k:tv_hrs5hrs                   0.657790
## famincome55k~75k:tv_hrs5hrs                   0.548845
## famincome75k~100k:tv_hrs5hrs                  0.327367
## famincomeabove 100k:tv_hrs5hrs                0.570210
## famincome25k~55k:tv_hrs0hr                    0.458812
## famincome55k~75k:tv_hrs0hr                    0.066071 .
## famincome75k~100k:tv_hrs0hr                   0.607677
## famincomeabove 100k:tv_hrs0hr                 0.420862
## famincome25k~55k:sleep_hr                     0.055499 .
## famincome55k~75k:sleep_hr                     0.298620
## famincome75k~100k:sleep_hr                    0.239695
## famincomeabove 100k:sleep_hr                  0.115794
## famincome25k~55k:smokesometimes               0.894939
## famincome55k~75k:smokesometimes               0.431698
## famincome75k~100k:smokesometimes              0.044692 *
## famincomeabove 100k:smokesometimes            0.215674
## famincome25k~55k:smokeno                      0.585764
## famincome55k~75k:smokeno                      0.130746
## famincome75k~100k:smokeno                     0.207872
## famincomeabove 100k:smokeno                   0.208577
## famincome25k~55k:smokemissing                 0.878428
## famincome55k~75k:smokemissing                 0.279923
## famincome75k~100k:smokemissing                0.301805
```

```
## famincomeabove 100k:smokemissing        0.088146 .
## famincome25k~55k:sleep_hr2               0.054001 .
## famincome55k~75k:sleep_hr2               0.338742
## famincome75k~100k:sleep_hr2              0.261410
## famincomeabove 100k:sleep_hr2            0.097600 .
## alcohol12yrno:alcoholfrq                 0.026621 *
## alcohol12yrno:log.grocery                0.669663
## alcohol12yrno:log.eatout                 0.378869
## alcohol12yrno:log.delivery               0.847123
## alcohol12yrno:milkrare                   0.117094
## alcohol12yrno:milksometimes              0.823777
## alcohol12yrno:milkoften                  0.539872
## alcohol12yrno:milkvaried                       NA
## alcohol12yrno:meals_nothome              0.110325
## alcohol12yrno:meals_fastfood             0.024657 *
## alcohol12yrno:depressedsometimes         0.049675 *
## alcohol12yrno:depressedoften             0.016759 *
## alcohol12yrno:depressedalwyas            0.004331 **
## alcohol12yrno:sleep_troublesometimes     0.099980 .
## alcohol12yrno:sleep_troubleoften         0.923726
## alcohol12yrno:sleep_troublealways        0.894278
## alcohol12yrno:activityNo                 0.640854
## alcohol12yrno:tv_hrs2~4hrs               0.612963
## alcohol12yrno:tv_hrs5hrs                 0.909226
## alcohol12yrno:tv_hrs0hr                  0.849850
## alcohol12yrno:sleep_hr                   0.942719
## alcohol12yrno:smokesometimes             0.160080
## alcohol12yrno:smokeno                    0.460718
## alcohol12yrno:smokemissing               0.691180
## alcohol12yrno:sleep_hr2                  0.836827
## alcoholfrq:log.grocery                   0.073439 .
## alcoholfrq:log.eatout                    0.686029
## alcoholfrq:log.delivery                  0.612381
## alcoholfrq:milkrare                      0.406516
## alcoholfrq:milksometimes                 0.828571
## alcoholfrq:milkoften                     0.279307
## alcoholfrq:milkvaried                          NA
## alcoholfrq:meals_nothome                 0.791208
## alcoholfrq:meals_fastfood                0.958619
## alcoholfrq:depressedsometimes            0.089176 .
## alcoholfrq:depressedoften                0.158529
## alcoholfrq:depressedalwyas               0.604406
## alcoholfrq:sleep_troublesometimes        0.962165
## alcoholfrq:sleep_troubleoften            0.559359
## alcoholfrq:sleep_troublealways           0.396388
## alcoholfrq:activityNo                    0.351242
## alcoholfrq:tv_hrs2~4hrs                  0.828074
## alcoholfrq:tv_hrs5hrs                    0.476440
```

```
## alcoholfrq:tv_hrs0hr                  0.619289
## alcoholfrq:sleep_hr                   0.267870
## alcoholfrq:smokesometimes             0.444238
## alcoholfrq:smokeno                    0.155070
## alcoholfrq:smokemissing               0.068974 .
## alcoholfrq:sleep_hr2                  0.181185
## log.grocery:log.eatout                0.929542
## log.grocery:log.delivery              0.997920
## log.grocery:milkrare                  0.716717
## log.grocery:milksometimes             0.752636
## log.grocery:milkoften                 0.883042
## log.grocery:milkvaried                      NA
## log.grocery:meals_nothome             0.602728
## log.grocery:meals_fastfood            0.305662
## log.grocery:depressedsometimes        0.464284
## log.grocery:depressedoften            0.951607
## log.grocery:depressedalwyas           0.844780
## log.grocery:sleep_troublesometimes    0.481315
## log.grocery:sleep_troubleoften        0.155887
## log.grocery:sleep_troublealways       0.554845
## log.grocery:activityNo                0.779812
## log.grocery:tv_hrs2~4hrs              0.887297
## log.grocery:tv_hrs5hrs                0.233192
## log.grocery:tv_hrs0hr                 0.219716
## log.grocery:sleep_hr                  0.582385
## log.grocery:smokesometimes            0.877430
## log.grocery:smokeno                   0.533128
## log.grocery:smokemissing              0.366092
## log.grocery:sleep_hr2                 0.640508
## log.eatout:log.delivery               0.763854
## log.eatout:milkrare                   0.659880
## log.eatout:milksometimes              0.494162
## log.eatout:milkoften                  0.634431
## log.eatout:milkvaried                       NA
## log.eatout:meals_nothome              0.354905
## log.eatout:meals_fastfood             0.910409
## log.eatout:depressedsometimes         0.561934
## log.eatout:depressedoften             0.789975
## log.eatout:depressedalwyas            0.152573
## log.eatout:sleep_troublesometimes     0.498395
## log.eatout:sleep_troubleoften         0.533609
## log.eatout:sleep_troublealways        0.136034
## log.eatout:activityNo                 0.674994
## log.eatout:tv_hrs2~4hrs               0.089139 .
## log.eatout:tv_hrs5hrs                 0.319641
## log.eatout:tv_hrs0hr                  0.937740
## log.eatout:sleep_hr                   0.328279
## log.eatout:smokesometimes             0.993349
```

```
## log.eatout:smokeno                          0.183334
## log.eatout:smokemissing                      0.849803
## log.eatout:sleep_hr2                          0.405786
## log.delivery:milkrare                         0.281321
## log.delivery:milksometimes                    0.422670
## log.delivery:milkoften                        0.099667 .
## log.delivery:milkvaried                             NA
## log.delivery:meals_nothome                     0.539433
## log.delivery:meals_fastfood                    0.946139
## log.delivery:depressedsometimes               0.654772
## log.delivery:depressedoften                   0.301493
## log.delivery:depressedalwyas                  0.162255
## log.delivery:sleep_troublesometimes           0.643677
## log.delivery:sleep_troubleoften               0.064692 .
## log.delivery:sleep_troublealways              0.833982
## log.delivery:activityNo                        0.986024
## log.delivery:tv_hrs2~4hrs                      0.464956
## log.delivery:tv_hrs5hrs                        0.378749
## log.delivery:tv_hrs0hr                         0.040314 *
## log.delivery:sleep_hr                          0.863852
## log.delivery:smokesometimes                    0.688736
## log.delivery:smokeno                           0.488238
## log.delivery:smokemissing                      0.526463
## log.delivery:sleep_hr2                         0.974977
## milkrare:meals_nothome                         0.150594
## milksometimes:meals_nothome                    0.891285
## milkoften:meals_nothome                        0.935758
## milkvaried:meals_nothome                            NA
## milkrare:meals_fastfood                        0.211414
## milksometimes:meals_fastfood                   0.478250
## milkoften:meals_fastfood                       0.703922
## milkvaried:meals_fastfood                           NA
## milkrare:depressedsometimes                    0.101014
## milksometimes:depressedsometimes               0.914680
## milkoften:depressedsometimes                   0.464120
## milkvaried:depressedsometimes                       NA
## milkrare:depressedoften                        0.114167
## milksometimes:depressedoften                   0.676064
## milkoften:depressedoften                       0.541742
## milkvaried:depressedoften                           NA
## milkrare:depressedalwyas                       0.375353
## milksometimes:depressedalwyas                  0.440684
## milkoften:depressedalwyas                      0.244774
## milkvaried:depressedalwyas                          NA
## milkrare:sleep_troublesometimes                0.342486
## milksometimes:sleep_troublesometimes           0.943841
## milkoften:sleep_troublesometimes               0.684168
## milkvaried:sleep_troublesometimes                   NA
```

```
## milkrare:sleep_troubleoften              0.519174
## milksometimes:sleep_troubleoften         0.248661
## milkoften:sleep_troubleoften             0.249990
## milkvaried:sleep_troubleoften                  NA
## milkrare:sleep_troublealways             0.382373
## milksometimes:sleep_troublealways        0.454360
## milkoften:sleep_troublealways            0.315098
## milkvaried:sleep_troublealways                 NA
## milkrare:activityNo                      0.609367
## milksometimes:activityNo                 0.307560
## milkoften:activityNo                     0.609828
## milkvaried:activityNo                          NA
## milkrare:tv_hrs2~4hrs                    0.867339
## milksometimes:tv_hrs2~4hrs               0.563246
## milkoften:tv_hrs2~4hrs                   0.743671
## milkvaried:tv_hrs2~4hrs                        NA
## milkrare:tv_hrs5hrs                      0.593394
## milksometimes:tv_hrs5hrs                 0.273420
## milkoften:tv_hrs5hrs                     0.264422
## milkvaried:tv_hrs5hrs                          NA
## milkrare:tv_hrs0hr                       0.986844
## milksometimes:tv_hrs0hr                  0.789545
## milkoften:tv_hrs0hr                      0.431224
## milkvaried:tv_hrs0hr                           NA
## milkrare:sleep_hr                        0.112221
## milksometimes:sleep_hr                   0.463618
## milkoften:sleep_hr                       0.993966
## milkvaried:sleep_hr                            NA
## milkrare:smokesometimes                  0.585998
## milksometimes:smokesometimes             0.551922
## milkoften:smokesometimes                 0.832109
## milkvaried:smokesometimes                      NA
## milkrare:smokeno                         0.628645
## milksometimes:smokeno                    0.329115
## milkoften:smokeno                        0.680212
## milkvaried:smokeno                             NA
## milkrare:smokemissing                    0.924514
## milksometimes:smokemissing               0.367446
## milkoften:smokemissing                   0.877816
## milkvaried:smokemissing                        NA
## milkrare:sleep_hr2                       0.155375
## milksometimes:sleep_hr2                  0.506647
## milkoften:sleep_hr2                      0.972864
## milkvaried:sleep_hr2                           NA
## meals_nothome:meals_fastfood             0.967235
## meals_nothome:depressedsometimes         0.839627
## meals_nothome:depressedoften             0.056666 .
## meals_nothome:depressedalwyas            0.365846
```
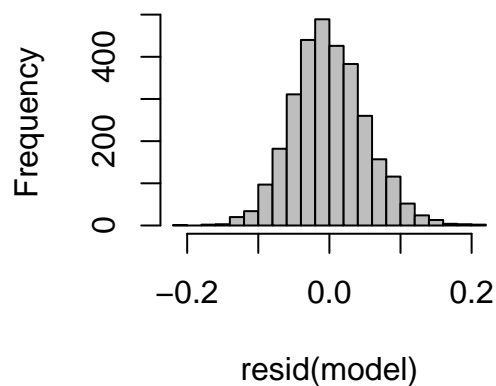
```
## meals_nothome:sleep_troublesometimes    0.880095
## meals_nothome:sleep_troubleoften         0.177156
## meals_nothome:sleep_troublealways        0.693863
## meals_nothome:activityNo                 0.580162
## meals_nothome:tv_hrs2~4hrs               0.418430
## meals_nothome:tv_hrs5hrs                 0.122890
## meals_nothome:tv_hrs0hr                  0.390163
## meals_nothome:sleep_hr                   0.788345
## meals_nothome:smokesometimes             0.857932
## meals_nothome:smokeno                    0.930601
## meals_nothome:smokemissing               0.445787
## meals_nothome:sleep_hr2                  0.789771
## meals_fastfood:depressedsometimes        0.467124
## meals_fastfood:depressedoften            0.856215
## meals_fastfood:depressedalwyas           0.753843
## meals_fastfood:sleep_troublesometimes    0.296112
## meals_fastfood:sleep_troubleoften        0.378675
## meals_fastfood:sleep_troublealways       0.059729 .
## meals_fastfood:activityNo                0.098495 .
## meals_fastfood:tv_hrs2~4hrs              0.638059
## meals_fastfood:tv_hrs5hrs                0.185568
## meals_fastfood:tv_hrs0hr                 0.046299 *
## meals_fastfood:sleep_hr                  0.957580
## meals_fastfood:smokesometimes            0.305377
## meals_fastfood:smokeno                   0.451905
## meals_fastfood:smokemissing              0.300850
## meals_fastfood:sleep_hr2                 0.954138
## depressedsometimes:sleep_troublesometimes 0.062736 .
## depressedoften:sleep_troublesometimes    0.489081
## depressedalwyas:sleep_troublesometimes   0.693198
## depressedsometimes:sleep_troubleoften    0.622805
## depressedoften:sleep_troubleoften        0.533465
## depressedalwyas:sleep_troubleoften       0.840206
## depressedsometimes:sleep_troublealways   0.918362
## depressedoften:sleep_troublealways       0.125255
## depressedalwyas:sleep_troublealways      0.488727
## depressedsometimes:activityNo            0.309519
## depressedoften:activityNo                0.997543
## depressedalwyas:activityNo               0.676035
## depressedsometimes:tv_hrs2~4hrs          0.245400
## depressedoften:tv_hrs2~4hrs              0.336123
## depressedalwyas:tv_hrs2~4hrs             0.533603
## depressedsometimes:tv_hrs5hrs            0.340876
## depressedoften:tv_hrs5hrs                0.710085
## depressedalwyas:tv_hrs5hrs               0.108768
## depressedsometimes:tv_hrs0hr             0.593290
## depressedoften:tv_hrs0hr                 0.164837
## depressedalwyas:tv_hrs0hr                0.055909 .
```
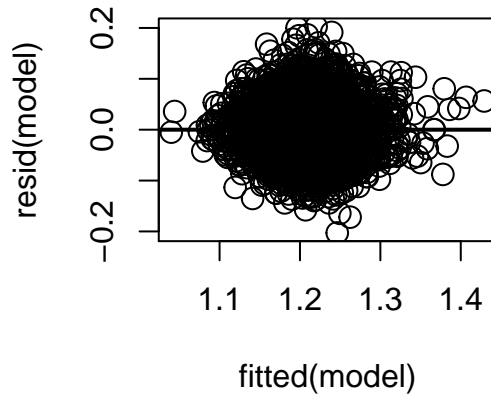
```
## depressedsometimes:sleep_hr                0.192075
## depressedoften:sleep_hr                     0.839853
## depressedalwyas:sleep_hr                    0.939474
## depressedsometimes:smokesometimes           0.632363
## depressedoften:smokesometimes               0.530101
## depressedalwyas:smokesometimes              0.989672
## depressedsometimes:smokeno                  0.114648
## depressedoften:smokeno                      0.206723
## depressedalwyas:smokeno                     0.762004
## depressedsometimes:smokemissing             0.509621
## depressedoften:smokemissing                 0.147263
## depressedalwyas:smokemissing                0.138343
## depressedsometimes:sleep_hr2                0.179908
## depressedoften:sleep_hr2                    0.530086
## depressedalwyas:sleep_hr2                   0.977551
## sleep_troublesometimes:activityNo           0.113373
## sleep_troubleoften:activityNo               0.914767
## sleep_troublealways:activityNo              0.571375
## sleep_troublesometimes:tv_hrs2~4hrs         0.992222
## sleep_troubleoften:tv_hrs2~4hrs             0.423827
## sleep_troublealways:tv_hrs2~4hrs            0.382457
## sleep_troublesometimes:tv_hrs5hrs           0.472843
## sleep_troubleoften:tv_hrs5hrs               0.187980
## sleep_troublealways:tv_hrs5hrs              0.776710
## sleep_troublesometimes:tv_hrs0hr            0.315406
## sleep_troubleoften:tv_hrs0hr                0.174305
## sleep_troublealways:tv_hrs0hr               0.107515
## sleep_troublesometimes:sleep_hr             0.431866
## sleep_troubleoften:sleep_hr                 0.941429
## sleep_troublealways:sleep_hr                0.805817
## sleep_troublesometimes:smokesometimes       0.030523 *
## sleep_troubleoften:smokesometimes           0.398364
## sleep_troublealways:smokesometimes          0.088643 .
## sleep_troublesometimes:smokeno              0.352383
## sleep_troubleoften:smokeno                  0.064565 .
## sleep_troublealways:smokeno                 0.259481
## sleep_troublesometimes:smokemissing         0.141857
## sleep_troubleoften:smokemissing             0.502100
## sleep_troublealways:smokemissing            0.148142
## sleep_troublesometimes:sleep_hr2            0.348960
## sleep_troubleoften:sleep_hr2                0.869751
## sleep_troublealways:sleep_hr2               0.652980
## activityNo:tv_hrs2~4hrs                     0.419276
## activityNo:tv_hrs5hrs                       0.933676
## activityNo:tv_hrs0hr                        0.431677
## activityNo:sleep_hr                         0.654696
## activityNo:smokesometimes                   0.783558
## activityNo:smokeno                          0.248905
```

```
## activityNo:smokemissing                   0.121592
## activityNo:sleep_hr2                        0.602806
## tv_hrs2~4hrs:sleep_hr                       0.322537
## tv_hrs5hrs:sleep_hr                         0.292871
## tv_hrs0hr:sleep_hr                          0.701988
## tv_hrs2~4hrs:smokesometimes                 0.031942 *
## tv_hrs5hrs:smokesometimes                   0.111102
## tv_hrs0hr:smokesometimes                    0.849782
## tv_hrs2~4hrs:smokeno                        0.662709
## tv_hrs5hrs:smokeno                          0.298489
## tv_hrs0hr:smokeno                           0.770768
## tv_hrs2~4hrs:smokemissing                   0.289010
## tv_hrs5hrs:smokemissing                     0.633418
## tv_hrs0hr:smokemissing                      0.055181 .
## tv_hrs2~4hrs:sleep_hr2                      0.213084
## tv_hrs5hrs:sleep_hr2                        0.269944
## tv_hrs0hr:sleep_hr2                         0.651151
## sleep_hr:smokesometimes                     0.176710
## sleep_hr:smokeno                            0.577056
## sleep_hr:smokemissing                       0.514608
## sleep_hr:sleep_hr2                          0.779986
## smokesometimes:sleep_hr2                    0.244555
## smokeno:sleep_hr2                           0.355945
## smokemissing:sleep_hr2                      0.343005
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06161 on 2142 degrees of freedom
## Multiple R-squared:  0.4159, Adjusted R-squared:  0.177
## F-statistic: 1.741 on 876 and 2142 DF,  p-value: < 2.2e-16
```

```
check_assumptions(model_interact)
```

Histogram of resid(model)

```
#forward selection from intercept only model to full model
model1b = step(lm(log2.bmi ~ 1, data = df_adult), scope = list(upper = model_interact), direction =
summary(model1b)
```

```
##
## Call:
## lm(formula = log2.bmi ~ race + tv_hrs + smoke + depressed + famincome +
##     milk + gender + marriage + log.eatout + sleep_hr + sleep_hr2 +
##     alcoholfrq + activity + meals_fastfood + famincome:gender +
##     smoke:gender + race:gender + smoke:marriage + depressed:famincome +
##     race:activity + depressed:milk + log.eatout:sleep_hr + race:meals_fastfood +
##     gender:meals_fastfood + tv_hrs:log.eatout + smoke:sleep_hr2 +
##     sleep_hr:alcoholfrq, data = df_adult)
##
## Residuals:
##       Min       1Q   Median       3Q      Max
## -0.205795 -0.041846 -0.003011  0.037880  0.220772
##
## Coefficients: (2 not defined because of singularities)
##                               Estimate Std. Error t value
## (Intercept)                   1.181e+00  2.579e-02  45.780
## raceother hispanic           -4.830e-03  1.041e-02  -0.464
## racewhite                    -9.149e-03  7.820e-03  -1.170
## raceblack                     1.071e-02  8.847e-03   1.210
## raceasian                    -2.414e-02  1.012e-02  -2.385
## raceother                     1.723e-02  1.555e-02   1.108
## tv_hrs2~4hrs                  2.381e-02  8.978e-03   2.651
## tv_hrs5hrs                    1.770e-02  1.083e-02   1.634
## tv_hrs0hr                     3.096e-02  2.607e-02   1.187
## smokesometimes                8.478e-03  1.834e-02   0.462
## smokeno                       1.592e-02  1.007e-02   1.582
## smokemissing                  2.636e-02  9.251e-03   2.850
## depressedsometimes           -2.547e-03  9.395e-03  -0.271
## depressedoften                4.563e-02  1.637e-02   2.788
## depressedalwyas               6.382e-03  1.679e-02   0.380
## famincome25k~55k              1.422e-02  4.705e-03   3.023
```

```
## famincome55k~75k                             1.054e-02  5.956e-03   1.770
## famincome75k~100k                            9.156e-03  6.363e-03   1.439
## famincomeabove 100k                          5.474e-03  5.259e-03   1.041
## milkrare                                     4.697e-03  4.467e-03   1.051
## milksometimes                                8.685e-03  3.986e-03   2.179
## milkoften                                    6.161e-04  3.944e-03   0.156
## milkvaried                                   5.552e-02  2.249e-02   2.468
## genderfemale                                 4.079e-02  9.876e-03   4.130
## marriagewidowed                             -2.387e-02  1.893e-02  -1.261
## marriagedivorced                             1.164e-02  7.602e-03   1.531
## marriagenever_married                       -8.838e-05  6.966e-03  -0.013
## log.eatout                                   1.139e-02  3.928e-03   2.899
## sleep_hr                                     -1.311e-02  5.552e-03  -2.362
## sleep_hr2                                     9.380e-04  3.901e-04   2.404
## alcoholfrq                                   -1.335e-03  7.539e-04  -1.771
## activityNo                                    1.774e-02  6.912e-03   2.566
## meals_fastfood                               7.518e-04  1.221e-03   0.616
## famincome25k~55k:genderfemale               -5.432e-03  6.295e-03  -0.863
## famincome55k~75k:genderfemale               -8.968e-03  8.379e-03  -1.070
## famincome75k~100k:genderfemale              -1.089e-02  8.879e-03  -1.227
## famincomeabove 100k:genderfemale            -2.482e-02  7.073e-03  -3.509
## smokesometimes:genderfemale                 -6.341e-03  1.322e-02  -0.480
## smokeno:genderfemale                        -9.130e-03  7.543e-03  -1.210
## smokemissing:genderfemale                   -2.817e-02  6.943e-03  -4.058
## raceother hispanic:genderfemale             -1.897e-02  1.068e-02  -1.777
## racewhite:genderfemale                      -1.366e-02  7.741e-03  -1.765
## raceblack:genderfemale                       6.910e-03  8.741e-03   0.791
## raceasian:genderfemale                      -2.960e-02  1.080e-02  -2.740
## raceother:genderfemale                      -1.970e-02  1.568e-02  -1.257
## smokesometimes:marriagewidowed               2.704e-02  3.567e-02   0.758
## smokeno:marriagewidowed                     -3.316e-03  2.064e-02  -0.161
## smokemissing:marriagewidowed                 3.108e-02  2.029e-02   1.532
## smokesometimes:marriagedivorced              1.508e-02  1.809e-02   0.833
## smokeno:marriagedivorced                    -1.111e-02  9.777e-03  -1.136
## smokemissing:marriagedivorced               -1.725e-02  9.117e-03  -1.892
## smokesometimes:marriagenever_married         2.629e-02  1.483e-02   1.773
## smokeno:marriagenever_married                2.178e-03  1.014e-02   0.215
## smokemissing:marriagenever_married          -1.975e-02  8.046e-03  -2.454
## depressedsometimes:famincome25k~55k         -1.015e-02  7.862e-03  -1.291
## depressedoften:famincome25k~55k             -3.394e-02  1.495e-02  -2.270
## depressedalwyas:famincome25k~55k            -3.297e-02  1.508e-02  -2.186
## depressedsometimes:famincome55k~75k         -1.162e-02  1.063e-02  -1.093
## depressedoften:famincome55k~75k             -4.636e-02  2.642e-02  -1.755
## depressedalwyas:famincome55k~75k             3.762e-03  2.505e-02   0.150
## depressedsometimes:famincome75k~100k        -9.002e-03  1.140e-02  -0.789
## depressedoften:famincome75k~100k            -1.235e-02  3.802e-02  -0.325
## depressedalwyas:famincome75k~100k            1.256e-02  3.393e-02   0.370
## depressedsometimes:famincomeabove 100k       5.778e-03  1.016e-02   0.569
```

```
## depressedoften:famincomeabove 100k     -8.046e-02  2.059e-02  -3.908
## depressedalwyas:famincomeabove 100k    -6.478e-02  3.345e-02  -1.936
## raceother hispanic:activityNo          -1.106e-02  1.061e-02  -1.042
## racewhite:activityNo                   -7.378e-03  7.662e-03  -0.963
## raceblack:activityNo                   -2.189e-02  8.801e-03  -2.487
## raceasian:activityNo                   -2.944e-02  1.058e-02  -2.783
## raceother:activityNo                   -1.418e-02  1.509e-02  -0.940
## depressedsometimes:milkrare             1.752e-02  1.047e-02   1.673
## depressedoften:milkrare                -1.224e-02  2.048e-02  -0.598
## depressedalwyas:milkrare                4.007e-02  2.127e-02   1.883
## depressedsometimes:milksometimes        4.762e-03  9.620e-03   0.495
## depressedoften:milksometimes            6.972e-03  1.903e-02   0.366
## depressedalwyas:milksometimes          -1.667e-02  1.947e-02  -0.857
## depressedsometimes:milkoften            1.101e-02  9.387e-03   1.173
## depressedoften:milkoften                1.321e-02  1.755e-02   0.753
## depressedalwyas:milkoften               4.218e-02  1.879e-02   2.245
## depressedsometimes:milkvaried           8.769e-02  6.745e-02   1.300
## depressedoften:milkvaried                      NA         NA      NA
## depressedalwyas:milkvaried                     NA         NA      NA
## log.eatout:sleep_hr                    -1.104e-03  5.378e-04  -2.052
## raceother hispanic:meals_fastfood       2.160e-05  1.874e-03   0.012
## racewhite:meals_fastfood                5.867e-04  1.345e-03   0.436
## raceblack:meals_fastfood               -3.041e-03  1.451e-03  -2.095
## raceasian:meals_fastfood               -1.821e-03  2.511e-03  -0.725
## raceother:meals_fastfood               -4.114e-03  2.446e-03  -1.682
## genderfemale:meals_fastfood             2.242e-03  9.140e-04   2.453
## tv_hrs2~4hrs:log.eatout                -2.064e-03  1.842e-03  -1.121
## tv_hrs5hrs:log.eatout                   2.802e-03  2.338e-03   1.199
## tv_hrs0hr:log.eatout                   -4.828e-03  5.690e-03  -0.848
## smokesometimes:sleep_hr2               -1.686e-04  3.229e-04  -0.522
## smokeno:sleep_hr2                       3.749e-04  1.757e-04   2.133
## smokemissing:sleep_hr2                  2.340e-04  1.620e-04   1.445
## sleep_hr:alcoholfrq                     1.597e-04  1.028e-04   1.554
##                                        Pr(>|t|)
## (Intercept)                            < 2e-16 ***
## raceother hispanic                     0.642852
## racewhite                              0.242127
## raceblack                              0.226198
## raceasian                              0.017143 *
## raceother                              0.267755
## tv_hrs2~4hrs                           0.008057 **
## tv_hrs5hrs                             0.102281
## tv_hrs0hr                              0.235145
## smokesometimes                         0.644006
## smokeno                                0.113820
## smokemissing                           0.004406 **
## depressedsometimes                     0.786353
## depressedoften                         0.005344 **
```

```
## depressedalwyas                          0.703871
## famincome25k~55k                         0.002522 **
## famincome55k~75k                         0.076873 .
## famincome75k~100k                        0.150265
## famincomeabove 100k                      0.298077
## milkrare                                 0.293172
## milksometimes                            0.029408 *
## milkoften                                0.875866
## milkvaried                               0.013635 *
## genderfemale                             3.72e-05 ***
## marriagewidowed                          0.207526
## marriagedivorced                         0.126000
## marriagenever_married                    0.989879
## log.eatout                               0.003769 **
## sleep_hr                                 0.018235 *
## sleep_hr2                                0.016271 *
## alcoholfrq                               0.076659 .
## activityNo                               0.010334 *
## meals_fastfood                           0.537979
## famincome25k~55k:genderfemale            0.388264
## famincome55k~75k:genderfemale            0.284603
## famincome75k~100k:genderfemale           0.220041
## famincomeabove 100k:genderfemale         0.000457 ***
## smokesometimes:genderfemale              0.631571
## smokeno:genderfemale                     0.226194
## smokemissing:genderfemale                5.09e-05 ***
## raceother hispanic:genderfemale          0.075700 .
## racewhite:genderfemale                   0.077741 .
## raceblack:genderfemale                   0.429280
## raceasian:genderfemale                   0.006185 **
## raceother:genderfemale                   0.209009
## smokesometimes:marriagewidowed           0.448441
## smokeno:marriagewidowed                  0.872350
## smokemissing:marriagewidowed             0.125611
## smokesometimes:marriagedivorced          0.404661
## smokeno:marriagedivorced                 0.256082
## smokemissing:marriagedivorced            0.058570 .
## smokesometimes:marriagenever_married     0.076296 .
## smokeno:marriagenever_married            0.829966
## smokemissing:marriagenever_married       0.014170 *
## depressedsometimes:famincome25k~55k      0.196817
## depressedoften:famincome25k~55k          0.023252 *
## depressedalwyas:famincome25k~55k         0.028873 *
## depressedsometimes:famincome55k~75k      0.274388
## depressedoften:famincome55k~75k          0.079371 .
## depressedalwyas:famincome55k~75k         0.880638
## depressedsometimes:famincome75k~100k     0.430001
## depressedoften:famincome75k~100k         0.745355
```

```
## depressedalwyas:famincome75k~100k        0.711312
## depressedsometimes:famincomeabove 100k   0.569640
## depressedoften:famincomeabove 100k       9.51e-05 ***
## depressedalwyas:famincomeabove 100k      0.052909 .
## raceother hispanic:activityNo            0.297324
## racewhite:activityNo                     0.335638
## raceblack:activityNo                     0.012946 *
## raceasian:activityNo                     0.005420 **
## raceother:activityNo                     0.347173
## depressedsometimes:milkrare              0.094343 .
## depressedoften:milkrare                  0.550172
## depressedalwyas:milkrare                 0.059747 .
## depressedsometimes:milksometimes         0.620660
## depressedoften:milksometimes             0.714120
## depressedalwyas:milksometimes            0.391773
## depressedsometimes:milkoften             0.241049
## depressedoften:milkoften                 0.451587
## depressedalwyas:milkoften                0.024843 *
## depressedsometimes:milkvaried            0.193724
## depressedoften:milkvaried                      NA
## depressedalwyas:milkvaried                     NA
## log.eatout:sleep_hr                      0.040219 *
## raceother hispanic:meals_fastfood        0.990804
## racewhite:meals_fastfood                 0.662722
## raceblack:meals_fastfood                 0.036215 *
## raceasian:meals_fastfood                 0.468549
## raceother:meals_fastfood                 0.092693 .
## genderfemale:meals_fastfood              0.014214 *
## tv_hrs2~4hrs:log.eatout                  0.262461
## tv_hrs5hrs:log.eatout                    0.230819
## tv_hrs0hr:log.eatout                     0.396246
## smokesometimes:sleep_hr2                 0.601668
## smokeno:sleep_hr2                        0.032973 *
## smokemissing:sleep_hr2                   0.148690
## sleep_hr:alcoholfrq                      0.120237
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06254 on 2924 degrees of freedom
## Multiple R-squared:  0.1785, Adjusted R-squared:  0.1521
## F-statistic: 6.759 on 94 and 2924 DF,  p-value: < 2.2e-16
```
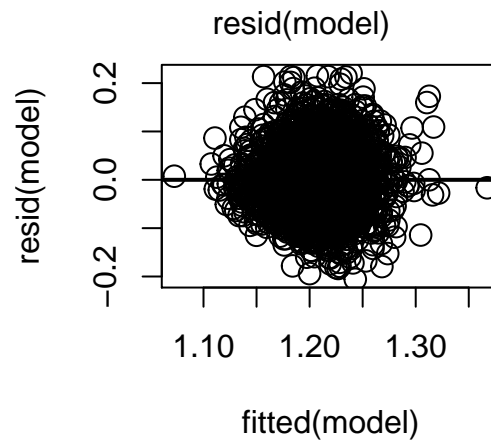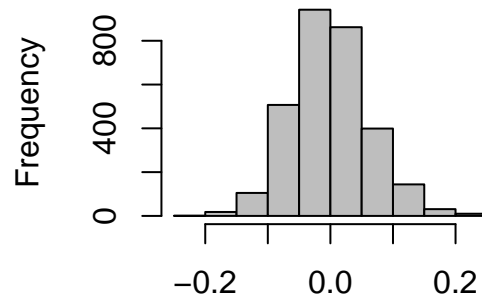
extractAIC(model1b)

```
## [1]     95.00 -16643.65
```

check_assumptions(model1b)

Histogram of resid(model)


```r
# Based on model1, add interaction terms between famsize and (famincome, log.grocery, log.eatout an
model2 = lm(log2.bmi~gender+age+race+edu+marriage+famsize+famincome+alcohol12yr+alcoholfrq+log.groc
summary(model2)
```

```
##
## Call:
## lm(formula = log2.bmi ~ gender + age + race + edu + marriage +
##     famsize + famincome + alcohol12yr + alcoholfrq + log.grocery +
##     log.eatout + log.delivery + milk + meals_nothome + meals_fastfood +
##     depressed + sleep_trouble + activity + tv_hrs + sleep_hr +
##     smoke + famsize * famincome + famsize * log.grocery + famsize *
##     log.eatout + famsize * log.delivery, data = df_adult)
##
## Residuals:
##       Min       1Q    Median       3Q      Max
## -0.211893 -0.043268 -0.001846  0.038872  0.254186
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)           1.168e+00  1.754e-02  66.599  < 2e-16 ***
## genderfemale          6.975e-03  2.533e-03   2.754 0.005923 **
## age                   9.801e-05  9.040e-05   1.084 0.278362
## raceother hispanic   -2.004e-02  5.414e-03  -3.701 0.000218 ***
```

```
## racewhite                     -1.811e-02  4.121e-03  -4.395 1.15e-05 ***
## raceblack                     -6.064e-03  4.611e-03  -1.315 0.188617
## raceasian                     -5.573e-02  5.636e-03  -9.888  < 2e-16 ***
## raceother                     -1.362e-02  7.686e-03  -1.773 0.076385 .
## eduhs                          5.458e-03  4.071e-03   1.341 0.180059
## eduabove hs                    8.642e-03  3.820e-03   2.262 0.023759 *
## marriagewidowed               -9.652e-03  5.853e-03  -1.649 0.099245 .
## marriagedivorced               1.766e-03  3.752e-03   0.471 0.637924
## marriagenever_married         -7.732e-03  3.607e-03  -2.144 0.032129 *
## famsize                        1.981e-03  4.434e-03   0.447 0.655126
## famincome25k~55k               1.732e-03  6.031e-03   0.287 0.774041
## famincome55k~75k              -1.041e-02  8.756e-03  -1.189 0.234440
## famincome75k~100k             -1.359e-03  9.908e-03  -0.137 0.890903
## famincomeabove 100k           -1.828e-02  8.384e-03  -2.180 0.029299 *
## alcohol12yrno                  3.356e-03  3.574e-03   0.939 0.347816
## alcoholfrq                    -1.508e-04  6.752e-05  -2.233 0.025636 *
## log.grocery                    3.344e-03  2.339e-03   1.430 0.152855
## log.eatout                    -7.499e-05  1.669e-03  -0.045 0.964162
## log.delivery                  -1.684e-03  1.295e-03  -1.301 0.193490
## milkrare                       7.940e-03  3.972e-03   1.999 0.045701 *
## milksometimes                  9.896e-03  3.575e-03   2.768 0.005680 **
## milkoften                      3.163e-03  3.527e-03   0.897 0.369850
## milkvaried                     5.516e-02  2.171e-02   2.540 0.011124 *
## meals_nothome                  1.228e-04  4.121e-04   0.298 0.765767
## meals_fastfood                 7.055e-04  5.662e-04   1.246 0.212833
## depressedsometimes             2.540e-04  3.293e-03   0.077 0.938535
## depressedoften                 2.298e-02  6.571e-03   3.497 0.000477 ***
## depressedalwyas                8.805e-03  6.976e-03   1.262 0.206931
## sleep_troublesometimes        -7.184e-05  2.973e-03  -0.024 0.980720
## sleep_troubleoften             6.570e-03  4.999e-03   1.314 0.188854
## sleep_troublealways            9.099e-03  4.590e-03   1.983 0.047511 *
## activityNo                     5.571e-03  2.442e-03   2.281 0.022600 *
## tv_hrs2~4hrs                   1.582e-02  2.838e-03   5.576 2.68e-08 ***
## tv_hrs5hrs                     2.792e-02  4.104e-03   6.802 1.24e-11 ***
## tv_hrs0hr                      1.062e-02  8.571e-03   1.239 0.215368
## sleep_hr                      -1.969e-03  8.840e-04  -2.228 0.025976 *
## smokesometimes                 7.883e-03  6.501e-03   1.213 0.225404
## smokeno                        2.321e-02  3.929e-03   5.908 3.86e-09 ***
## smokemissing                   1.649e-02  3.646e-03   4.524 6.30e-06 ***
## famsize:famincome25k~55k       1.146e-03  1.845e-03   0.621 0.534382
## famsize:famincome55k~75k       3.319e-03  2.673e-03   1.241 0.214542
## famsize:famincome75k~100k      6.130e-05  2.811e-03   0.022 0.982604
## famsize:famincomeabove 100k    1.874e-03  2.352e-03   0.797 0.425465
## famsize:log.grocery           -9.139e-04  6.745e-04  -1.355 0.175554
## famsize:log.eatout             6.752e-04  4.625e-04   1.460 0.144488
## famsize:log.delivery           3.654e-04  3.618e-04   1.010 0.312575
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```
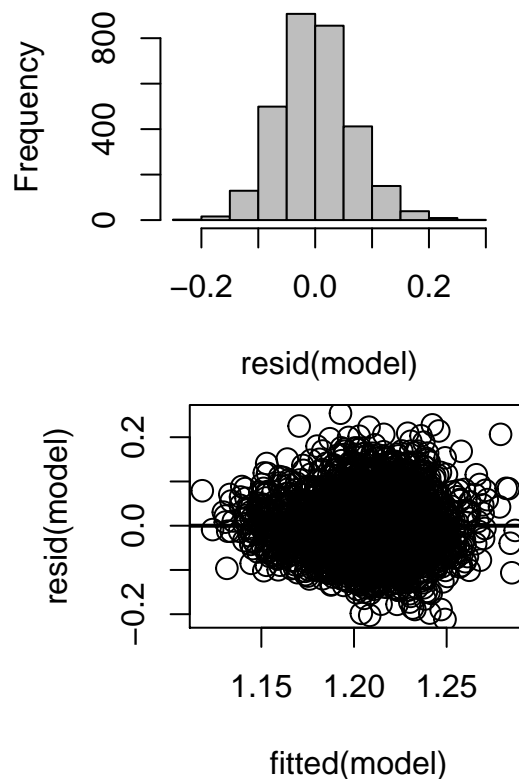
```
##
## Residual standard error: 0.06425 on 2969 degrees of freedom
## Multiple R-squared:  0.1196, Adjusted R-squared:  0.1051
## F-statistic: 8.231 on 49 and 2969 DF,  p-value: < 2.2e-16
```
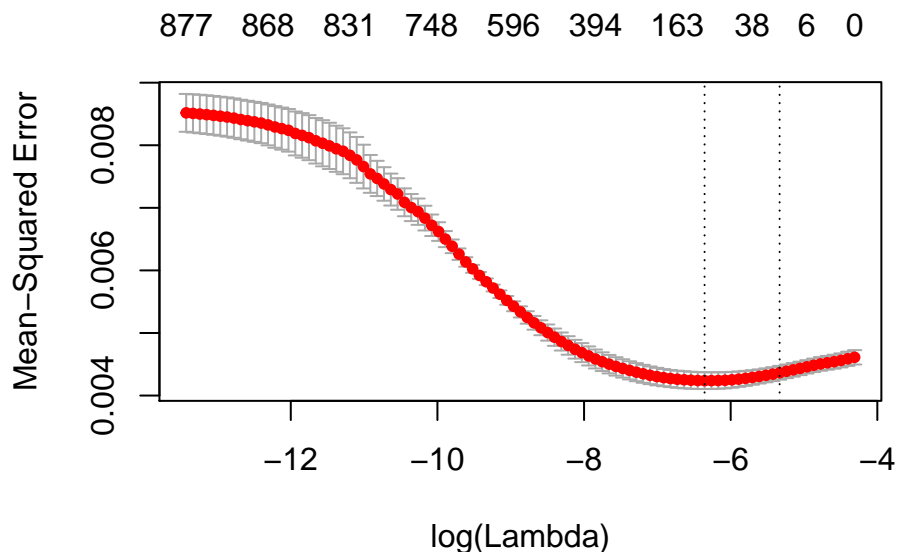
`check_assumptions`(model2)

Histogram of resid(model)

`anova`(model1, model2)

```
## Analysis of Variance Table
##
## Model 1: log2.bmi ~ gender + age + race + edu + marriage + famsize + famincome +
##     alcohol12yr + alcoholfrq + log.grocery + log.eatout + log.delivery +
##     milk + meals_nothome + meals_fastfood + depressed + sleep_trouble +
##     activity + tv_hrs + sleep_hr + smoke
## Model 2: log2.bmi ~ gender + age + race + edu + marriage + famsize + famincome +
##     alcohol12yr + alcoholfrq + log.grocery + log.eatout + log.delivery +
##     milk + meals_nothome + meals_fastfood + depressed + sleep_trouble +
##     activity + tv_hrs + sleep_hr + smoke + famsize * famincome +
##     famsize * log.grocery + famsize * log.eatout + famsize *
##     log.delivery
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1   2976 12.289
## 2   2969 12.256  7  0.032686 1.1311 0.3402
```

```
#lasso
require(glmnet)
```

Loading required package: glmnet

Warning: package 'glmnet' was built under R version 3.3.2

Loading required package: Matrix

Loading required package: foreach
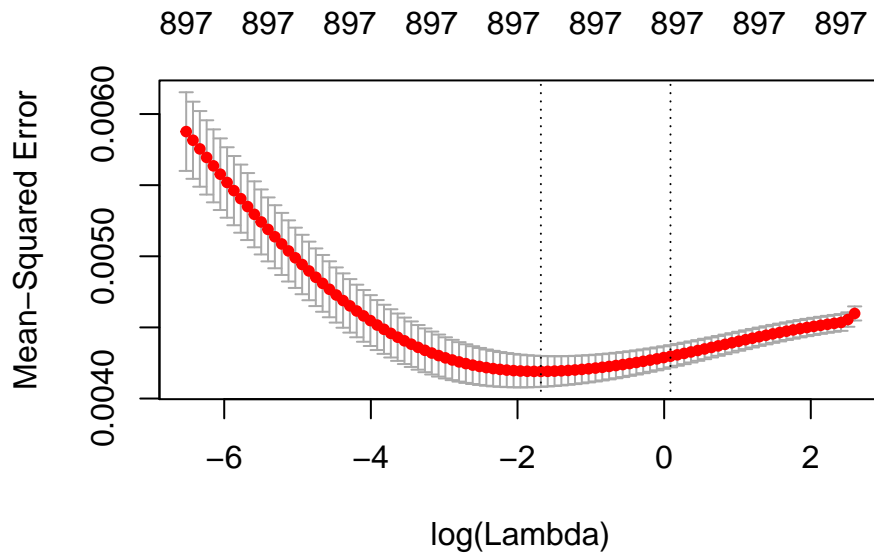
Loaded glmnet 2.0-13

```
x.lasso = model.matrix(formula(model_interact), data=df_adult)
model_lasso = cv.glmnet(x.lasso, df_adult$log2.bmi, nfolds = 5)
#plot
plot(model_lasso)
```



```
lasso.lambda.min = model_lasso$lambda.min
lasso.mse.min = min(model_lasso$cvm)

coef.lasso = coef(model_lasso, s = "lambda.min")
nonzero_coef_lasso = cbind(rownames(coef.lasso)[which(coef.lasso != 0)], coef.lasso[which(coef.lass
```
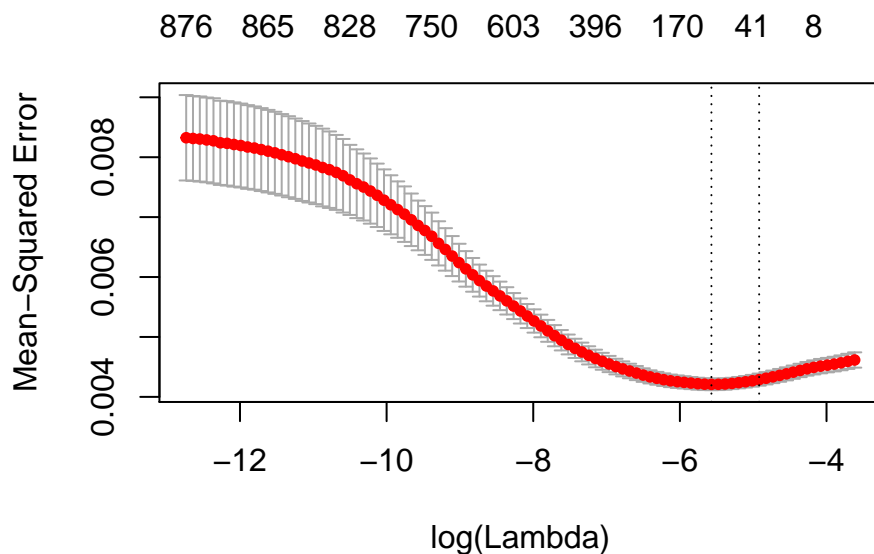
```
#ridge
x.ridge = model.matrix(formula(model_interact), data=df_adult)
model_ridge = cv.glmnet(x.ridge, df_adult$log2.bmi, alpha = 0, nfolds = 5)
#plot
plot(model_ridge)
```

```
ridge.lambda.min = model_ridge$lambda.min
ridge.mse.min = min(model_ridge$cvm)

coef.ridge = coef(model_ridge, s = "lambda.min")
nonzero_coef_ridge = cbind(rownames(coef.ridge)[which(coef.ridge != 0)], coef.ridge[which(coef.ridg
```

```
#elastic net
x.mix = model.matrix(formula(model_interact), data=df_adult)
model_mix = cv.glmnet(x.mix, df_adult$log2.bmi, alpha = 0.5, nfolds = 5)
#plot
plot(model_mix)
```



```
mix.lambda.min = model_mix$lambda.min
mix.mse.min = min(model_mix$cvm)

coef.mix = coef(model_mix, s = "lambda.min")
nonzero_coef_mix = cbind(rownames(coef.mix)[which(coef.mix != 0)], coef.mix[which(coef.mix != 0)])
```