Final Project

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Data Import

```
cancer_raw =
  read_csv("./data/Cancer_Registry.csv") %>%
  janitor::clean_names() %>%
  dplyr::select(target_death_rate, geography, everything()) %>%
  separate(geography, into = c("county", "state"), sep = ",")
```

Data varibale dictionary:

- **target_death_rate:** mean per capita (100,000) cancer mortalities (a)
- **avg_ann_count:** mean number of reported cases of cancer diagnosed annually (a)
- **avg_deaths_per_year:** mean number of reported mortalities due to cancer (a)
- **incidence_rate:** mean per capita (100,000) cancer diagnoses (a)
- **med_income:** median income per county (b)
- **pop_est2015:** population of county (b)
- **poverty_percent:** percent of population in poverty (b)
- **study_per_cap** per capita number of cancer-related clinical trials per county (a)
- **binned_inc:** median income per capita binned by decile (b)
- **median_age:** median age of county residents (b)
- **median_age_male:** median age of male county residents (b)
- **median_age_female:** median age of female county residents (b)
- **geography:** county name (b)
- **avg_household_size:** mean household size of county (b)
- **percent_married:** percent of county residents who are married (b)
- **pct_no_hs18_24:** percent of county residents ages 18-24 highest education attained: less than high school (b)
- **pct_hs18_24:** percent of county residents ages 18-24 highest education attained: high school diploma (b)
- **pct_some_col18_24:** percent of county residents ages 18-24 highest education attained: some college (b)
- **pct_bach_deg18_24:** percent of county residents ages 18-24 highest education attained: bachelor's degree (b)
- **pct_hs25_over:** percent of county residents ages 25 and over highest education attained: high school diploma (b)
- **pct_bach_deg25_over:** percent of county residents ages 25 and over highest education attained: bachelor's degree (b)
- **pct_employed16_over:** percent of county residents ages 16 and over employed (b)
- **pct_unemployed16_over:** percent of county residents ages 16 and over unemployed (b)
- **pct_private_coverage:** percent of county residents with private health coverage (b)
- **pct_private_coverage_alone:** percent of county residents with private health coverage alone (no public assistance) (b)

- **pct_emp_priv_coverage:** percent of county residents with employee-provided private health coverage (b)

- **pct_public_coverage:** percent of county residents with government-provided health coverage (b)
- **pct_public_coverage_alone:** percent of county residents with government-provided health coverage alone (b)

- **pct_white:** percent of county residents who identify as White (b)

- **pct_black:** percent of county residents who identify as Black (b)
- **pct_asian:** percent of county residents who identify as Asian (b)

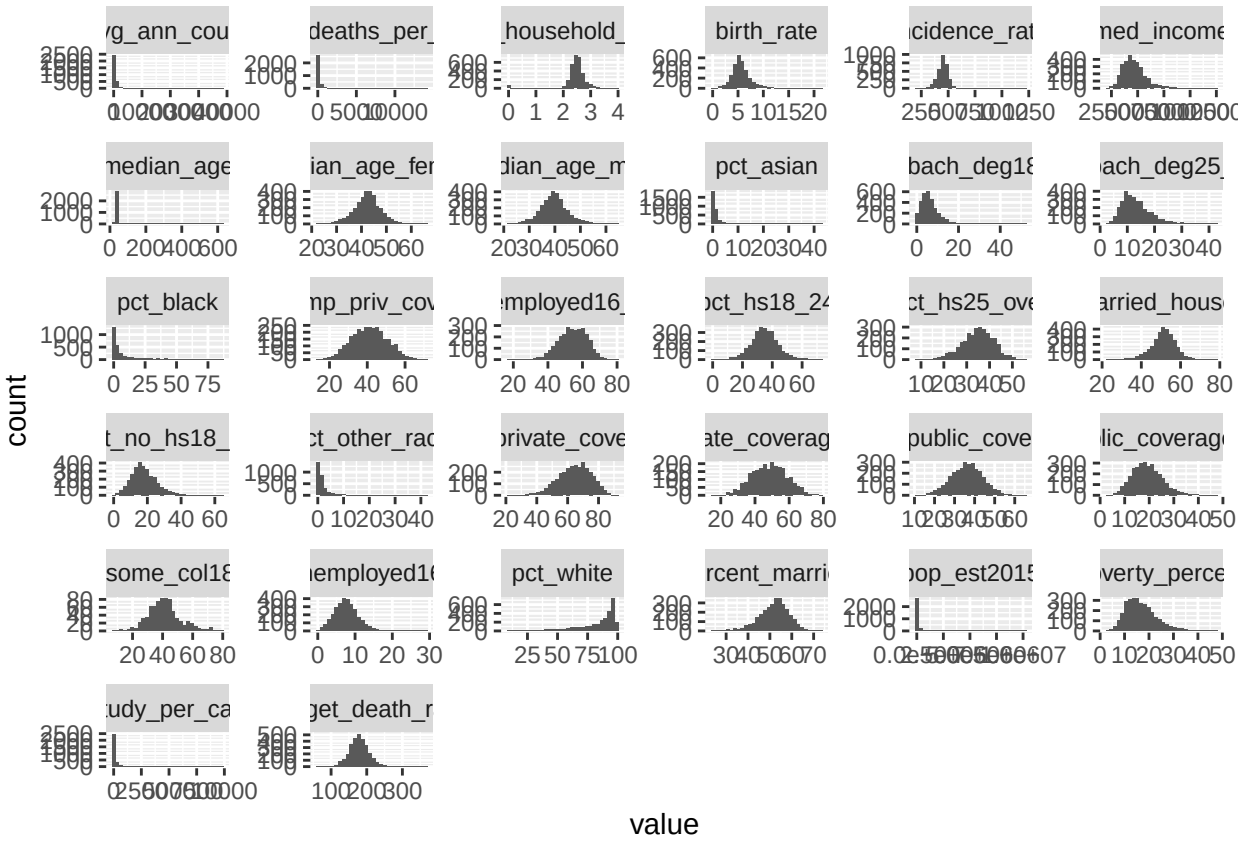
- **pct_other_race:** percent of county residents who identify in a category which is not White, Black, or Asian (b)

- **pct_married_households:** percent of married households (b)
- **birth_rate:** number of live births relative to number of women in county (b)

Look at the distribution of all varibales:

```
cancer_raw %>%
  keep(is.numeric) %>%
  gather() %>%
  ggplot(aes(value)) +
    facet_wrap(~ key, scales = "free") +
    geom_histogram(bins = 30)
```

```
## Warning: Removed 3046 rows containing non-finite values (stat_bin).
```



Choose variables:

```
cancer_county =
  cancer_raw %>%
  janitor::clean_names() %>%
  dplyr::select(target_death_rate, incidence_rate, med_income, poverty_percent, median_age:median_age_f
  dplyr::select(-pct_hs25_over, -pct_bach_deg25_over, -pct_employed16_over, -percent_married) %>%
  mutate(pct_upto_hs18_24 = pct_no_hs18_24 + pct_hs18_24,
         pct_above_hs18_24 = 100 - pct_upto_hs18_24,
         pct_with_coverage = pct_private_coverage + pct_public_coverage_alone,
         income_cat = ifelse(med_income < 35000, 0, 1)) %>%
  dplyr::select(-(pct_no_hs18_24:pct_bach_deg18_24), -pct_above_hs18_24, -(pct_private_coverage:pct_publ
```

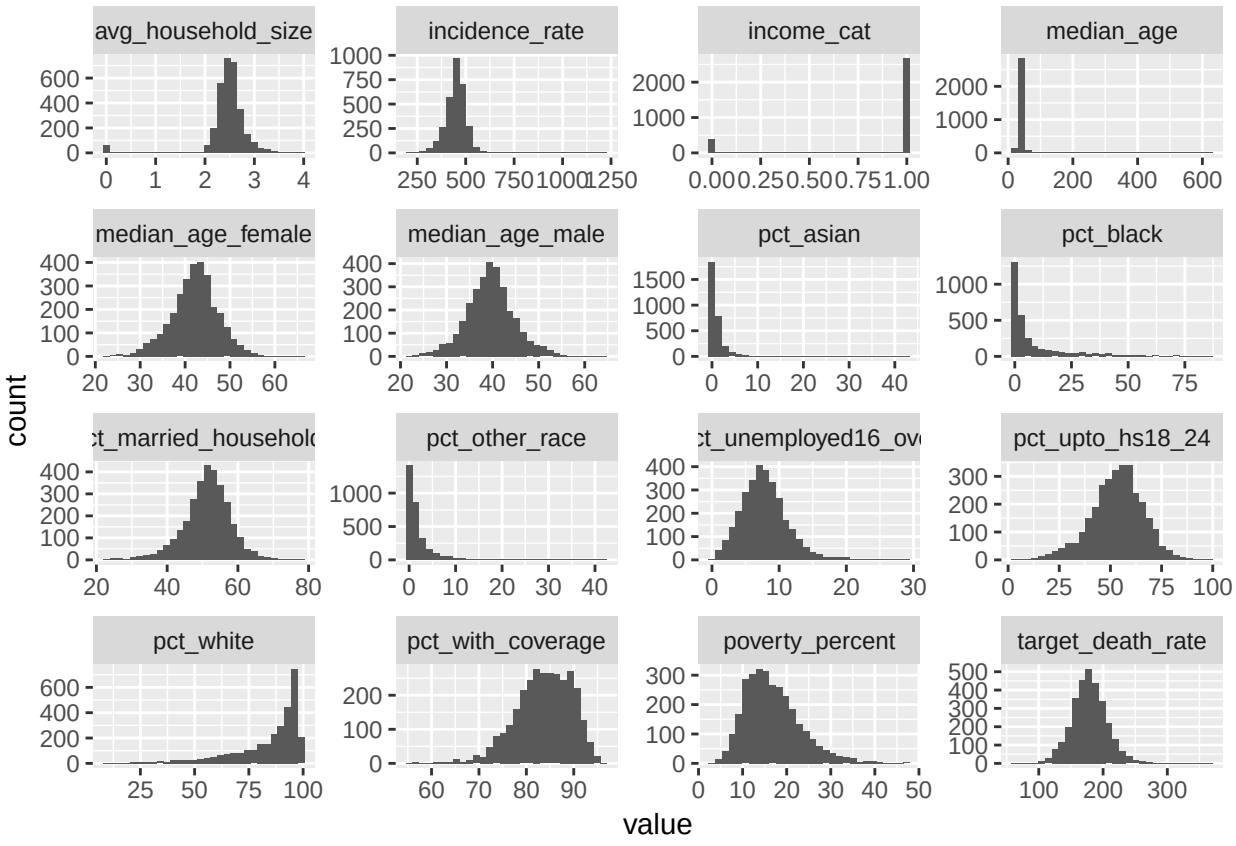
Check correlation and distribution:

```
cor(cancer_county) %>%
  knitr::kable()
```

	target_death_rate	incidence_rate	poverty_percent	median_age	median_age_male	m
target_death_rate	1.0000000	0.4494317	0.4293890	0.0043751	-0.0219294	
incidence_rate	0.4494317	1.0000000	0.0090463	0.0180892	-0.0147332	
poverty_percent	0.4293890	0.0090463	1.0000000	-0.0292800	-0.2140010	
median_age	0.0043751	0.0180892	-0.0292800	1.0000000	0.1291195	

	target_death_rate	incidence_rate	poverty_percent	median_age	median_age_male	n
median_age_male	-0.0219294	-0.0147332	-0.2140010	0.1291195	1.0000000	
median_age_female	0.0120484	-0.0091056	-0.1481635	0.1246784	0.9336961	
avg_household_size	-0.0369053	-0.1184000	0.0743076	-0.0319441	-0.3431887	
pct_unemployed16_over	0.3784124	0.0999795	0.6551481	0.0185904	-0.1427375	
pct_white	-0.1774000	-0.0145098	-0.5094328	0.0350094	0.3980444	
pct_black	0.2570236	0.1134890	0.5115297	-0.0171732	-0.2427481	
pct_asian	-0.1863311	-0.0081234	-0.1572887	-0.0384239	-0.2383224	
pct_other_race	-0.1898936	-0.2087483	0.0470959	-0.0302765	-0.2666554	
pct_married_households	-0.2933253	-0.1521763	-0.6049528	0.0145036	0.2222777	
pct_upto_hs18_24	0.2443042	-0.0929669	0.2517431	0.0401926	0.2371826	
pct_with_coverage	-0.2292798	0.2302489	-0.6516658	0.0049621	0.1497702	
income_cat	-0.3030288	0.0110839	-0.6344122	0.0103377	0.0266055	

```
cancer_county %>%
  gather() %>%
  ggplot(aes(value)) +
  facet_wrap(~ key, scales = "free") +
  geom_histogram(bins = 30)
```



The discriptive statistics:

```
state_summary = function(x){
  mean = mean(x)
```

```
  max = max(x)
  min = min(x)
  median = median(x)
  var = var(x)
  sd = sd(x)
  sample_size = length(x) - sum(is.na(x))
  tibble(mean, max, min, median, var, sd, sample_size)
}

#cancer_county %>% dplyr::select(-income_cat) %>% gather() %>% group_by(key) %>% nest() %>% mutate(summ

df_target_death_rate = state_summary(cancer_county$target_death_rate)
df_incidence_rate = state_summary(cancer_county$incidence_rate)
df_poverty_percent = state_summary(cancer_county$poverty_percent)
df_median_age = state_summary(cancer_county$median_age)
df_median_agemale = state_summary(cancer_county$median_age_male)
df_median_agefemale = state_summary(cancer_county$median_age_female)
df_avg_household_size = state_summary(cancer_county$avg_household_size)
df_pct_unemployed16_over = state_summary(cancer_county$pct_unemployed16_over)
df_pct_white = state_summary(cancer_county$pct_white)
df_pct_black = state_summary(cancer_county$pct_black)
df_pct_asian = state_summary(cancer_county$pct_asian)
df_pct_other_race = state_summary(cancer_county$pct_other_race)
df_pct_married_households = state_summary(cancer_county$pct_married_households)
df_pct_upto_hs18_24 = state_summary(cancer_county$pct_upto_hs18_24)
df_pct_with_coverage = state_summary(cancer_county$pct_with_coverage)

state_des <- bind_rows(df_target_death_rate,
                       df_incidence_rate,
                       df_poverty_percent,
                       df_median_age,
                       df_median_agemale,
                       df_median_agefemale,
                       df_avg_household_size,
                       df_pct_unemployed16_over,
                       df_pct_white,
                       df_pct_black,
                       df_pct_asian,
                       df_pct_other_race,
                       df_pct_married_households,
                       df_pct_upto_hs18_24,
                       df_pct_with_coverage)
variable = c("target_death_rate", "incidence_rate","poverty_percent", "median_age", "median_agemale", "

state_wholedes = cbind(variable, state_des)

knitr::kable(state_wholedes)
```

variable	mean	max	min	median	var	sd	sample_size
target_death_rate	178.664063	362.80000	59.70000	178.1000000	770.1463805	27.7515113	3047
incidence_rate	448.268586	1206.90000	201.30000	453.5494221	2976.8735549	54.5607327	3047
poverty_percent	16.878175	47.40000	3.20000	15.9000000	41.0763948	6.4090869	3047
median_age	45.272333	624.00000	22.30000	41.0000000	2052.4959218	45.3044802	3047

variable	mean	max	min	median	var	sd	sample_size
median_agemale	39.570725	64.70000	22.40000	39.6000000	27.3112504	5.2260167	3047
median_agefemale	42.145323	65.70000	22.30000	42.4000000	28.0142518	5.2928491	3047
avg_household_size	2.479662	3.97000	0.02210	2.5000000	0.1841906	0.4291744	3047
pct_unemployed16_over	7.852412	29.40000	0.40000	7.6000000	11.9188640	3.4523708	3047
pct_white	83.645286	100.00000	10.19916	90.0597742	268.3052265	16.3800252	3047
pct_black	9.107978	85.94780	0.00000	2.2475763	211.2527926	14.5345379	3047
pct_asian	1.253965	42.61942	0.00000	0.5498117	6.8135428	2.6102764	3047
pct_other_race	1.983523	41.93025	0.00000	0.8261852	12.3742846	3.5177101	3047
pct_married_households	51.243872	78.07540	22.99249	51.6699411	43.2018812	6.5728138	3047
pct_upto_hs18_24	53.226518	100.00000	4.80000	53.9000000	160.1814371	12.6562805	3047
pct_with_coverage	83.595011	95.70000	54.60000	84.0000000	35.3664623	5.9469709	3047

Model building:

Stepwise:

```
# building full model
full_model <- lm(target_death_rate ~., data = cancer_county)
summary(full_model)
```

```
##
## Call:
## lm(formula = target_death_rate ~ ., data = cancer_county)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -129.883  -11.469    0.163   12.142  126.523
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             72.058821  12.583888   5.726 1.13e-08 ***
## incidence_rate           0.219657   0.007547  29.104  < 2e-16 ***
## poverty_percent          1.036531   0.120008   8.637  < 2e-16 ***
## median_age              -0.004080   0.008394  -0.486 0.626969
## median_age_male         -0.241798   0.212259  -1.139 0.254726
## median_age_female        0.046110   0.209093   0.221 0.825476
## avg_household_size      -0.117704   1.007617  -0.117 0.907015
## pct_unemployed16_over    0.781391   0.153410   5.093 3.73e-07 ***
## pct_white                0.067342   0.058298   1.155 0.248127
## pct_black               -0.016016   0.057020  -0.281 0.778818
## pct_asian               -0.628303   0.178918  -3.512 0.000452 ***
## pct_other_race          -0.940645   0.124524  -7.554 5.56e-14 ***
## pct_married_households -0.220555   0.088361  -2.496 0.012611 *
## pct_upto_hs18_24         0.392918   0.038241  10.275  < 2e-16 ***
## pct_with_coverage       -0.194259   0.101672  -1.911 0.056145 .
## income_cat              -4.104213   1.507502  -2.723 0.006516 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 20.77 on 3031 degrees of freedom
## Multiple R-squared:  0.4427, Adjusted R-squared:  0.4399
## F-statistic: 160.5 on 15 and 3031 DF,  p-value: < 2.2e-16
```

```r
# Using the stepwise
stepwise_model = stepAIC(full_model, direction = "both", trace = FALSE)
summary(stepwise_model)
```

```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_white + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage + income_cat, data = cancer_county)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -129.978  -11.453    0.127   12.095  126.386
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             70.812109  11.698781   6.053 1.60e-09 ***
## incidence_rate           0.219430   0.007509  29.223  < 2e-16 ***
## poverty_percent          1.038613   0.119140   8.718  < 2e-16 ***
## median_age_male         -0.202308   0.086539  -2.338 0.019465 *
## pct_unemployed16_over    0.774783   0.152081   5.095 3.71e-07 ***
## pct_white                0.080440   0.034847   2.308 0.021043 *
## pct_asian               -0.613378   0.167491  -3.662 0.000254 ***
## pct_other_race          -0.933301   0.119239  -7.827 6.84e-15 ***
## pct_married_households -0.222728   0.086039  -2.589 0.009680 **
## pct_upto_hs18_24         0.394452   0.037753  10.448  < 2e-16 ***
## pct_with_coverage       -0.194337   0.099299  -1.957 0.050430 .
## income_cat              -4.069227   1.500008  -2.713 0.006709 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 20.76 on 3035 degrees of freedom
## Multiple R-squared:  0.4426, Adjusted R-squared:  0.4406
## F-statistic: 219.1 on 11 and 3035 DF,  p-value: < 2.2e-16
```

```r
vif(stepwise_model)
```

```
##         incidence_rate        poverty_percent        median_age_male
##               1.186642               4.122196               1.446080
##  pct_unemployed16_over             pct_white             pct_asian
##               1.948976               2.303407               1.351383
##         pct_other_race pct_married_households       pct_upto_hs18_24
##               1.243892               2.261059               1.614089
##      pct_with_coverage             income_cat
##               2.465515               1.729209
```

```r
# Cp and AIC and Adjusted R2
model_dig = glance(stepwise_model) %>%
  as.data.frame() %>%
  dplyr::select(adj.r.squared, sigma, p.value, AIC, BIC) %>%
  rename(RES = sigma) %>%
  mutate(cp = ols_mallows_cp(stepwise_model, full_model))

model_dig
```

```
##   adj.r.squared      RES p.value      AIC      BIC      cp
## 1     0.4405848 20.75648       0 27143.23 27221.51 8.35992
```

Cross validation and Criterion method summery

```
cross_df = crossv_mc(cancer_county, n = 100, test = 0.2)

cross_result =
  cross_df %>%
  mutate(
    step_mod = map(train, ~lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_white + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage + income_cat, data = .x)),
    rmse_train = map2_dbl(step_mod, train, ~rmse(model = .x, data = .y)),
    rmse_test = map2_dbl(step_mod, test, ~rmse(model = .x, data = .y))
    )


mse_results = cross_result %>%
  dplyr::select(rmse_train, rmse_test) %>%
  summarize(mse_train = (mean(rmse_train))^2,
            mse_test = (mean(rmse_test))^2) #mse results

#LOOCV
glm.fit = glm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_white + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage + income_cat, data = cancer_county)

cv.err = cv.glm(cancer_county, glm.fit)

# The two delta values should be similar: we use the first one
# The second value is bias corrected
cv.err$delta   #434.8355
```

```
## [1] 434.8355 434.8346
```

```
anova(stepwise_model)[12, 3] #MSE: 431
```

```
## [1] 430.8316
```

```
tibble(
  mse_model = anova(stepwise_model)[12, 3],
  mse_LOOCV = cv.err$delta[1],
  mse_CV_train = mse_results$mse_train,
  mse_CV_test = mse_results$mse_test
)
```

```
## # A tibble: 1 x 4
##   mse_model mse_LOOCV mse_CV_train mse_CV_test
##       <dbl>     <dbl>        <dbl>       <dbl>
## 1      431.      435.         430.        429.
```

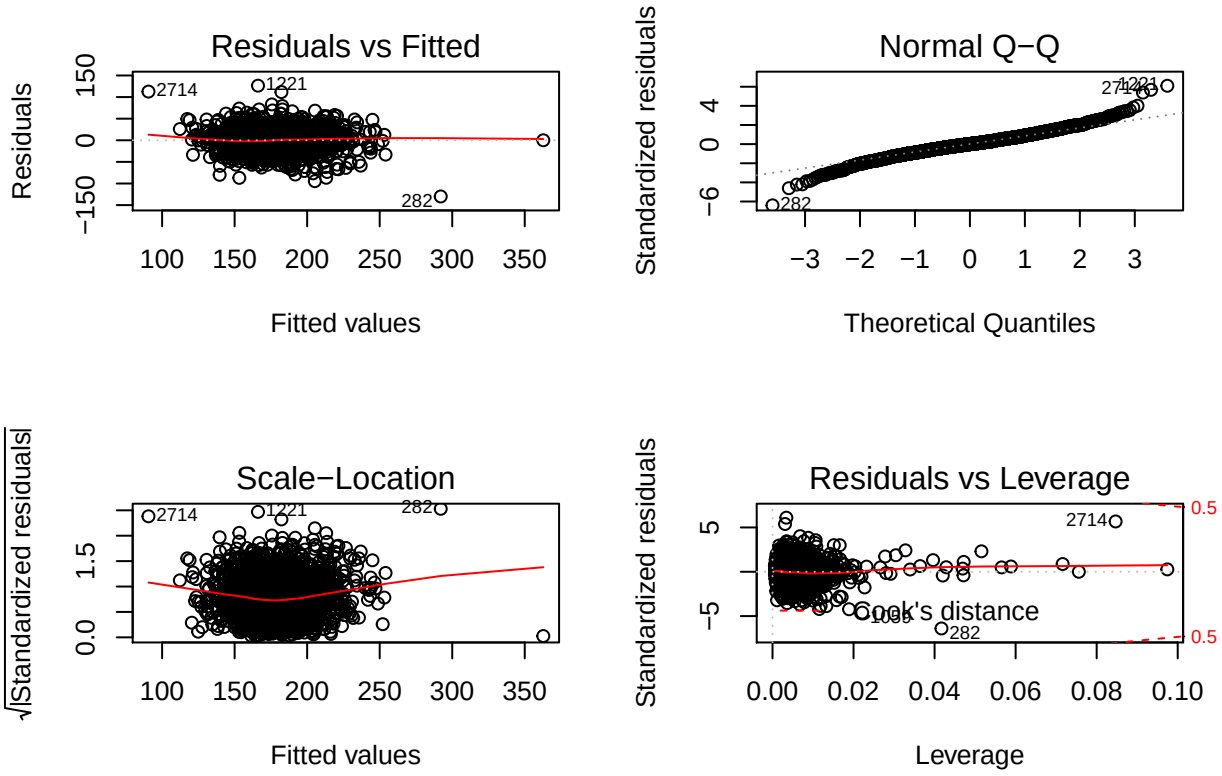
Bootstrap

```
cancer_county %>%
  modelr::bootstrap(n = 1000) %>%
  mutate(models = map(strap, ~lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_white + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage + income_cat, data = .x)),
         results = map(models, broom::tidy)) %>%
  dplyr::select(-strap, -models) %>%
  unnest() %>%
  group_by(term) %>%
  summarize(boot_se = sd(estimate))
```

```
## # A tibble: 12 x 2
##    term                   boot_se
##    <chr>                    <dbl>
##  1 (Intercept)            15.3
##  2 incidence_rate          0.0124
##  3 income_cat              1.72
##  4 median_age_male         0.0963
##  5 pct_asian               0.268
##  6 pct_married_households  0.101
##  7 pct_other_race          0.151
##  8 pct_unemployed16_over   0.190
##  9 pct_upto_hs18_24        0.0430
## 10 pct_white               0.0411
## 11 pct_with_coverage       0.124
## 12 poverty_percent         0.143
```

Outliers

```
par(mfrow = c(2,2))
plot(stepwise_model) # we observe the 282, 1059 are outliers
```




```
# Using the studentized residuals
stu_res_step <- rstandard(stepwise_model)
outliers_y_step = stu_res_step[abs(stu_res_step) > 2.5]
outliers_y_step
```

```
##       116       119       120       122       124       166       189
##  3.832977 -2.987984 -2.938723  3.451322 -3.218087  3.004467 -2.722478
##       209       250       254       256       264       282       522
##  2.634644  2.588483  3.557345 -2.852694 -3.008080 -6.396845  2.942781
##       524       621       627       666       775       783       803
##  2.568705 -2.758364  3.045997  2.920921  3.334436 -2.537021 -2.663472
##       812       845       912       921       979      1048      1058
## -3.536931 -3.028088 -3.843379 -3.048353  2.507593 -2.742014 -2.740598
##      1059      1066      1076      1094      1217      1221      1261
## -4.608218 -2.851923  2.589435 -3.878191  2.599136  6.099415  3.086750
##      1310      1331      1345      1366      1429      1497      1797
##  2.535483 -2.754403 -2.677687  5.386441 -3.247185  4.014689 -2.821788
##      1868      1942      1958      1965      2016      2036      2066
## -2.751254 -4.227918  3.000271 -2.799419  2.516370  2.505926 -3.205862
##      2174      2176      2318      2323      2444      2549      2563
##  2.961474  2.732626 -3.324763 -2.721648 -3.437022  2.598223  2.685328
##      2590      2600      2626      2637      2642      2646      2659
##  2.708745  3.313439 -3.205136  3.444507 -2.786091 -4.202767 -3.695226
##      2669      2674      2696      2714      2726      2727      2809
## -2.505761 -3.095519 -2.594155  5.675093  2.838797  3.252953 -2.983391
```

```
# various measure of influence
influence.measures(stepwise_model) %>%
  summary() #we observe the 282, 1059 are potential outliers
```

```
## Potentially influential observations of
##   lm(formula = target_death_rate ~ incidence_rate + poverty_percent +      median_age_male + pct_unem
##
##      dfb.1_ dfb.incd_ dfb.pvr_ dfb.md__ dfb.p_16 dfb.pct_w dfb.pct_s
## 21    0.03   0.04     -0.07     0.04     0.01    -0.05     -0.05
## 116   0.19   0.04     -0.23     0.02     0.13     0.13     -0.04
## 119  -0.04  -0.01      0.12     0.09    -0.12    -0.04      0.01
## 120   0.00  -0.01      0.05     0.06    -0.10    -0.03      0.01
## 122   0.05  -0.01     -0.09     0.15     0.14     0.03      0.05
## 124   0.00  -0.01      0.01     0.02    -0.02    -0.03      0.00
## 140   0.00   0.00      0.00     0.00     0.00     0.00     -0.01
## 147   0.01   0.00      0.00     0.00     0.00     0.01      0.02
## 150   0.00   0.01      0.00     0.01     0.00     0.00      0.07
## 156   0.00   0.00      0.00     0.00     0.00     0.00      0.02
## 161   0.01   0.00      0.00     0.02    -0.01     0.00      0.00
## 165   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 166  -0.05   0.05     -0.01     0.14    -0.09     0.02     -0.03
## 176  -0.11   0.07      0.01     0.03     0.01     0.12      0.04
## 177   0.00   0.00      0.00     0.03    -0.01     0.00     -0.02
## 180   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 181   0.00  -0.02      0.02    -0.01     0.01     0.01     -0.03
## 184   0.00   0.00      0.00     0.06    -0.03     0.01     -0.04
## 188   0.00   0.01      0.01    -0.03    -0.01     0.00      0.01
## 189   0.11  -0.11     -0.13    -0.06     0.01    -0.03     -0.03
## 191   0.01   0.00     -0.01     0.00     0.00     0.00      0.00
## 194   0.02  -0.01      0.00    -0.01     0.00     0.00      0.01
## 209   0.02  -0.11      0.02     0.00     0.05     0.06      0.01
## 210  -0.01  -0.01      0.00     0.00     0.00    -0.01      0.06
## 217   0.00   0.01     -0.02     0.01     0.01    -0.01     -0.01
## 237   0.02  -0.06      0.01     0.02     0.01     0.03      0.00
## 245  -0.01   0.00      0.01     0.00    -0.01    -0.01      0.00
## 250  -0.01  -0.09      0.05    -0.02     0.05     0.05      0.00
## 253   0.01  -0.01     -0.01     0.00     0.00     0.00      0.00
## 254   0.12  -0.26     -0.10    -0.06     0.08     0.14      0.01
## 256   0.03  -0.24     -0.11     0.04     0.17    -0.05     -0.11
## 264  -0.02  -0.13     -0.12     0.10     0.10    -0.12     -0.07
## 270   0.01   0.00     -0.01     0.00     0.00     0.02      0.01
## 271  -0.02  -0.06      0.04    -0.01     0.01     0.05      0.02
## 274   0.00   0.00      0.00     0.01     0.00    -0.01      0.00
## 282   0.13  -1.22_*   -0.06     0.14     0.16    -0.11     -0.15
## 284   0.01   0.00      0.00     0.01    -0.01     0.00      0.01
## 292   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 294   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 296  -0.01   0.01     -0.01    -0.01     0.02     0.00     -0.02
## 300   0.00   0.00      0.00     0.00     0.00     0.00     -0.02
## 321   0.00   0.00     -0.01     0.01     0.00    -0.01      0.00
## 394  -0.01   0.00      0.00    -0.01     0.01    -0.02     -0.04
## 469   0.10  -0.02     -0.05     0.00    -0.07     0.02     -0.02
## 479   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 492   0.04   0.02      0.02     0.00    -0.06    -0.06     -0.02
## 522  -0.01  -0.09      0.08    -0.02    -0.05    -0.10     -0.04
## 524   0.03   0.03     -0.05     0.02    -0.05    -0.08      0.01
## 537   0.03   0.01     -0.01     0.04    -0.01    -0.04     -0.06
## 564   0.01   0.02      0.02    -0.01     0.01     0.05      0.00
```

```
## 576  -0.03   0.00      0.02     0.01     0.01     0.00     -0.03
## 585  -0.01   0.00      0.01     0.02     0.00     0.00      0.12
## 591   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 594   0.02   0.00     -0.02     0.00    -0.01    -0.01     -0.02
## 597   0.03   0.02     -0.01     0.01    -0.10    -0.03      0.02
## 621   0.04  -0.09      0.01    -0.05     0.04     0.05      0.00
## 627   0.07  -0.06     -0.02     0.14    -0.06    -0.01     -0.01
## 650  -0.08   0.02      0.04    -0.05     0.02    -0.01      0.03
## 660   0.06   0.01     -0.06    -0.07     0.07     0.01     -0.04
## 666   0.02   0.02      0.01     0.08    -0.09    -0.03     -0.01
## 670   0.02  -0.07     -0.01     0.04    -0.02     0.00     -0.02
## 727  -0.11  -0.03      0.14     0.00    -0.06     0.00      0.03
## 749  -0.07   0.02      0.06     0.02     0.04     0.03      0.01
## 775  -0.01  -0.04      0.08    -0.02    -0.12    -0.06      0.01
## 780  -0.07   0.02      0.06     0.03    -0.08    -0.08     -0.02
## 783  -0.04   0.03     -0.02     0.04     0.08    -0.03     -0.02
## 796  -0.05   0.00      0.04     0.06    -0.07    -0.09     -0.01
## 803   0.09  -0.06     -0.03     0.02     0.00     0.03      0.00
## 809   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 812  -0.09  -0.05      0.03     0.05     0.03    -0.01      0.00
## 840   0.01  -0.01     -0.01     0.01     0.02     0.01      0.00
## 845  -0.19   0.04      0.11    -0.03    -0.02     0.03      0.02
## 853  -0.03  -0.01      0.03     0.01     0.00    -0.01      0.00
## 884   0.00   0.00      0.00     0.00     0.00     0.01     -0.03
## 886   0.00   0.01      0.01    -0.01     0.00     0.01     -0.04
## 900  -0.04   0.03     -0.09     0.06     0.06    -0.06     -0.03
## 905  -0.02   0.03     -0.06     0.06     0.02    -0.08     -0.04
## 912  -0.13   0.09     -0.02     0.22    -0.03    -0.20     -0.06
## 913  -0.10   0.08      0.02     0.09    -0.03    -0.14      0.00
## 921  -0.07   0.03      0.07     0.05    -0.06    -0.03      0.00
## 922  -0.01   0.00      0.00     0.00     0.00     0.00      0.00
## 925  -0.07   0.03      0.09     0.05    -0.01    -0.05     -0.01
## 927   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 937  -0.05   0.00      0.06     0.08    -0.01     0.00      0.01
## 961   0.01  -0.01     -0.01     0.00     0.00     0.00      0.01
## 979   0.00  -0.09      0.01     0.00     0.01     0.04      0.00
## 982   0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1000  0.00   0.00      0.00     0.00     0.00     0.00      0.01
## 1005 -0.01   0.00      0.01     0.00     0.01     0.00      0.00
## 1007 -0.11   0.07      0.12    -0.01    -0.11    -0.04      0.03
## 1013  0.00   0.00      0.00     0.00     0.00     0.00      0.02
## 1016  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1017  0.00   0.00      0.00     0.00     0.00     0.00      0.01
## 1019 -0.01   0.00      0.00     0.00     0.01     0.00      0.01
## 1022  0.00   0.00      0.01     0.02    -0.01     0.02      0.14
## 1023 -0.01   0.00      0.01     0.00     0.01     0.00      0.02
## 1025 -0.01   0.00      0.00     0.01     0.00     0.00      0.04
## 1027 -0.02   0.00      0.01     0.02     0.00     0.00      0.11
## 1033 -0.01   0.01      0.00     0.01     0.02     0.00      0.06
## 1036  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1043 -0.01   0.00      0.01     0.00     0.00     0.00      0.02
## 1048 -0.02   0.01      0.03    -0.10    -0.02     0.01      0.00
## 1050  0.01   0.01     -0.02     0.00     0.00     0.00      0.00
## 1058 -0.05   0.12      0.01    -0.07    -0.07    -0.10     -0.04
```

```
## 1059  0.33   0.18     -0.24    -0.02    -0.46    -0.20     -0.03
## 1063  0.00  -0.01      0.00     0.00     0.00     0.00      0.00
## 1066 -0.12   0.07      0.12     0.06     0.00    -0.02      0.04
## 1074 -0.04  -0.01      0.08    -0.09    -0.08    -0.05      0.00
## 1076  0.07  -0.05      0.01     0.03    -0.07    -0.03     -0.03
## 1094 -0.26   0.22      0.28     0.02    -0.11    -0.15      0.03
## 1105  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1139  0.01   0.00      0.00    -0.01     0.00    -0.03      0.00
## 1174  0.07  -0.01     -0.09    -0.10    -0.01     0.02     -0.03
## 1202  0.00  -0.01     -0.01     0.00     0.00     0.02      0.01
## 1203  0.01  -0.03      0.01     0.01    -0.10     0.03      0.03
## 1204 -0.06   0.01      0.16     0.10    -0.09    -0.11      0.01
## 1217  0.00   0.06      0.02    -0.02    -0.03    -0.05     -0.03
## 1221  0.03   0.01     -0.01     0.01    -0.11    -0.30     -0.09
## 1236  0.04  -0.03     -0.03     0.02     0.13    -0.05     -0.04
## 1261  0.07  -0.08     -0.05     0.02    -0.03     0.05      0.01
## 1297 -0.04   0.05     -0.03    -0.02     0.02    -0.02     -0.06
## 1299 -0.03   0.02      0.03     0.07    -0.02    -0.05     -0.03
## 1310 -0.06   0.04      0.05    -0.05    -0.07    -0.06     -0.06
## 1311 -0.02  -0.01      0.03     0.01     0.00    -0.01      0.01
## 1331  0.03  -0.01     -0.05    -0.03     0.09     0.03      0.02
## 1345 -0.01   0.01      0.02    -0.07     0.01    -0.01      0.02
## 1350  0.00   0.01     -0.01     0.00     0.01     0.00     -0.01
## 1366  0.07   0.03      0.04     0.13    -0.14     0.07      0.02
## 1390 -0.04   0.06      0.09     0.03    -0.04     0.03      0.03
## 1422  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1429 -0.02  -0.01      0.04    -0.10    -0.10     0.19      0.08
## 1490  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1497 -0.07   0.08      0.09     0.08    -0.18    -0.01     -0.02
## 1542  0.01  -0.02      0.03     0.00    -0.01    -0.04     -0.01
## 1554  0.00   0.01      0.00     0.00    -0.02     0.00     -0.01
## 1568  0.06   0.00     -0.01    -0.04    -0.09    -0.03     -0.01
## 1601  0.00   0.00     -0.01     0.01     0.00    -0.01      0.00
## 1633 -0.06   0.01      0.03     0.04     0.01    -0.01     -0.01
## 1687 -0.04  -0.02      0.00     0.03    -0.03    -0.04     -0.05
## 1695  0.03   0.02     -0.03    -0.07     0.00     0.01      0.00
## 1723 -0.02   0.00      0.02    -0.01    -0.02    -0.01      0.00
## 1771  0.01   0.02     -0.01    -0.01    -0.02     0.02      0.01
## 1797 -0.07   0.02     -0.07     0.09     0.04    -0.12     -0.05
## 1813  0.03   0.01     -0.04     0.00     0.02     0.00     -0.01
## 1817 -0.02   0.01     -0.03     0.01     0.00    -0.03     -0.07
## 1818 -0.12   0.04      0.05     0.08    -0.08    -0.10     -0.11
## 1824  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1828  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1840  0.00   0.00      0.00     0.00     0.00     0.00     -0.01
## 1843  0.00   0.00      0.00     0.01     0.01     0.00      0.00
## 1844  0.02   0.00     -0.01    -0.02    -0.01     0.00      0.00
## 1846 -0.01  -0.04      0.06     0.01    -0.05    -0.01      0.01
## 1848  0.05  -0.01     -0.01    -0.04    -0.01     0.02      0.02
## 1849 -0.03   0.02      0.00     0.05    -0.03    -0.03     -0.07
## 1858 -0.01  -0.02      0.00     0.04     0.06     0.00      0.00
## 1868 -0.10   0.03     -0.05     0.09     0.03    -0.10     -0.05
## 1888 -0.03   0.01      0.03     0.00    -0.02    -0.01     -0.02
## 1898  0.00   0.02     -0.03     0.00     0.01    -0.02      0.01
```

```
## 1916 -0.09   0.01      0.04     0.07    -0.04    -0.07     -0.01
## 1918  0.01  -0.01     -0.01     0.00     0.00     0.00      0.00
## 1933  0.01   0.00      0.00     0.03     0.00     0.00      0.00
## 1942 -0.37   0.25      0.23     0.10    -0.03    -0.22     -0.17
## 1945  0.01   0.01     -0.01     0.01    -0.02    -0.01     -0.02
## 1946  0.01  -0.01      0.00     0.01     0.01     0.00      0.00
## 1958  0.06   0.08     -0.04     0.06    -0.05    -0.03     -0.09
## 1965 -0.15   0.01     -0.01     0.11    -0.03    -0.15     -0.05
## 1968  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 1979 -0.01  -0.01     -0.01     0.04    -0.04    -0.07     -0.11
## 2016  0.03   0.03      0.02    -0.02    -0.02     0.04      0.02
## 2022  0.04  -0.11      0.00    -0.01     0.01     0.00      0.00
## 2036  0.01  -0.06     -0.01     0.03     0.02    -0.02     -0.02
## 2066 -0.15  -0.02      0.04     0.05    -0.12     0.13      0.04
## 2087  0.00   0.00      0.00    -0.01     0.00     0.00     -0.04
## 2157  0.03  -0.11     -0.02    -0.01     0.03    -0.07     -0.06
## 2174 -0.02  -0.04      0.03     0.00     0.00    -0.01     -0.03
## 2176 -0.09   0.06      0.14     0.00    -0.05     0.08      0.06
## 2204 -0.05  -0.01      0.03     0.03     0.00    -0.01      0.00
## 2292  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 2305 -0.01   0.02      0.00     0.00     0.01     0.02      0.01
## 2313  0.01   0.00     -0.01    -0.01     0.00     0.01     -0.02
## 2314 -0.01   0.00      0.01     0.01    -0.01     0.00      0.08
## 2315 -0.04  -0.01      0.05     0.04    -0.03    -0.02      0.22
## 2316  0.02   0.00     -0.02    -0.01     0.01     0.01     -0.08
## 2318 -0.04   0.00      0.09    -0.08    -0.09    -0.06     -0.04
## 2323 -0.05   0.04      0.06    -0.02     0.03    -0.02      0.01
## 2328 -0.03   0.07      0.01     0.01    -0.01    -0.01      0.00
## 2347  0.12   0.05     -0.17     0.07    -0.03     0.01      0.00
## 2353  0.03   0.05      0.01     0.07    -0.05    -0.03      0.04
## 2355 -0.05   0.05      0.08     0.08    -0.05    -0.05      0.02
## 2395  0.04   0.09     -0.04    -0.02     0.01     0.09      0.02
## 2426  0.00  -0.05     -0.01     0.03     0.02     0.04      0.00
## 2444  0.00   0.09     -0.12     0.01     0.13     0.14     -0.03
## 2452  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 2510  0.00   0.00      0.00     0.00     0.00     0.00      0.00
## 2546 -0.01   0.04     -0.06     0.00     0.01     0.09      0.03
## 2549  0.04  -0.03     -0.02    -0.02     0.09    -0.10     -0.07
## 2563 -0.05   0.09      0.07    -0.02    -0.05     0.05      0.04
## 2573 -0.06   0.01      0.07     0.00     0.01     0.02      0.02
## 2579 -0.08   0.02      0.07    -0.02     0.05     0.05      0.03
## 2590 -0.03   0.11      0.03    -0.01    -0.02     0.04      0.02
## 2594 -0.09   0.02      0.15     0.02    -0.07     0.06      0.06
## 2596 -0.05   0.10      0.02    -0.01     0.05     0.08      0.03
## 2598 -0.04   0.13      0.01    -0.05    -0.05     0.10      0.04
## 2600 -0.18   0.08      0.18     0.09    -0.07     0.02      0.03
## 2626 -0.02   0.07      0.00     0.01    -0.06     0.08      0.02
## 2637  0.01   0.01      0.06     0.03    -0.02    -0.02      0.01
## 2642 -0.03   0.09     -0.01    -0.02     0.03     0.09      0.03
## 2646 -0.09  -0.26      0.03    -0.02     0.04    -0.08      0.00
## 2659  0.04  -0.08     -0.15    -0.09     0.16     0.18      0.00
## 2669 -0.01  -0.02      0.04    -0.01    -0.08     0.01      0.01
## 2671  0.00  -0.01      0.02    -0.01    -0.01     0.00      0.00
## 2674  0.02  -0.06     -0.13    -0.02     0.21     0.12     -0.01
```

```
## 2682 -0.06   0.02      0.03    -0.06     0.07    -0.02      0.00
## 2684  0.00   0.01     -0.09     0.05     0.07    -0.04     -0.04
## 2689  0.01  -0.02      0.00     0.01     0.01    -0.05     -0.03
## 2696  0.02   0.00      0.00    -0.01    -0.03     0.10      0.03
## 2699  0.02  -0.02     -0.05    -0.01     0.03     0.02      0.00
## 2706  0.02  -0.01      0.01     0.02     0.00    -0.03     -0.01
## 2714  0.22  -0.38      0.02     0.19    -0.31     0.07      1.54_*
## 2716  0.05  -0.08     -0.04    -0.06     0.06    -0.12     -0.04
## 2718  0.10  -0.01     -0.08    -0.03     0.01    -0.12     -0.03
## 2720 -0.15  -0.01      0.11    -0.03     0.06     0.00     -0.04
## 2724  0.09   0.02     -0.05    -0.01    -0.02     0.00      0.24
## 2726  0.09   0.04     -0.07    -0.07     0.04    -0.15     -0.05
## 2727  0.18   0.06     -0.21    -0.02    -0.02    -0.13      0.03
## 2729  0.01  -0.01     -0.01    -0.01     0.01    -0.01     -0.01
## 2733 -0.04  -0.01      0.03     0.00    -0.01     0.02      0.01
## 2747  0.01   0.02     -0.01     0.00    -0.01    -0.01      0.00
## 2783  0.00   0.00      0.00    -0.01     0.00     0.00      0.00
## 2785  0.03   0.05      0.00     0.04    -0.12     0.02      0.01
## 2789  0.04   0.06     -0.01     0.02     0.03     0.00      0.01
## 2790 -0.05  -0.02      0.06     0.02    -0.05     0.02      0.02
## 2809 -0.02  -0.03     -0.07     0.02     0.09     0.08      0.00
## 2811  0.02   0.15     -0.04    -0.07     0.00    -0.01     -0.01
## 2826  0.00   0.00      0.00    -0.01     0.01     0.00      0.00
## 2842 -0.01   0.07     -0.02    -0.01     0.02     0.01     -0.01
## 2858 -0.02   0.07      0.03     0.02    -0.04     0.00     -0.01
## 2922 -0.03   0.03      0.00     0.02     0.03     0.02     -0.01
## 3040  0.03   0.03     -0.01     0.05    -0.06    -0.02     -0.02
##      dfb.pct_t_ dfb.pct_m_ dfb.p__1 dfb.pct_w_ dfb.incm_ dffit   cov.r
## 21     0.01       0.01       0.02    -0.05      -0.03     -0.13    1.01
## 116    0.12      -0.23       0.02    -0.18      -0.01      0.36_*  0.96_*
## 119    0.01       0.02      -0.10     0.03       0.02     -0.21_*  0.97_*
## 120    0.03      -0.05      -0.04     0.03      -0.01     -0.16    0.97_*
## 122    0.06      -0.16      -0.04    -0.06       0.05      0.31_*  0.97_*
## 124   -0.01       0.01      -0.05     0.02      -0.04     -0.11    0.96_*
## 140    0.00       0.00       0.00     0.00       0.00     -0.01    1.02_*
## 147    0.01      -0.01       0.00    -0.01       0.00      0.03    1.02_*
## 150   -0.01       0.01       0.00    -0.01       0.00      0.08    1.03_*
## 156    0.00       0.01       0.00     0.00       0.00      0.03    1.02_*
## 161    0.00       0.01      -0.02    -0.01      -0.01      0.04    1.02_*
## 165    0.00       0.00       0.00     0.00       0.00      0.00    1.01_*
## 166    0.27      -0.11       0.05     0.07      -0.16      0.37_*  0.98_*
## 176    0.05      -0.04       0.04     0.06       0.04     -0.24_*  0.99
## 177    0.07       0.00      -0.03     0.00      -0.02      0.08    1.05_*
## 180   -0.02       0.00       0.00     0.00       0.01     -0.02    1.02_*
## 181    0.08       0.00      -0.04     0.01       0.01      0.10    1.01_*
## 184    0.22      -0.06      -0.03     0.02      -0.06      0.25_*  1.05_*
## 188   -0.05       0.02       0.00     0.00      -0.01     -0.07    1.02_*
## 189   -0.04      -0.05       0.00     0.00      -0.10     -0.20_*  0.98_*
## 191   -0.02       0.00       0.00    -0.01       0.00     -0.02    1.01_*
## 194   -0.08       0.02       0.00    -0.03       0.02     -0.09    1.05_*
## 209   -0.02       0.03      -0.07     0.01      -0.10      0.21_*  0.98_*
## 210   -0.01       0.03       0.01     0.01      -0.01      0.08    1.02_*
## 217    0.00       0.00       0.01    -0.01      -0.01     -0.03    1.01_*
## 237   -0.02      -0.01      -0.02    -0.02       0.03      0.10    0.98_*
```

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## 245   0.00       0.00       0.01     0.02       0.01      0.03    1.02_*
## 250  -0.03      -0.01      -0.02     0.03       0.05      0.14    0.98_*
## 253   0.00      -0.01       0.00     0.00       0.00      0.02    1.01_*
## 254  -0.02      -0.18       0.03     0.05      -0.19      0.37_*  0.97_*
## 256   0.00       0.09       0.02     0.02      -0.06     -0.38_*  0.99
## 264   0.01       0.08       0.08     0.04      -0.07     -0.33_*  0.98_*
## 270   0.00      -0.02       0.00     0.00      -0.02      0.03    1.01_*
## 271   0.00       0.03      -0.01     0.01       0.04     -0.11    1.01_*
## 274   0.00       0.01       0.00    -0.01       0.01     -0.02    1.02_*
## 282  -0.10       0.02       0.24     0.22      -0.02     -1.34_*  0.89_*
## 284  -0.04      -0.01      -0.01    -0.01       0.00     -0.05    1.03_*
## 292  -0.01       0.00       0.00     0.00       0.00     -0.01    1.02_*
## 294   0.02       0.00       0.00     0.00       0.00      0.02    1.02_*
## 296   0.08       0.00       0.01     0.01       0.00      0.09    1.01_*
## 300   0.00       0.00       0.00     0.00       0.00     -0.02    1.01_*
## 321   0.00       0.00       0.01    -0.01      -0.01     -0.03    1.01_*
## 394  -0.03       0.05       0.00     0.00       0.00     -0.08    1.02_*
## 469  -0.03      -0.07      -0.02    -0.06      -0.02      0.14    0.99_*
## 479   0.00       0.00       0.00     0.00       0.00      0.00    1.01_*
## 492  -0.03       0.01      -0.03    -0.04       0.03      0.11    1.02_*
## 522  -0.05      -0.03       0.04     0.08       0.10      0.22_*  0.98_*
## 524  -0.03       0.00       0.03    -0.01      -0.13      0.18    0.98_*
## 537   0.09       0.00      -0.06    -0.04       0.03      0.14    0.98_*
## 564  -0.01      -0.03       0.00    -0.03       0.04      0.10    0.98_*
## 576   0.15       0.01       0.00     0.02       0.02      0.16    1.01_*
## 585   0.00       0.01       0.01     0.00       0.00      0.12    1.04_*
## 591   0.00       0.00       0.00     0.00       0.00      0.00    1.02_*
## 594  -0.04      -0.01       0.00    -0.01      -0.01     -0.05    1.02_*
## 597  -0.14      -0.03       0.03    -0.01      -0.03     -0.19_*  1.01
## 621   0.00      -0.08      -0.03     0.02       0.02     -0.17    0.98_*
## 627  -0.02      -0.04      -0.07    -0.08       0.01      0.21_*  0.97_*
## 650   0.00       0.03       0.09     0.07       0.01     -0.14    0.99_*
## 660   0.01      -0.03      -0.07    -0.02      -0.03     -0.16    0.99_*
## 666  -0.01       0.02      -0.07    -0.04       0.00      0.15    0.97_*
## 670  -0.01      -0.03      -0.03     0.02      -0.01      0.12    0.98_*
## 727   0.01       0.03       0.07     0.11       0.00      0.19    1.01
## 749   0.01       0.04       0.00     0.02       0.05      0.11    0.98_*
## 775  -0.03       0.02       0.10     0.02       0.06      0.20_*  0.96_*
## 780   0.03       0.11       0.02     0.04       0.00      0.17    0.99_*
## 783  -0.08       0.00      -0.11     0.06      -0.03     -0.24_*  0.99_*
## 796  -0.05       0.03       0.01     0.05       0.05     -0.16    1.01_*
## 803  -0.01      -0.10      -0.05    -0.05       0.00     -0.16    0.98_*
## 809   0.00       0.00       0.00     0.00       0.00     -0.01    1.01_*
## 812   0.05       0.02       0.00     0.08       0.13     -0.21_*  0.96_*
## 840   0.00       0.00      -0.02    -0.01       0.01     -0.03    1.01_*
## 845   0.07       0.11       0.00     0.15       0.08     -0.28_*  0.98_*
## 853   0.01       0.01       0.00     0.03       0.02     -0.05    1.01_*
## 884   0.01      -0.01       0.00     0.00       0.00     -0.03    1.02_*
## 886   0.00      -0.01       0.00     0.00       0.01     -0.05    1.01_*
## 900   0.02      -0.03       0.03     0.07      -0.06     -0.18    1.01
## 905   0.02      -0.03      -0.01     0.05       0.02     -0.17    1.01
## 912   0.08      -0.05      -0.01     0.14       0.13     -0.42_*  0.96_*
## 913  -0.05       0.07       0.03     0.05       0.09     -0.23_*  0.99
## 921   0.06      -0.01      -0.01     0.08       0.01     -0.15    0.97_*
```

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## 922   0.00       0.01       0.00     0.00       0.00     -0.01    1.01_*
## 925   0.04       0.08      -0.11     0.04       0.01     -0.17    0.99_*
## 927   0.00      -0.01       0.00     0.00       0.00     -0.01    1.01_*
## 937   0.04      -0.05       0.01     0.04       0.04     -0.14    0.99_*
## 961   0.00      -0.01       0.00     0.00       0.00      0.02    1.01_*
## 979  -0.01       0.01      -0.03     0.04      -0.13      0.19    0.98_*
## 982   0.00       0.00       0.00     0.00       0.00     -0.01    1.02_*
## 1000  0.01       0.00       0.00     0.00       0.00      0.02    1.02_*
## 1005  0.02       0.00       0.00     0.00       0.00      0.02    1.02_*
## 1007 -0.05       0.07       0.05     0.08       0.02     -0.20_*  1.00
## 1013  0.01       0.00       0.00     0.00       0.00      0.03    1.02_*
## 1016 -0.01       0.00       0.00     0.00       0.00     -0.01    1.01_*
## 1017  0.00       0.00       0.00     0.00       0.00      0.01    1.01_*
## 1019  0.02       0.01       0.00     0.00       0.00      0.03    1.01_*
## 1022 -0.01      -0.03       0.01    -0.01       0.00      0.15    1.07_*
## 1023  0.01       0.01       0.00     0.00       0.00      0.03    1.02_*
## 1025  0.00       0.00       0.00     0.00       0.00      0.05    1.04_*
## 1027  0.00       0.02       0.01     0.00       0.00      0.12    1.06_*
## 1033  0.01       0.01       0.01     0.01       0.00      0.07    1.01_*
## 1036  0.00       0.00       0.00     0.00       0.00      0.00    1.02_*
## 1043  0.01       0.00       0.00     0.00       0.00      0.03    1.01_*
## 1048 -0.07      -0.02       0.02     0.07      -0.02     -0.17    0.98_*
## 1050  0.00       0.00      -0.01    -0.01      -0.01     -0.02    1.02_*
## 1058 -0.01       0.05       0.04     0.04       0.09     -0.25_*  0.98_*
## 1059 -0.18      -0.15       0.09    -0.28       0.02     -0.70_*  0.94_*
## 1063  0.00       0.00       0.00     0.00       0.00      0.01    1.01_*
## 1066 -0.05       0.06      -0.01     0.05       0.05     -0.18    0.98_*
## 1074 -0.05       0.06       0.04     0.05       0.10     -0.20_*  0.99
## 1076 -0.04       0.02      -0.11    -0.06       0.00      0.16    0.98_*
## 1094  0.03       0.37      -0.02     0.07       0.07     -0.45_*  0.96_*
## 1105  0.00      -0.01       0.00     0.00       0.00      0.01    1.01_*
## 1139 -0.02       0.00       0.02    -0.01       0.02      0.05    1.02_*
## 1174 -0.02      -0.04       0.04    -0.02      -0.05      0.15    0.98_*
## 1202  0.01       0.00       0.00    -0.01       0.00     -0.04    1.01_*
## 1203  0.01       0.02       0.00    -0.02       0.01     -0.18    1.01
## 1204 -0.03       0.05       0.01     0.00       0.14      0.24_*  1.00
## 1217 -0.02       0.02      -0.02     0.00       0.03      0.11    0.98_*
## 1221 -0.04       0.11      -0.11     0.05       0.00      0.36_*  0.87_*
## 1236 -0.03       0.00      -0.07    -0.02      -0.03      0.21_*  1.00
## 1261 -0.03      -0.10       0.03    -0.03       0.00      0.16    0.97_*
## 1297  0.19       0.05       0.03     0.02      -0.02      0.23_*  1.01
## 1299  0.05       0.07      -0.09     0.00       0.00      0.13    1.02_*
## 1310  0.11       0.11      -0.02     0.06      -0.01      0.22_*  0.99_*
## 1311  0.02       0.01      -0.01     0.02       0.01     -0.07    0.99_*
## 1331 -0.01      -0.01       0.02    -0.03      -0.01     -0.13    0.98_*
## 1345 -0.01       0.04       0.04     0.00       0.00     -0.12    0.98_*
## 1350  0.08      -0.01       0.00     0.00       0.00      0.09    1.03_*
## 1366 -0.02      -0.14      -0.02    -0.10       0.07      0.30_*  0.90_*
## 1390  0.00       0.10      -0.09    -0.03      -0.06      0.20_*  0.99
## 1422  0.00      -0.01       0.00     0.00       0.00      0.01    1.01_*
## 1429  0.03       0.00       0.07    -0.03       0.06     -0.33_*  0.97_*
## 1490  0.00       0.00       0.00     0.00       0.00      0.00    1.09_*
## 1497  0.23      -0.02       0.09     0.01       0.04      0.33_*  0.95_*
## 1542 -0.03       0.03      -0.01    -0.02       0.05      0.10    0.98_*
```

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## 1554  0.08       0.00       0.01     0.00       0.00      0.09    1.02_*
## 1568 -0.03      -0.02      -0.03    -0.03      -0.04     -0.13    0.99_*
## 1601  0.00       0.00       0.01    -0.01       0.01     -0.03    1.01_*
## 1633  0.04      -0.02      -0.01     0.07       0.00     -0.10    1.02_*
## 1687  0.16       0.03       0.03     0.05      -0.01      0.20_*  1.00
## 1695 -0.01      -0.03       0.05    -0.01       0.03     -0.11    1.01_*
## 1723  0.00       0.00       0.03     0.02       0.01      0.04    1.01_*
## 1771  0.00       0.00       0.01    -0.02       0.00     -0.05    1.01_*
## 1797 -0.01      -0.05       0.05     0.11       0.08     -0.29_*  0.98_*
## 1813  0.00      -0.02      -0.02    -0.02      -0.02     -0.05    1.02_*
## 1817  0.24      -0.01       0.02     0.03      -0.02      0.27_*  1.04_*
## 1818  0.49       0.09       0.02     0.09      -0.01      0.54_*  1.04_*
## 1824  0.00       0.00       0.00     0.00       0.00      0.00    1.01_*
## 1828  0.00       0.00       0.00     0.00       0.00      0.01    1.01_*
## 1840  0.00       0.00       0.00     0.00       0.00     -0.01    1.02_*
## 1843 -0.02       0.00      -0.01     0.00       0.01     -0.03    1.02_*
## 1844 -0.01       0.00       0.01    -0.02       0.00      0.03    1.02_*
## 1846  0.01       0.02       0.01     0.01       0.03      0.09    1.01_*
## 1848 -0.10      -0.02       0.00    -0.04      -0.01     -0.11    1.02_*
## 1849  0.31      -0.01       0.02     0.01       0.01      0.33_*  1.02_*
## 1858  0.00      -0.03      -0.04     0.02       0.01     -0.12    0.99_*
## 1868  0.00      -0.09       0.09     0.15       0.08     -0.32_*  0.99_*
## 1888  0.09       0.00       0.02     0.03       0.01      0.10    1.02_*
## 1898 -0.06       0.00       0.00     0.01      -0.02     -0.09    1.01_*
## 1916  0.01      -0.02       0.03     0.10       0.07     -0.18    1.01
## 1918  0.00       0.00       0.01    -0.01      -0.01      0.02    1.01_*
## 1933  0.01      -0.02      -0.02    -0.01       0.00     -0.04    1.01_*
## 1942  0.11       0.17      -0.11     0.30       0.23     -0.59_*  0.95_*
## 1945  0.09       0.01       0.00    -0.02      -0.01      0.11    1.05_*
## 1946  0.00       0.00      -0.01    -0.01       0.00      0.02    1.01_*
## 1958  0.32       0.04      -0.10    -0.11      -0.01      0.39_*  0.99_*
## 1965  0.03      -0.06       0.10     0.22       0.07     -0.36_*  0.99
## 1968 -0.01       0.00       0.00     0.00       0.00     -0.01    1.01_*
## 1979  0.40       0.04      -0.01     0.01      -0.01      0.45_*  1.01_*
## 2016 -0.03      -0.02       0.00    -0.05      -0.07      0.15    0.98_*
## 2022 -0.05       0.03      -0.04    -0.02       0.01      0.14    0.99_*
## 2036 -0.03       0.05      -0.04    -0.01       0.00      0.12    0.98_*
## 2066  0.14      -0.13       0.09     0.23      -0.13     -0.41_*  0.98_*
## 2087  0.00       0.00       0.00     0.00       0.00     -0.04    1.03_*
## 2157  0.00       0.00      -0.07     0.03       0.09     -0.20_*  0.99_*
## 2174 -0.02       0.05      -0.06     0.03       0.01      0.12    0.97_*
## 2176  0.01       0.05       0.00     0.04      -0.06      0.23_*  0.98_*
## 2204  0.03      -0.01       0.00     0.06       0.01     -0.08    1.03_*
## 2292  0.00       0.00       0.00     0.00       0.00      0.00    1.01_*
## 2305  0.01       0.00       0.01    -0.01       0.02     -0.04    1.01_*
## 2313  0.00       0.00       0.00     0.00       0.00     -0.03    1.03_*
## 2314 -0.02       0.01       0.01     0.00       0.00      0.09    1.11_*
## 2315 -0.05       0.04       0.04     0.01       0.01      0.24_*  1.08_*
## 2316  0.02      -0.01      -0.02    -0.01       0.00     -0.09    1.05_*
## 2318  0.02       0.06      -0.09     0.10      -0.03     -0.25_*  0.97_*
## 2323 -0.07       0.06      -0.02     0.02       0.02     -0.14    0.98_*
## 2328  0.03       0.00      -0.01     0.02      -0.01     -0.10    0.98_*
## 2347  0.02      -0.19       0.09    -0.08      -0.06     -0.27_*  1.01_*
## 2353 -0.09       0.01      -0.07    -0.07       0.00     -0.16    0.99_*
```

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## 2355 -0.02       0.05      -0.07     0.01       0.02     -0.15    0.99_*
## 2395  0.01       0.02      -0.08    -0.10       0.02     -0.19_*  1.00
## 2426  0.02       0.00      -0.05     0.00       0.06     -0.16    0.99_*
## 2444  0.09      -0.03      -0.06    -0.05       0.05     -0.31_*  0.97_*
## 2452 -0.01       0.01      -0.01     0.00       0.00     -0.02    1.02_*
## 2510  0.00       0.00       0.00     0.00       0.00      0.00    1.01_*
## 2546  0.03       0.01       0.04    -0.04       0.00     -0.19_*  1.00
## 2549 -0.04      -0.02      -0.07     0.03      -0.06      0.25_*  0.99_*
## 2563  0.00       0.08       0.00     0.00      -0.11      0.21_*  0.98_*
## 2573  0.01       0.04       0.01     0.04       0.01      0.09    1.02_*
## 2579  0.01       0.05       0.02     0.05      -0.01      0.14    1.01_*
## 2590 -0.01       0.01       0.03    -0.04       0.04      0.15    0.98_*
## 2594  0.01       0.02       0.03     0.05       0.01      0.19    1.01_*
## 2596  0.01       0.03       0.00    -0.01      -0.09      0.19_*  0.99
## 2598  0.02      -0.06       0.09     0.02      -0.10      0.23_*  0.99
## 2600  0.03       0.05       0.03     0.09       0.09      0.23_*  0.97_*
## 2626  0.06       0.05      -0.10    -0.03       0.04     -0.28_*  0.97_*
## 2637 -0.05       0.14      -0.13    -0.08       0.03      0.20_*  0.96_*
## 2642  0.00      -0.01      -0.04    -0.02       0.08     -0.21_*  0.98_*
## 2646 -0.19      -0.09       0.12     0.25       0.18     -0.46_*  0.95_*
## 2659  0.05      -0.10       0.00     0.04      -0.14     -0.31_*  0.96_*
## 2669 -0.02       0.00       0.00     0.02       0.09     -0.16    0.98_*
## 2671  0.00       0.00      -0.01     0.00       0.01      0.03    1.01_*
## 2674  0.00       0.01      -0.10    -0.02       0.03     -0.33_*  0.98_*
## 2682  0.00       0.10       0.00     0.04       0.01      0.15    1.01_*
## 2684  0.00       0.03       0.04    -0.04       0.04     -0.20_*  1.00
## 2689 -0.01      -0.01      -0.03     0.03      -0.02      0.09    1.01_*
## 2696  0.03       0.03      -0.07    -0.07       0.04     -0.22_*  0.98_*
## 2699  0.00      -0.01       0.01    -0.02      -0.01     -0.07    1.02_*
## 2706 -0.01       0.00      -0.04    -0.01      -0.01      0.07    1.01_*
## 2714 -0.32      -0.18       0.36    -0.23       0.00      1.74_*  0.97_*
## 2716 -0.08       0.03       0.06     0.00       0.05      0.23_*  1.01
## 2718 -0.07       0.01       0.01    -0.08       0.02      0.18    1.01
## 2720  0.05       0.08      -0.03     0.15       0.01     -0.21_*  1.00
## 2724 -0.08       0.03       0.01    -0.13      -0.02      0.29_*  1.02_*
## 2726 -0.10      -0.01       0.07    -0.07       0.08      0.30_*  0.98_*
## 2727 -0.07      -0.13       0.09    -0.12      -0.02      0.34_*  0.97_*
## 2729 -0.01       0.00       0.01    -0.01       0.00      0.03    1.02_*
## 2733  0.02       0.01       0.00     0.05      -0.02     -0.07    1.02_*
## 2747 -0.03      -0.01       0.00    -0.01      -0.01     -0.04    1.01_*
## 2783  0.00       0.00       0.00     0.00       0.00      0.01    1.01_*
## 2785  0.02      -0.03      -0.03    -0.05       0.01     -0.17    1.02_*
## 2789  0.01       0.02      -0.09    -0.08       0.01     -0.13    0.99_*
## 2790  0.02       0.01       0.00     0.04       0.03     -0.09    1.02_*
## 2809  0.07      -0.02      -0.03     0.04      -0.08     -0.19    0.97_*
## 2811  0.02       0.04      -0.04    -0.06      -0.04     -0.19_*  0.99_*
## 2826  0.00       0.00       0.00     0.00       0.00      0.02    1.02_*
## 2842  0.01       0.03      -0.02    -0.03       0.00      0.10    0.99_*
## 2858 -0.01       0.05      -0.03    -0.02       0.01      0.11    0.98_*
## 2922  0.00       0.01      -0.02     0.01       0.01      0.08    0.99_*
## 3040  0.02       0.01      -0.05    -0.05      -0.01      0.11    0.99_*
##      cook.d hat
## 21     0.00   0.01_*
## 116    0.01   0.01
```

```
## 119   0.00   0.00
## 120   0.00   0.00
## 122   0.01   0.01
## 124   0.00   0.00
## 140   0.00   0.01_*
## 147   0.00   0.01_*
## 150   0.00   0.03_*
## 156   0.00   0.01_*
## 161   0.00   0.02_*
## 165   0.00   0.01
## 166   0.01   0.02_*
## 176   0.00   0.01
## 177   0.00   0.05_*
## 180   0.00   0.01_*
## 181   0.00   0.01_*
## 184   0.01   0.05_*
## 188   0.00   0.01_*
## 189   0.00   0.01
## 191   0.00   0.01
## 194   0.00   0.05_*
## 209   0.00   0.01
## 210   0.00   0.02_*
## 217   0.00   0.01
## 237   0.00   0.00
## 245   0.00   0.01_*
## 250   0.00   0.00
## 253   0.00   0.01
## 254   0.01   0.01
## 256   0.01   0.02_*
## 264   0.01   0.01_*
## 270   0.00   0.01
## 271   0.00   0.01_*
## 274   0.00   0.01_*
## 282   0.15   0.04_*
## 284   0.00   0.02_*
## 292   0.00   0.01_*
## 294   0.00   0.01_*
## 296   0.00   0.01_*
## 300   0.00   0.01
## 321   0.00   0.01
## 394   0.00   0.01_*
## 469   0.00   0.00
## 479   0.00   0.01
## 492   0.00   0.02_*
## 522   0.00   0.01
## 524   0.00   0.00
## 537   0.00   0.00
## 564   0.00   0.00
## 576   0.00   0.01_*
## 585   0.00   0.04_*
## 591   0.00   0.01
## 594   0.00   0.02_*
## 597   0.00   0.01_*
## 621   0.00   0.00
```

```
## 627   0.00   0.00
## 650   0.00   0.00
## 660   0.00   0.00
## 666   0.00   0.00
## 670   0.00   0.00
## 727   0.00   0.01_*
## 749   0.00   0.00
## 775   0.00   0.00
## 780   0.00   0.01
## 783   0.00   0.01
## 796   0.00   0.02_*
## 803   0.00   0.00
## 809   0.00   0.01
## 812   0.00   0.00
## 840   0.00   0.01
## 845   0.01   0.01
## 853   0.00   0.01
## 884   0.00   0.01_*
## 886   0.00   0.01
## 900   0.00   0.01_*
## 905   0.00   0.01_*
## 912   0.01   0.01_*
## 913   0.00   0.01
## 921   0.00   0.00
## 922   0.00   0.01
## 925   0.00   0.01
## 927   0.00   0.01
## 937   0.00   0.00
## 961   0.00   0.01
## 979   0.00   0.01
## 982   0.00   0.02_*
## 1000  0.00   0.01_*
## 1005  0.00   0.02_*
## 1007  0.00   0.01
## 1013  0.00   0.02_*
## 1016  0.00   0.01
## 1017  0.00   0.01
## 1019  0.00   0.01
## 1022  0.00   0.06_*
## 1023  0.00   0.01_*
## 1025  0.00   0.03_*
## 1027  0.00   0.06_*
## 1033  0.00   0.01
## 1036  0.00   0.01_*
## 1043  0.00   0.01
## 1048  0.00   0.00
## 1050  0.00   0.01_*
## 1058  0.01   0.01
## 1059  0.04   0.02_*
## 1063  0.00   0.01
## 1066  0.00   0.00
## 1074  0.00   0.01
## 1076  0.00   0.00
## 1094  0.02   0.01_*
```

```
## 1105  0.00   0.01
## 1139  0.00   0.01_*
## 1174  0.00   0.00
## 1202  0.00   0.01
## 1203  0.00   0.01_*
## 1204  0.00   0.01_*
## 1217  0.00   0.00
## 1221  0.01   0.00
## 1236  0.00   0.01
## 1261  0.00   0.00
## 1297  0.00   0.02_*
## 1299  0.00   0.02_*
## 1310  0.00   0.01
## 1311  0.00   0.00
## 1331  0.00   0.00
## 1345  0.00   0.00
## 1350  0.00   0.02_*
## 1366  0.01   0.00
## 1390  0.00   0.01
## 1422  0.00   0.01
## 1429  0.01   0.01
## 1490  0.00   0.08_*
## 1497  0.01   0.01
## 1542  0.00   0.00
## 1554  0.00   0.02_*
## 1568  0.00   0.00
## 1601  0.00   0.01
## 1633  0.00   0.02_*
## 1687  0.00   0.01
## 1695  0.00   0.01_*
## 1723  0.00   0.01
## 1771  0.00   0.01
## 1797  0.01   0.01
## 1813  0.00   0.01_*
## 1817  0.01   0.04_*
## 1818  0.02   0.05_*
## 1824  0.00   0.01
## 1828  0.00   0.01
## 1840  0.00   0.02_*
## 1843  0.00   0.02_*
## 1844  0.00   0.01
## 1846  0.00   0.01
## 1848  0.00   0.02_*
## 1849  0.01   0.03_*
## 1858  0.00   0.00
## 1868  0.01   0.01_*
## 1888  0.00   0.02_*
## 1898  0.00   0.01
## 1916  0.00   0.01_*
## 1918  0.00   0.01
## 1933  0.00   0.01
## 1942  0.03   0.02_*
## 1945  0.00   0.04_*
## 1946  0.00   0.01
```

```
## 1958  0.01   0.02_*
## 1965  0.01   0.02_*
## 1968  0.00   0.01
## 1979  0.02   0.03_*
## 2016  0.00   0.00
## 2022  0.00   0.00
## 2036  0.00   0.00
## 2066  0.01   0.02_*
## 2087  0.00   0.03_*
## 2157  0.00   0.01
## 2174  0.00   0.00
## 2176  0.00   0.01
## 2204  0.00   0.02_*
## 2292  0.00   0.01
## 2305  0.00   0.01
## 2313  0.00   0.03_*
## 2314  0.00   0.10_*
## 2315  0.00   0.07_*
## 2316  0.00   0.04_*
## 2318  0.01   0.01
## 2323  0.00   0.00
## 2328  0.00   0.00
## 2347  0.01   0.02_*
## 2353  0.00   0.00
## 2355  0.00   0.00
## 2395  0.00   0.01_*
## 2426  0.00   0.00
## 2444  0.01   0.01
## 2452  0.00   0.02_*
## 2510  0.00   0.01
## 2546  0.00   0.01
## 2549  0.01   0.01
## 2563  0.00   0.01
## 2573  0.00   0.02_*
## 2579  0.00   0.01_*
## 2590  0.00   0.00
## 2594  0.00   0.02_*
## 2596  0.00   0.01
## 2598  0.00   0.01
## 2600  0.00   0.00
## 2626  0.01   0.01
## 2637  0.00   0.00
## 2642  0.00   0.01
## 2646  0.02   0.01
## 2659  0.01   0.01
## 2669  0.00   0.00
## 2671  0.00   0.01
## 2674  0.01   0.01
## 2682  0.00   0.01_*
## 2684  0.00   0.01
## 2689  0.00   0.01_*
## 2696  0.00   0.01
## 2699  0.00   0.02_*
## 2706  0.00   0.01
```

```
## 2714  0.25   0.08_*
## 2716  0.00   0.02_*
## 2718  0.00   0.01_*
## 2720  0.00   0.01
## 2724  0.01   0.03_*
## 2726  0.01   0.01
## 2727  0.01   0.01
## 2729  0.00   0.02_*
## 2733  0.00   0.02_*
## 2747  0.00   0.01
## 2783  0.00   0.01
## 2785  0.00   0.02_*
## 2789  0.00   0.00
## 2790  0.00   0.02_*
## 2809  0.00   0.00
## 2811  0.00   0.01
## 2826  0.00   0.01_*
## 2842  0.00   0.00
## 2858  0.00   0.00
## 2922  0.00   0.00
## 3040  0.00   0.00
```

Remove outliers:

```
# filter outlier 282
step_model_no_282 <- cancer_county %>%
  dplyr::select(-median_age, -pct_black, -median_age_female, avg_household_size) %>%
  tibble::rowid_to_column() %>%
  filter(rowid != 282) %>%
  na.omit()

step_no_282 <- update(stepwise_model, . ~ ., data = step_model_no_282)
summary(step_no_282)
```

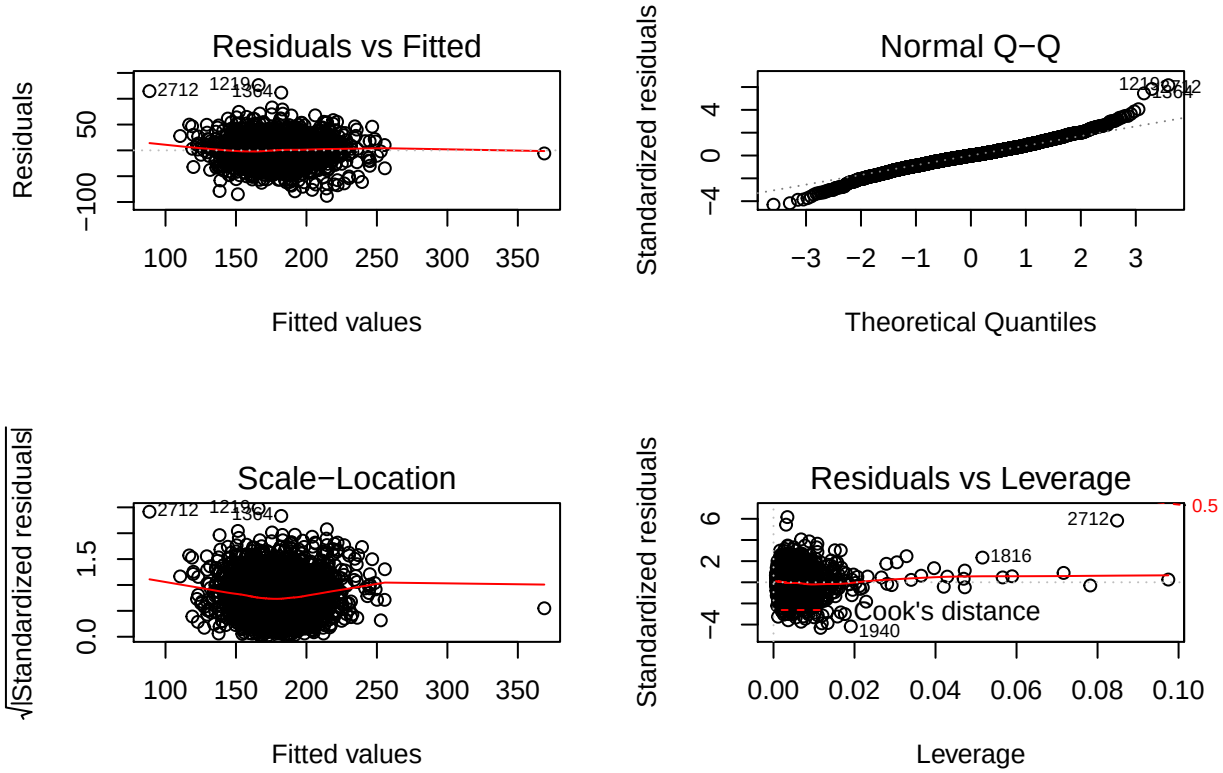
```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_white + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage + income_cat, data = step_model_no_282)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -93.887 -11.689  -0.051  11.936 126.194
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)            69.286035  11.623979   5.961 2.80e-09 ***
## incidence_rate          0.228536   0.007592  30.102  < 2e-16 ***
## poverty_percent         1.045635   0.118358   8.834  < 2e-16 ***
## median_age_male        -0.214490   0.085989  -2.494  0.01267 *
## pct_unemployed16_over   0.750476   0.151124   4.966 7.21e-07 ***
```

```
## pct_white               0.084336   0.034622   2.436  0.01491 *
## pct_asian              -0.587738   0.166433  -3.531  0.00042 ***
## pct_other_race         -0.920930   0.118468  -7.774 1.04e-14 ***
## pct_married_households -0.224288   0.085471  -2.624  0.00873 **
## pct_upto_hs18_24        0.385467   0.037529  10.271  < 2e-16 ***
## pct_with_coverage      -0.215951   0.098701  -2.188  0.02875 *
## income_cat             -4.039980   1.490114  -2.711  0.00674 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 20.62 on 3034 degrees of freedom
## Multiple R-squared:  0.4501, Adjusted R-squared:  0.4481
## F-statistic: 225.7 on 11 and 3034 DF,  p-value: < 2.2e-16
```

```r
# filter #282, 1059
step_model_no_all <- cancer_county %>%
  dplyr::select(-median_age, -pct_black, -median_age_female, avg_household_size) %>%
  tibble::rowid_to_column() %>%
  filter(rowid != 282 & rowid != 1059) %>%
  na.omit()

step_no_all <- update(stepwise_model, . ~ ., data = step_model_no_all)
summary(step_no_all)
```

```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_white + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage + income_cat, data = step_model_no_all)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -88.069 -11.710  -0.021  11.854 126.460
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)            65.423198  11.615333   5.632 1.94e-08 ***
## incidence_rate          0.227187   0.007572  30.002  < 2e-16 ***
## poverty_percent         1.073476   0.118117   9.088  < 2e-16 ***
## median_age_male        -0.212629   0.085703  -2.481 0.013155 *
## pct_unemployed16_over   0.820282   0.151376   5.419 6.47e-08 ***
## pct_white               0.091233   0.034539   2.641 0.008297 **
## pct_asian              -0.583348   0.165881  -3.517 0.000443 ***
## pct_other_race         -0.900209   0.118158  -7.619 3.40e-14 ***
## pct_married_households -0.211546   0.085231  -2.482 0.013117 *
## pct_upto_hs18_24        0.382276   0.037410  10.218  < 2e-16 ***
## pct_with_coverage      -0.188060   0.098557  -1.908 0.056468 .
## income_cat             -4.075167   1.485162  -2.744 0.006107 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 20.55 on 3033 degrees of freedom
## Multiple R-squared:  0.4528, Adjusted R-squared:  0.4508
## F-statistic: 228.2 on 11 and 3033 DF,  p-value: < 2.2e-16
```

```
par(mfrow = c(2,2))
plot(step_no_all)
```



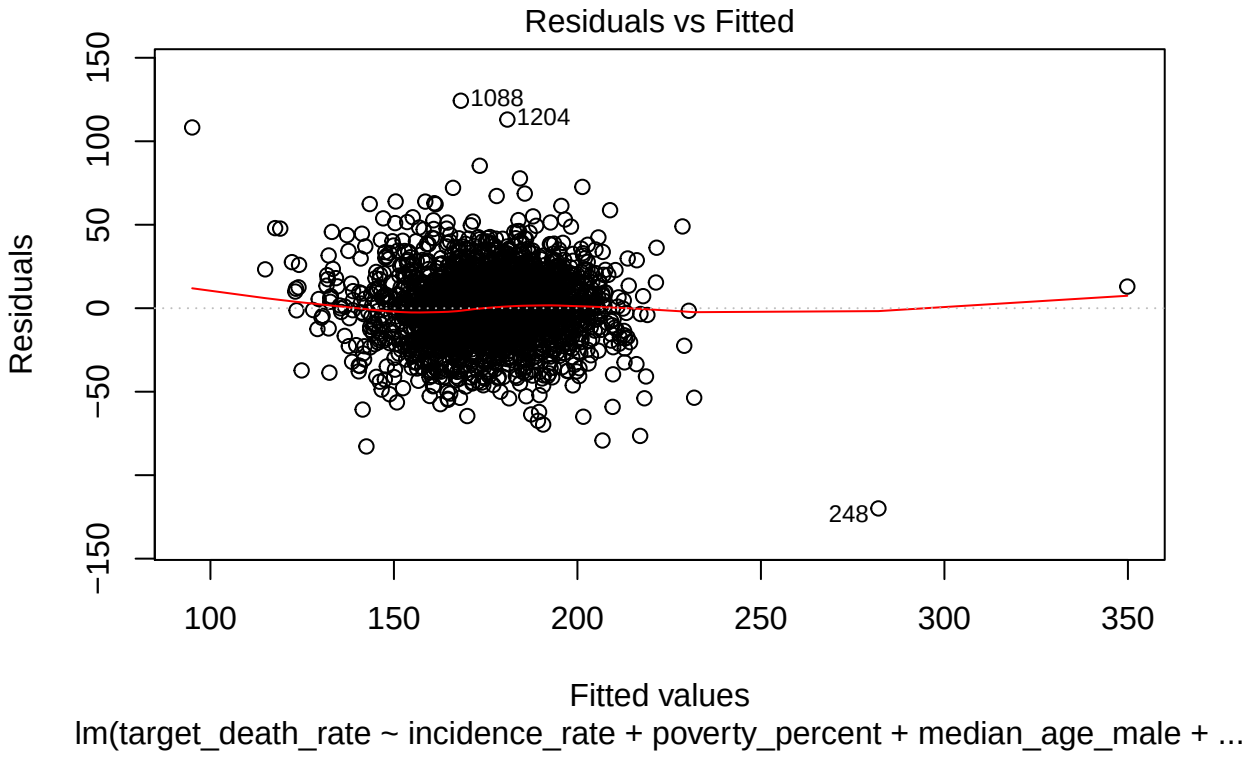
Separate Income Level

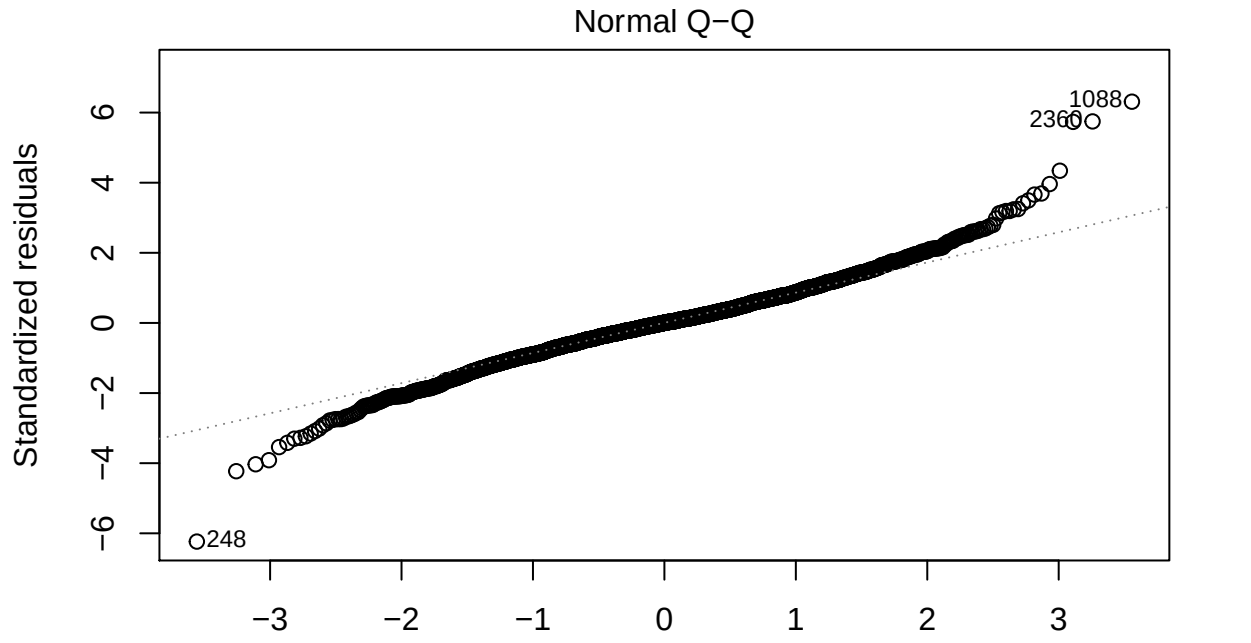
```
income_low_data <- cancer_county %>% filter(income_cat == 0) %>% dplyr::select(-income_cat)
income_high_data <- cancer_county %>% filter(income_cat == 1) %>% dplyr::select(-income_cat)

model_low_income <- lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_white + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_low_data)

model_high_income <- lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_white + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_high_data)

summary_table = cbind(summary(model_low_income)$coefficients[,1],
                      summary(model_low_income)$coefficients[,4],
                      summary(model_high_income)$coefficients[,1],
                      summary(model_high_income)$coefficients[,4])
summary_table
```

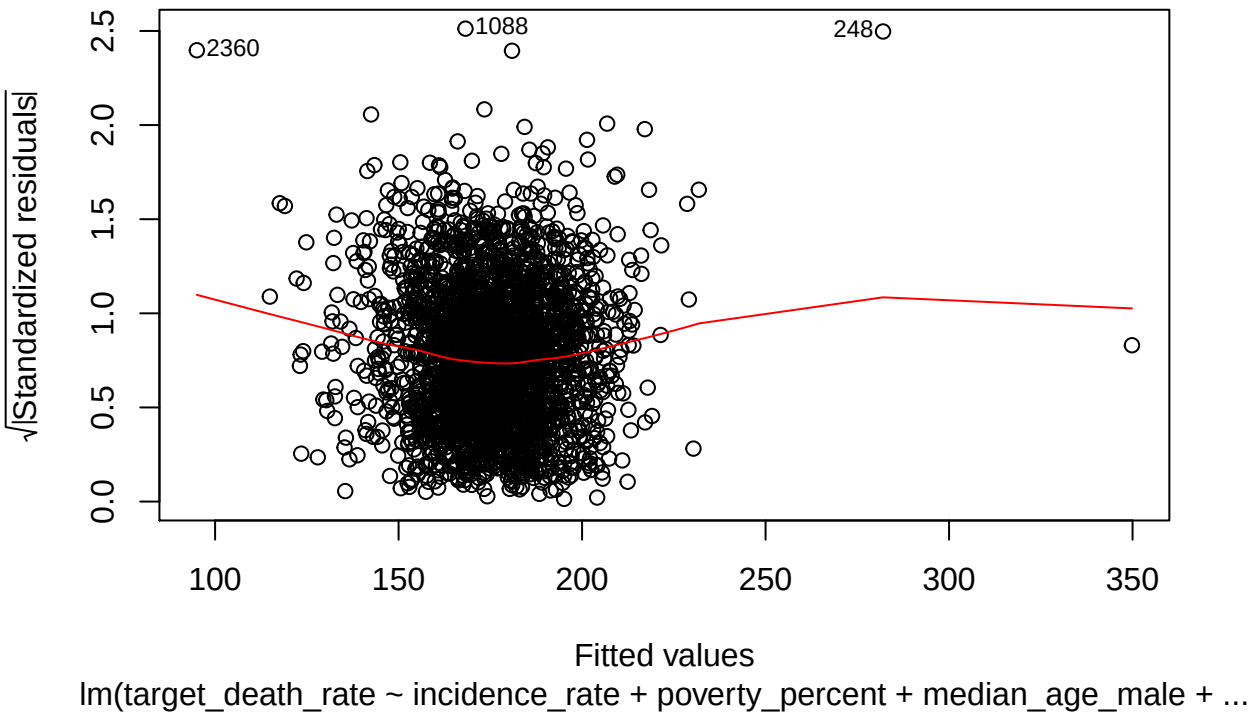
```
##                               [,1]         [,2]        [,3]          [,4]
## (Intercept)           -9.98041269 7.616353e-01 95.16691074  8.652255e-15
## incidence_rate         0.27773708 2.339449e-33  0.20015626 1.696636e-126
```

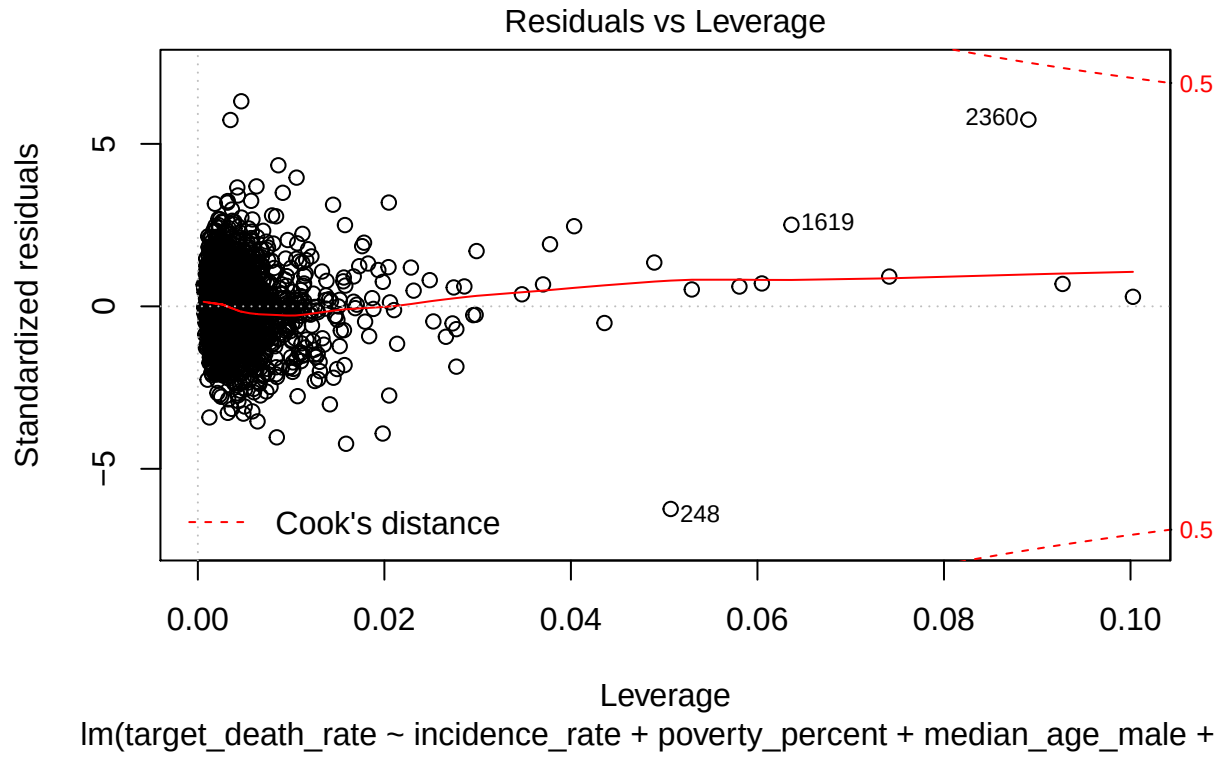
```
## poverty_percent          0.63536720 5.154360e-02  0.94031205  3.006044e-13
## median_age_male         -0.22206171 4.872790e-01 -0.27457885  1.840149e-03
## pct_unemployed16_over    0.01592747 9.670511e-01  0.98793425  1.865499e-09
## pct_white                0.20031237 3.292692e-02 -0.01723638  6.683679e-01
## pct_asian               -5.19387943 1.079811e-02 -0.77626937  3.481646e-06
## pct_other_race          -0.90270280 5.383448e-03 -1.07379851  6.805986e-17
## pct_married_households -0.45314232 1.701884e-01 -0.25796135  3.124664e-03
## pct_upto_hs18_24         0.28738237 1.442042e-02  0.40498578  7.434234e-25
## pct_with_coverage        0.92366136 2.082438e-03 -0.27491829  9.122972e-03
```

```
plot(model_high_income)
```

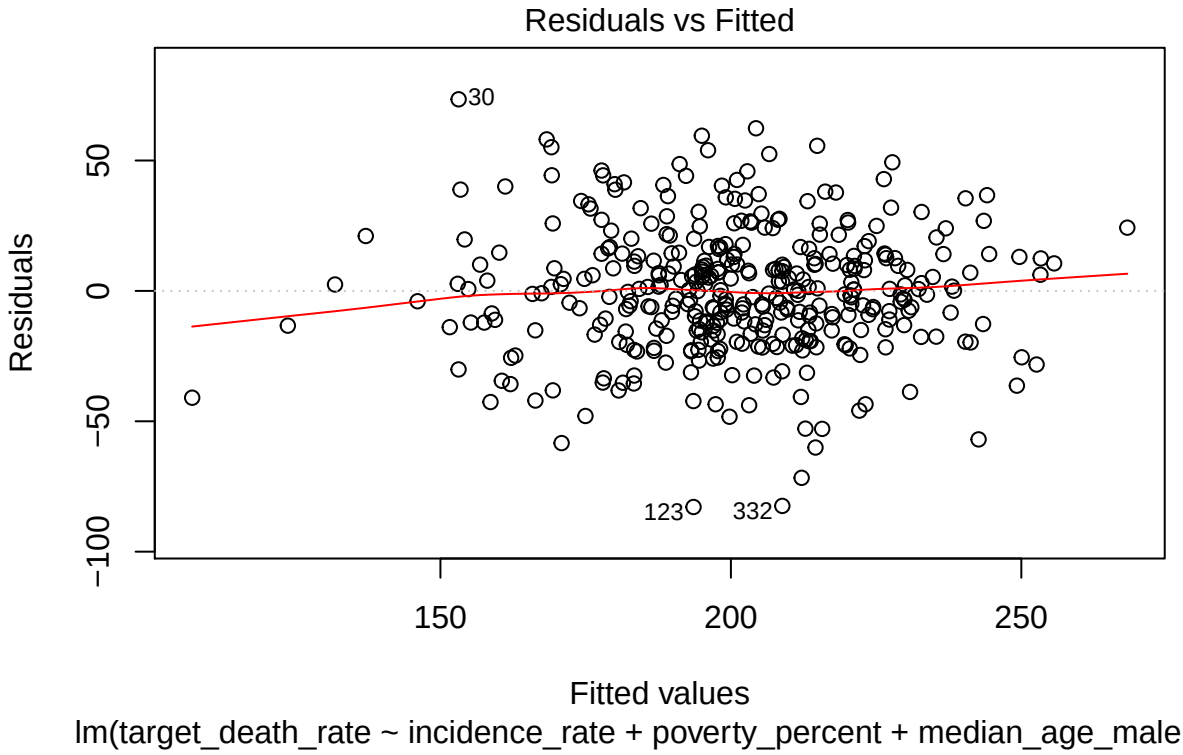


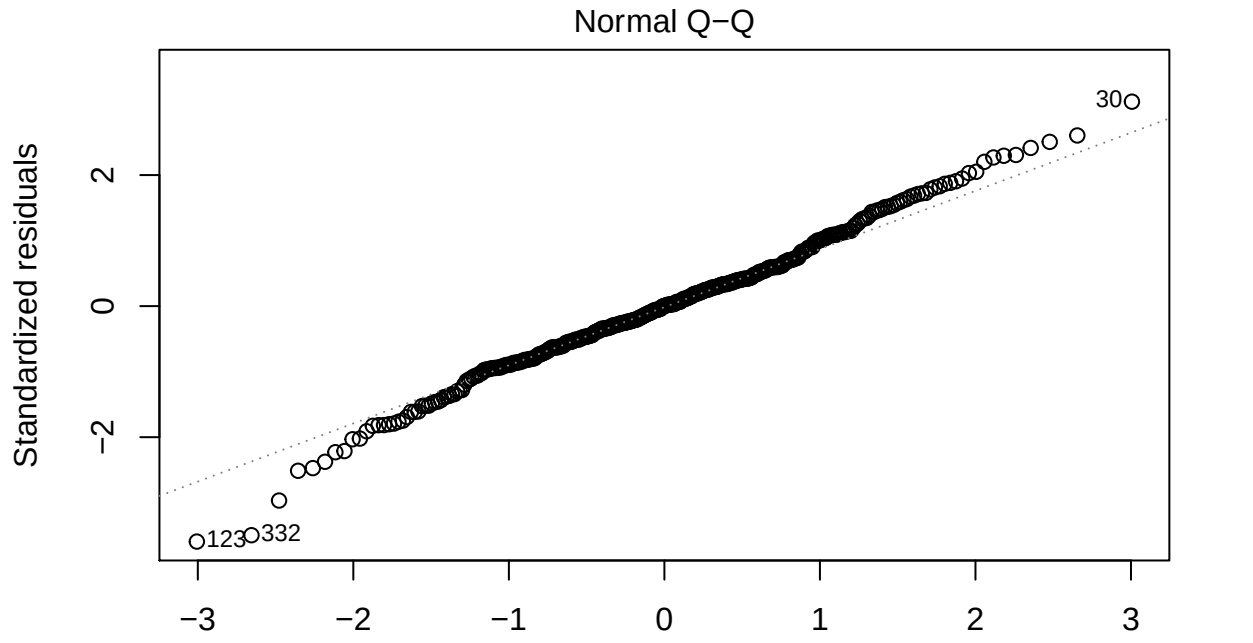

Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
1088
2360
248

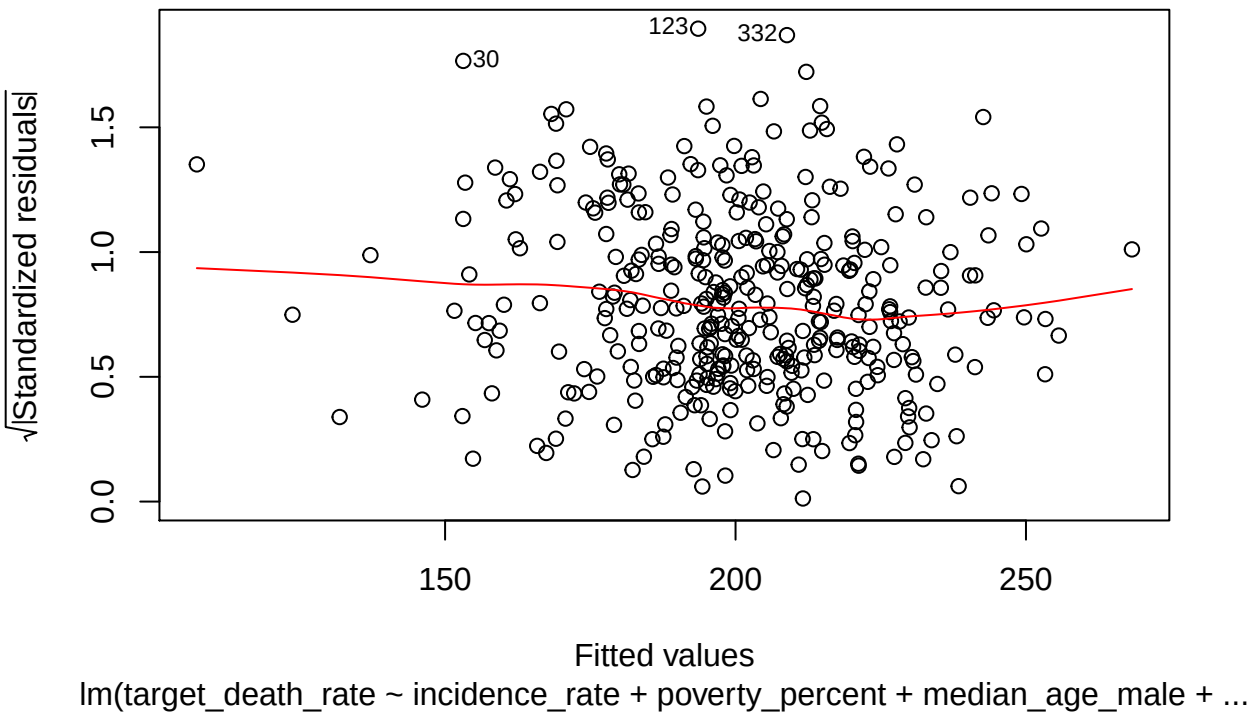

Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
2360
1088
248

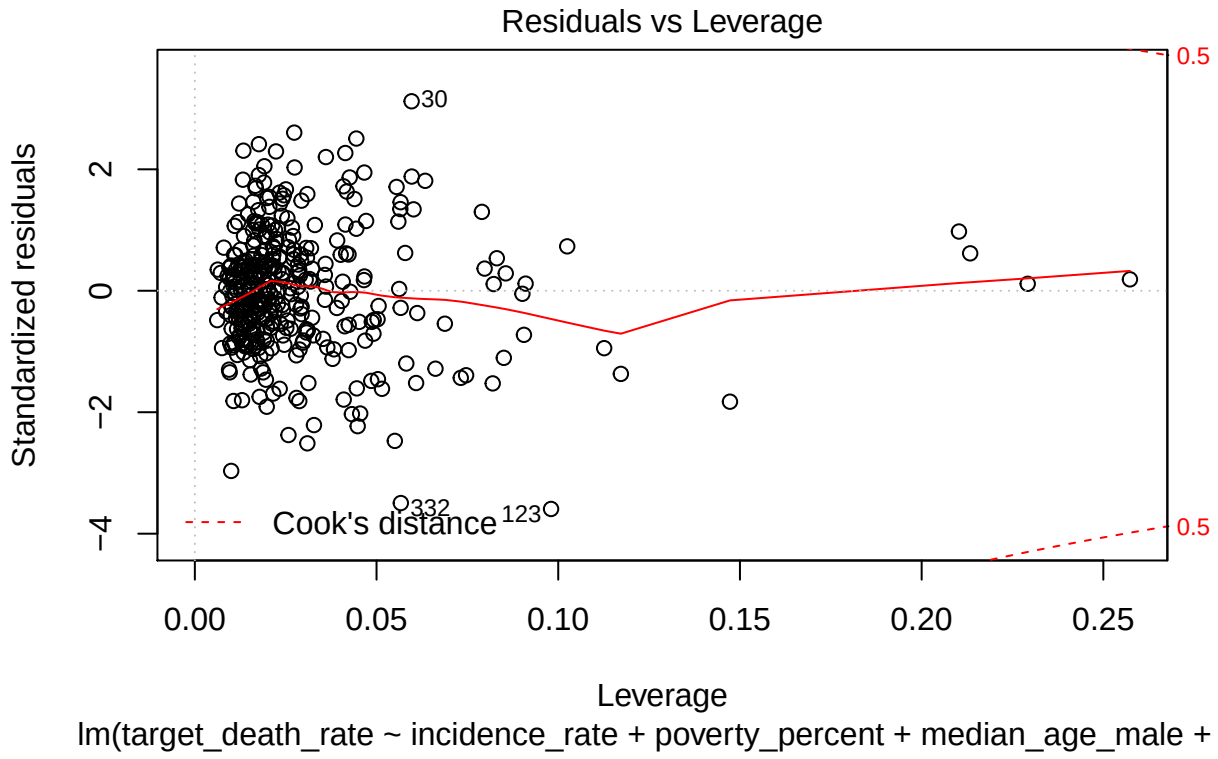



```
plot(model_low_income)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
30
123
332
−3
−2
−1
0
1
2
3


Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
123
332
30
0.0
0.5
1.0
1.5
150
200
250




```
dim(income_high_data)
```

```
## [1] 2669   15
```

```
dim(income_low_data)
```

```
## [1] 378  15
```

Stepwise by Income Level

```
# low income
full_model_low <- lm(target_death_rate ~., data = income_low_data)
summary(full_model_low)
```

```
##
## Call:
## lm(formula = target_death_rate ~ ., data = income_low_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -71.007 -13.685   0.306  13.741  70.463
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)            -5.621931  35.161833  -0.160 0.873059
## incidence_rate          0.284582   0.020753  13.713  < 2e-16 ***
## poverty_percent         0.699413   0.326259   2.144 0.032718 *
## median_age             -0.001782   0.033246  -0.054 0.957295
## median_age_male        -1.604684   0.606440  -2.646 0.008498 **
## median_age_female       1.688740   0.597041   2.829 0.004936 **
```

```
## avg_household_size     -1.042002   3.058094  -0.341 0.733500
## pct_unemployed16_over  -0.009237   0.387431  -0.024 0.980992
## pct_white              -0.087916   0.135784  -0.647 0.517736
## pct_black              -0.374241   0.121281  -3.086 0.002186 **
## pct_asian              -5.128157   2.034947  -2.520 0.012162 *
## pct_other_race         -1.134103   0.334695  -3.388 0.000780 ***
## pct_married_households -0.531820   0.332391  -1.600 0.110472
## pct_upto_hs18_24        0.221861   0.117064   1.895 0.058858 .
## pct_with_coverage       1.095918   0.300486   3.647 0.000304 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 23.97 on 363 degrees of freedom
## Multiple R-squared:  0.4999, Adjusted R-squared:  0.4806
## F-statistic: 25.92 on 14 and 363 DF,  p-value: < 2.2e-16
```

```
step(full_model_low, direction = "backward")
```

```
## Start:  AIC=2416.34
## target_death_rate ~ incidence_rate + poverty_percent + median_age +
##     median_age_male + median_age_female + avg_household_size +
##     pct_unemployed16_over + pct_white + pct_black + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage
##
##                          Df Sum of Sq    RSS    AIC
## - pct_unemployed16_over   1         0 208559 2414.3
## - median_age              1         2 208560 2414.3
## - avg_household_size      1        67 208625 2414.5
## - pct_white               1       241 208799 2414.8
## <none>                                208559 2416.3
## - pct_married_households  1      1471 210029 2417.0
## - pct_upto_hs18_24        1      2064 210622 2418.1
## - poverty_percent         1      2640 211199 2419.1
## - pct_asian               1      3649 212207 2420.9
## - median_age_male         1      4023 212581 2421.6
## - median_age_female       1      4597 213155 2422.6
## - pct_black               1      5471 214029 2424.1
## - pct_other_race          1      6597 215155 2426.1
## - pct_with_coverage       1      7642 216201 2427.9
## - incidence_rate          1    108036 316594 2572.1
##
## Step:  AIC=2414.35
## target_death_rate ~ incidence_rate + poverty_percent + median_age +
##     median_age_male + median_age_female + avg_household_size +
##     pct_white + pct_black + pct_asian + pct_other_race + pct_married_households +
##     pct_upto_hs18_24 + pct_with_coverage
##
##                          Df Sum of Sq    RSS    AIC
## - median_age              1         2 208561 2412.3
## - avg_household_size      1        67 208626 2412.5
## - pct_white               1       245 208804 2412.8
## <none>                                208559 2414.3
## - pct_married_households  1      1478 210037 2415.0
## - pct_upto_hs18_24        1      2064 210623 2416.1
```

```
## - poverty_percent         1      2857 211416 2417.5
## - pct_asian               1      3663 212222 2418.9
## - median_age_male         1      4050 212609 2419.6
## - median_age_female       1      4621 213180 2420.6
## - pct_black               1      5494 214053 2422.2
## - pct_other_race          1      6872 215431 2424.6
## - pct_with_coverage       1      7671 216230 2426.0
## - incidence_rate          1    108727 317286 2570.9
##
## Step:  AIC=2412.35
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     median_age_female + avg_household_size + pct_white + pct_black +
##     pct_asian + pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage
##
##                          Df Sum of Sq    RSS    AIC
## - avg_household_size      1        68 208628 2410.5
## - pct_white               1       243 208804 2410.8
## <none>                                208561 2412.3
## - pct_married_households  1      1479 210039 2413.0
## - pct_upto_hs18_24        1      2064 210625 2414.1
## - poverty_percent         1      2875 211436 2415.5
## - pct_asian               1      3663 212223 2416.9
## - median_age_male         1      4058 212618 2417.6
## - median_age_female       1      4621 213182 2418.6
## - pct_black               1      5517 214078 2420.2
## - pct_other_race          1      6873 215434 2422.6
## - pct_with_coverage       1      7806 216367 2424.2
## - incidence_rate          1    109612 318173 2570.0
##
## Step:  AIC=2410.47
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     median_age_female + pct_white + pct_black + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage
##
##                          Df Sum of Sq    RSS    AIC
## - pct_white               1       200 208828 2408.8
## <none>                                208628 2410.5
## - pct_married_households  1      1566 210195 2411.3
## - pct_upto_hs18_24        1      2130 210759 2412.3
## - poverty_percent         1      2808 211436 2413.5
## - pct_asian               1      3596 212224 2414.9
## - median_age_male         1      4072 212701 2415.8
## - median_age_female       1      4847 213475 2417.2
## - pct_black               1      5507 214136 2418.3
## - pct_other_race          1      6987 215616 2420.9
## - pct_with_coverage       1      7806 216435 2422.4
## - incidence_rate          1    110176 318805 2568.8
##
## Step:  AIC=2408.83
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     median_age_female + pct_black + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage
##
```

```
##                           Df Sum of Sq    RSS    AIC
## <none>                                  208828 2408.8
## - pct_upto_hs18_24         1      2393 211222 2411.1
## - pct_married_households   1      2520 211349 2411.4
## - poverty_percent          1      2690 211518 2411.7
## - pct_asian                1      3771 212599 2413.6
## - median_age_male          1      4023 212852 2414.1
## - median_age_female        1      4647 213476 2415.2
## - pct_other_race           1      6788 215617 2418.9
## - pct_with_coverage        1      7623 216452 2420.4
## - pct_black                1      8384 217212 2421.7
## - incidence_rate           1    110965 319793 2567.9
```

```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + median_age_female + pct_black + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage, data = income_low_data)
##
## Coefficients:
##            (Intercept)          incidence_rate         poverty_percent
##                -6.7837                  0.2831                  0.6631
##        median_age_male       median_age_female               pct_black
##                -1.5990                  1.6474                 -0.3151
##              pct_asian          pct_other_race  pct_married_households
##                -5.1184                 -1.1093                 -0.6253
##       pct_upto_hs18_24       pct_with_coverage
##                 0.2354                  1.0621
```

```
backward_model_low <- lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + median_age_female + pct_black + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_low_data)
summary(backward_model_low)
```

```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + median_age_female + pct_black + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage, data = income_low_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -71.584 -13.813  -0.024  13.851  69.455
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)            -6.78373   32.21806  -0.211 0.833350
## incidence_rate          0.28314    0.02028  13.965  < 2e-16 ***
## poverty_percent         0.66310    0.30497   2.174 0.030321 *
## median_age_male        -1.59902    0.60135  -2.659 0.008180 **
## median_age_female       1.64742    0.57646   2.858 0.004509 **
## pct_black              -0.31512    0.08210  -3.838 0.000146 ***
```

```
## pct_asian              -5.11844    1.98835  -2.574 0.010438 *
## pct_other_race         -1.10933    0.32118  -3.454 0.000617 ***
## pct_married_households -0.62529    0.29711  -2.105 0.036009 *
## pct_upto_hs18_24        0.23543    0.11479   2.051 0.040992 *
## pct_with_coverage       1.06213    0.29018   3.660 0.000289 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 23.85 on 367 degrees of freedom
## Multiple R-squared:  0.4992, Adjusted R-squared:  0.4856
## F-statistic: 36.59 on 10 and 367 DF,  p-value: < 2.2e-16
```

```
# high income
full_model_high <- lm(target_death_rate ~., data = income_high_data)
summary(full_model_high)
```

```
##
## Call:
## lm(formula = target_death_rate ~ ., data = income_high_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -119.771  -11.264    0.223   11.410  123.636
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)            92.662611  13.217700   7.010 3.00e-12 ***
## incidence_rate          0.199461   0.007958  25.063  < 2e-16 ***
## poverty_percent         0.927587   0.129691   7.152 1.10e-12 ***
## median_age             -0.002868   0.008358  -0.343 0.731525
## median_age_male        -0.247908   0.223519  -1.109 0.267482
## median_age_female      -0.038208   0.219559  -0.174 0.861860
## avg_household_size     -0.243315   1.044062  -0.233 0.815743
## pct_unemployed16_over   0.988191   0.165310   5.978 2.57e-09 ***
## pct_white               0.038794   0.066375   0.584 0.558956
## pct_black               0.073062   0.067584   1.081 0.279767
## pct_asian              -0.699572   0.181421  -3.856 0.000118 ***
## pct_other_race         -1.029068   0.134008  -7.679 2.24e-14 ***
## pct_married_households -0.254272   0.089532  -2.840 0.004546 **
## pct_upto_hs18_24        0.409273   0.039506  10.360  < 2e-16 ***
## pct_with_coverage      -0.294225   0.108429  -2.714 0.006700 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.75 on 2654 degrees of freedom
## Multiple R-squared:  0.396,  Adjusted R-squared:  0.3928
## F-statistic: 124.3 on 14 and 2654 DF,  p-value: < 2.2e-16
```

```
step(full_model_high, direction = "backward")
```

```
## Start:  AIC=15938.37
## target_death_rate ~ incidence_rate + poverty_percent + median_age +
##     median_age_male + median_age_female + avg_household_size +
##     pct_unemployed16_over + pct_white + pct_black + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
```

```
##     pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## - median_age_female        1        12 1034983 15936
## - avg_household_size       1        21 1034992 15936
## - median_age               1        46 1035017 15936
## - pct_white                1       133 1035104 15937
## - pct_black                1       456 1035427 15938
## - median_age_male          1       480 1035451 15938
## <none>                                 1034971 15938
## - pct_with_coverage        1      2871 1037843 15944
## - pct_married_households   1      3145 1038116 15944
## - pct_asian                1      5799 1040770 15951
## - pct_unemployed16_over    1     13935 1048906 15972
## - poverty_percent          1     19949 1054920 15987
## - pct_other_race           1     22996 1057967 15995
## - pct_upto_hs18_24         1     41853 1076824 16042
## - incidence_rate           1    244965 1279936 16503
##
## Step:  AIC=15936.4
## target_death_rate ~ incidence_rate + poverty_percent + median_age +
##     median_age_male + avg_household_size + pct_unemployed16_over +
##     pct_white + pct_black + pct_asian + pct_other_race + pct_married_households +
##     pct_upto_hs18_24 + pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## - avg_household_size       1        18 1035001 15934
## - median_age               1        46 1035029 15934
## - pct_white                1       128 1035111 15935
## - pct_black                1       445 1035428 15936
## <none>                                 1034983 15936
## - pct_with_coverage        1      2976 1037959 15942
## - pct_married_households   1      3135 1038118 15942
## - median_age_male          1      3633 1038616 15944
## - pct_asian                1      5793 1040776 15949
## - pct_unemployed16_over    1     13989 1048972 15970
## - poverty_percent          1     20051 1055034 15986
## - pct_other_race           1     23007 1057990 15993
## - pct_upto_hs18_24         1     42543 1077526 16042
## - incidence_rate           1    245682 1280665 16503
##
## Step:  AIC=15934.45
## target_death_rate ~ incidence_rate + poverty_percent + median_age +
##     median_age_male + pct_unemployed16_over + pct_white + pct_black +
##     pct_asian + pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## - median_age               1        47 1035048 15933
## - pct_white                1       138 1035140 15933
## - pct_black                1       458 1035459 15934
## <none>                                 1035001 15934
## - pct_with_coverage        1      2959 1037960 15940
## - pct_married_households   1      3409 1038410 15941
```

```
## - median_age_male         1      3805 1038806 15942
## - pct_asian               1      5832 1040834 15947
## - pct_unemployed16_over   1     14062 1049064 15968
## - poverty_percent         1     20167 1055168 15984
## - pct_other_race          1     23093 1058095 15991
## - pct_upto_hs18_24        1     42542 1077544 16040
## - incidence_rate          1    246317 1281319 16502
##
## Step:  AIC=15932.57
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     pct_unemployed16_over + pct_white + pct_black + pct_asian +
##     pct_other_race + pct_married_households + pct_upto_hs18_24 +
##     pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## - pct_white                1       136 1035185 15931
## - pct_black                1       452 1035500 15932
## <none>                                 1035048 15933
## - pct_with_coverage        1      2953 1038002 15938
## - pct_married_households   1      3398 1038446 15939
## - median_age_male          1      3944 1038992 15941
## - pct_asian                1      5827 1040875 15946
## - pct_unemployed16_over    1     14025 1049073 15966
## - poverty_percent          1     20229 1055277 15982
## - pct_other_race           1     23114 1058162 15990
## - pct_upto_hs18_24         1     42533 1077581 16038
## - incidence_rate           1    246274 1281322 16500
##
## Step:  AIC=15930.92
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     pct_unemployed16_over + pct_black + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## - pct_black                1       387 1035572 15930
## <none>                                 1035185 15931
## - pct_with_coverage        1      2817 1038002 15936
## - pct_married_households   1      3262 1038447 15937
## - median_age_male          1      3811 1038996 15939
## - pct_asian                1      9206 1044390 15953
## - pct_unemployed16_over    1     13889 1049073 15964
## - poverty_percent          1     20411 1055596 15981
## - pct_other_race           1     27135 1062320 15998
## - pct_upto_hs18_24         1     42605 1077789 16037
## - incidence_rate           1    247263 1282448 16501
##
## Step:  AIC=15929.92
## target_death_rate ~ incidence_rate + poverty_percent + median_age_male +
##     pct_unemployed16_over + pct_asian + pct_other_race + pct_married_households +
##     pct_upto_hs18_24 + pct_with_coverage
##
##                           Df Sum of Sq     RSS   AIC
## <none>                                 1035572 15930
## - pct_with_coverage        1      2790 1038362 15935
```

```
## - pct_married_households  1      4110 1039682 15938
## - median_age_male         1      4387 1039959 15939
## - pct_asian               1      9084 1044655 15951
## - pct_unemployed16_over   1     15086 1050658 15966
## - poverty_percent         1     21094 1056666 15982
## - pct_other_race          1     27742 1063313 15998
## - pct_upto_hs18_24        1     43134 1078706 16037
## - incidence_rate          1    249078 1284650 16503
```

```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
##     data = income_high_data)
##
## Coefficients:
##            (Intercept)          incidence_rate         poverty_percent
##                94.8143                  0.2002                  0.9428
##        median_age_male   pct_unemployed16_over               pct_asian
##                -0.2847                  1.0012                  -0.7501
##         pct_other_race  pct_married_households        pct_upto_hs18_24
##                -1.0655                 -0.2695                  0.4069
##      pct_with_coverage
##                -0.2801
```

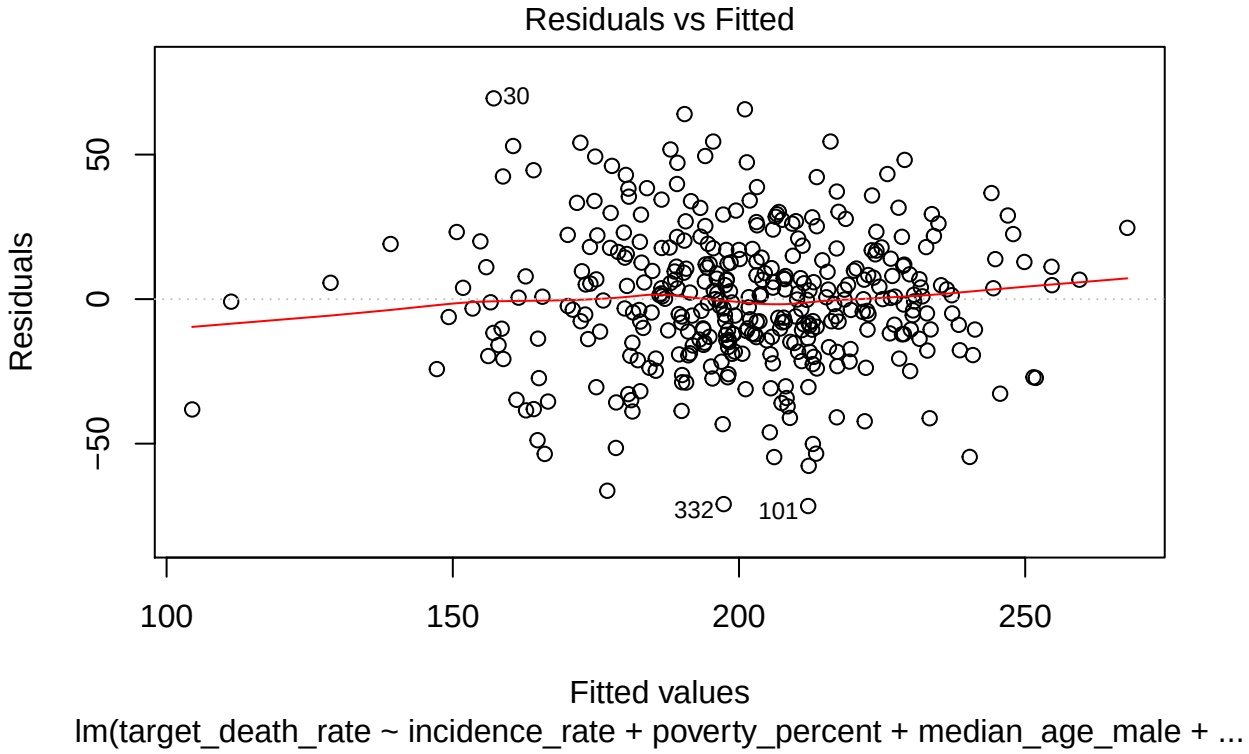
```
backward_model_high <- lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
    pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
    data = income_high_data)
summary(backward_model_high)
```

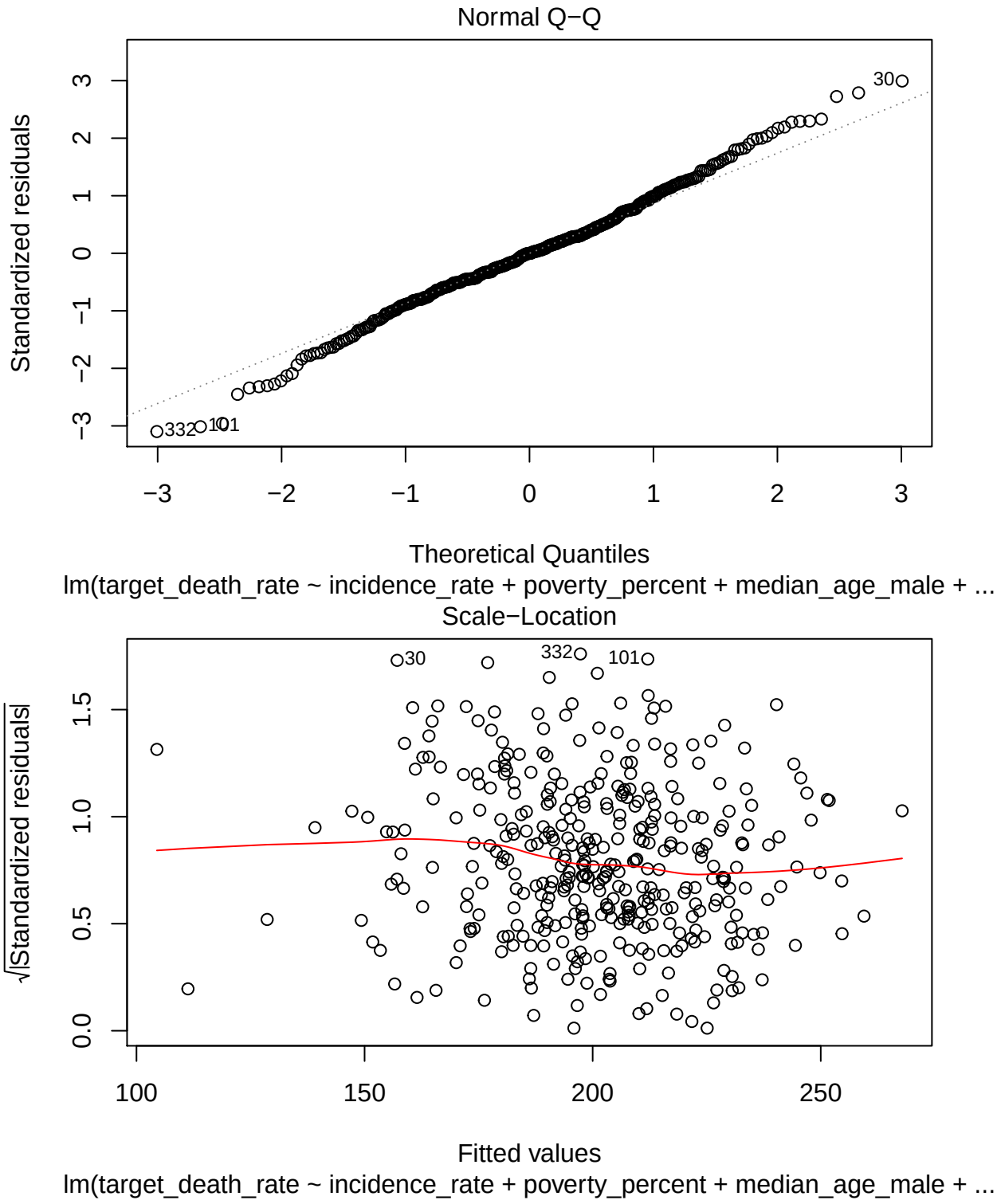
```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
##     data = income_high_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -120.096  -11.354    0.142   11.441  124.769
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)            94.814283  12.167303   7.793 9.34e-15 ***
## incidence_rate          0.200212   0.007917  25.289  < 2e-16 ***
## poverty_percent         0.942798   0.128106   7.360 2.45e-13 ***
## median_age_male        -0.284695   0.084824  -3.356 0.000801 ***
## pct_unemployed16_over   1.001186   0.160862   6.224 5.62e-10 ***
## pct_asian              -0.750069   0.155312  -4.829 1.45e-06 ***
## pct_other_race         -1.065515   0.126248  -8.440  < 2e-16 ***
## pct_married_households -0.269476   0.082954  -3.249 0.001175 **
## pct_upto_hs18_24        0.406944   0.038668  10.524  < 2e-16 ***
## pct_with_coverage      -0.280093   0.104649  -2.676 0.007485 **
```

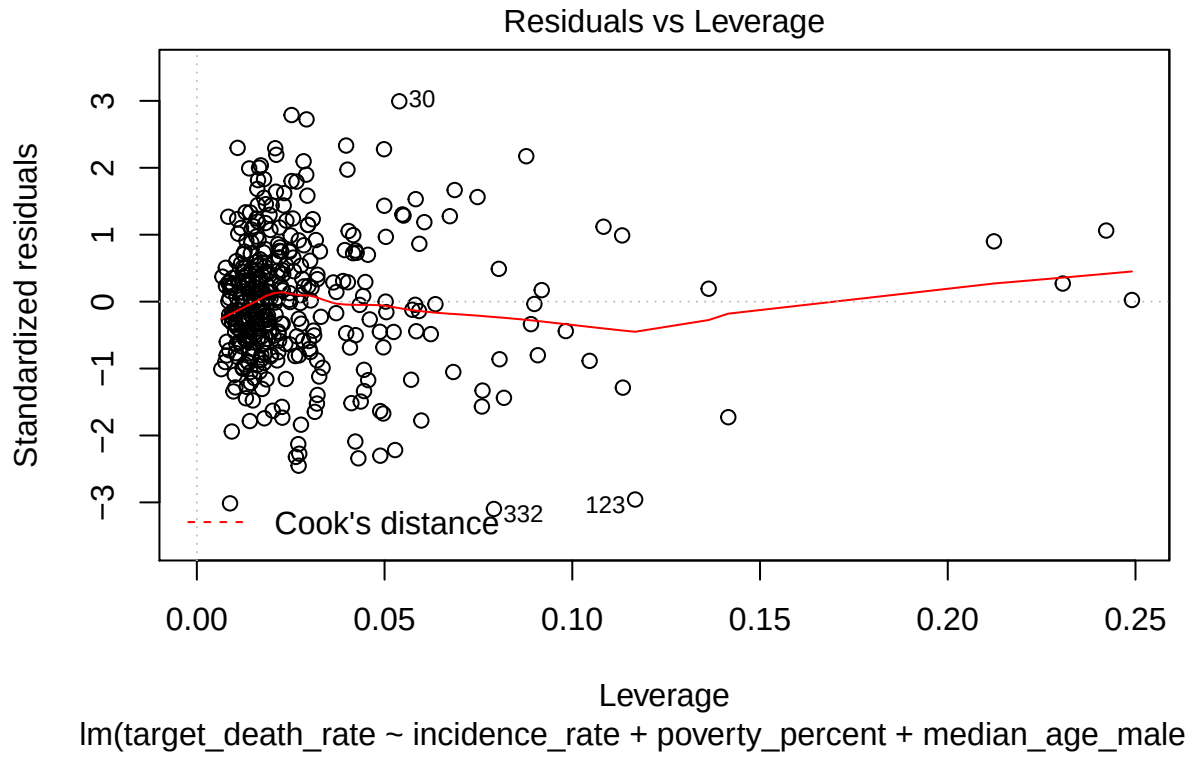
```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.73 on 2659 degrees of freedom
## Multiple R-squared:  0.3956, Adjusted R-squared:  0.3936
## F-statistic: 193.4 on 9 and 2659 DF,  p-value: < 2.2e-16
```

Check Assumption

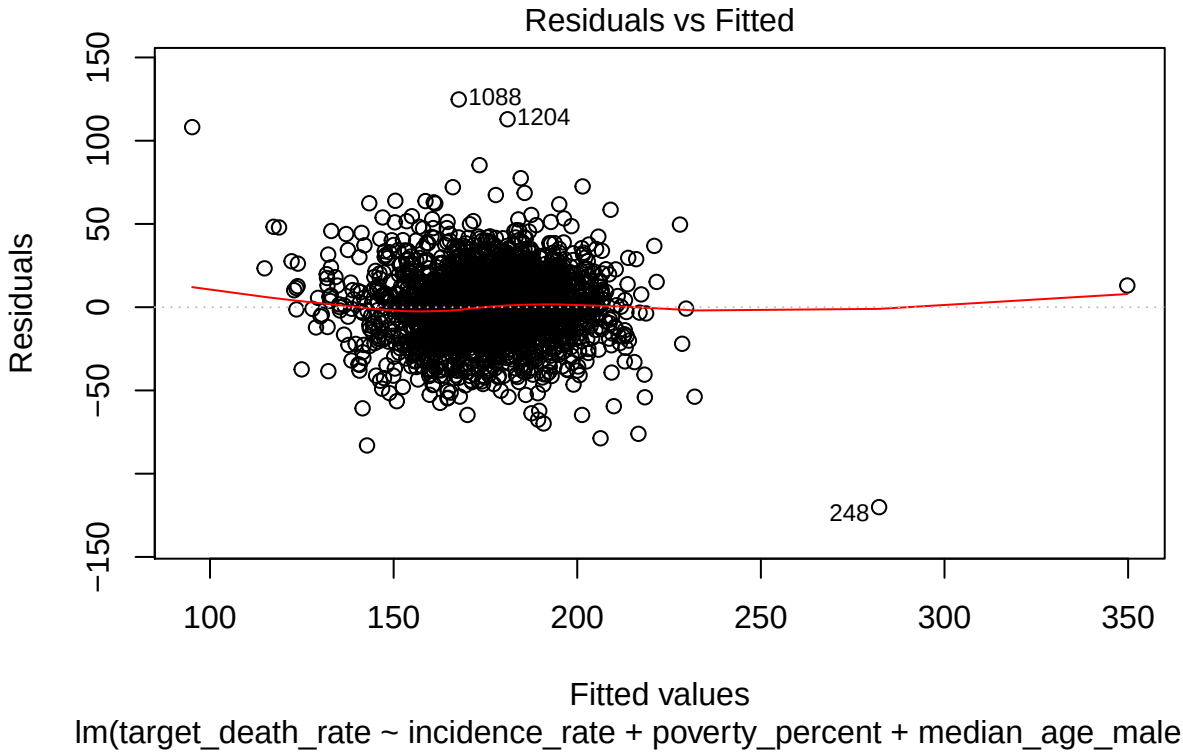
```
plot(backward_model_low)
```

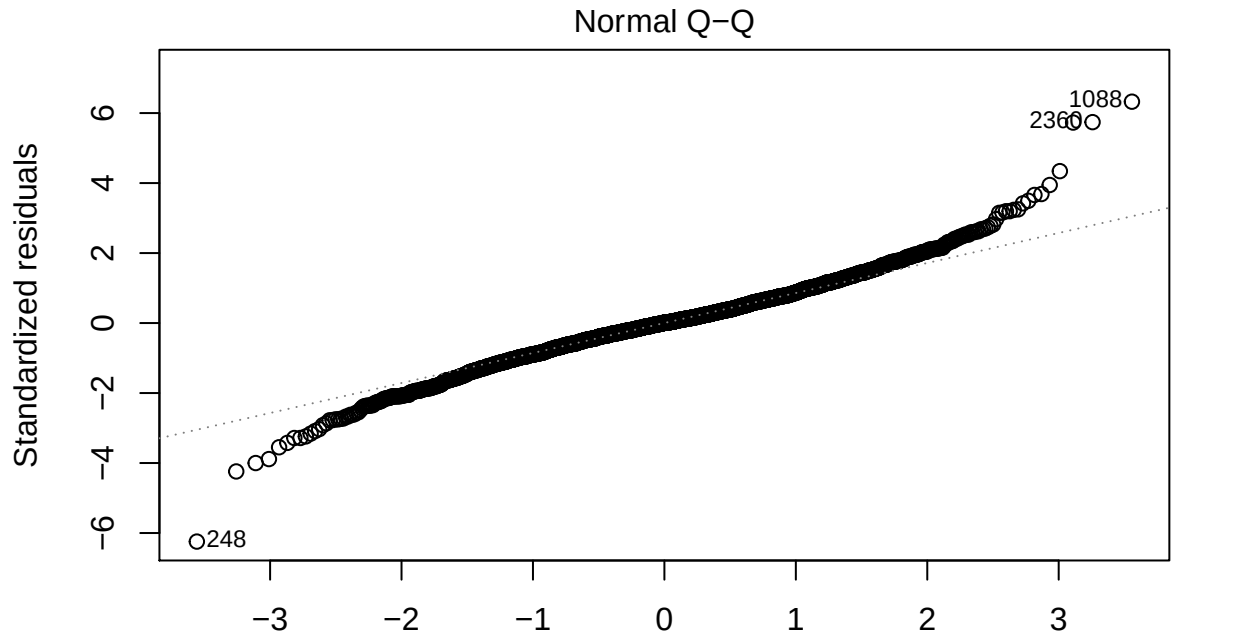


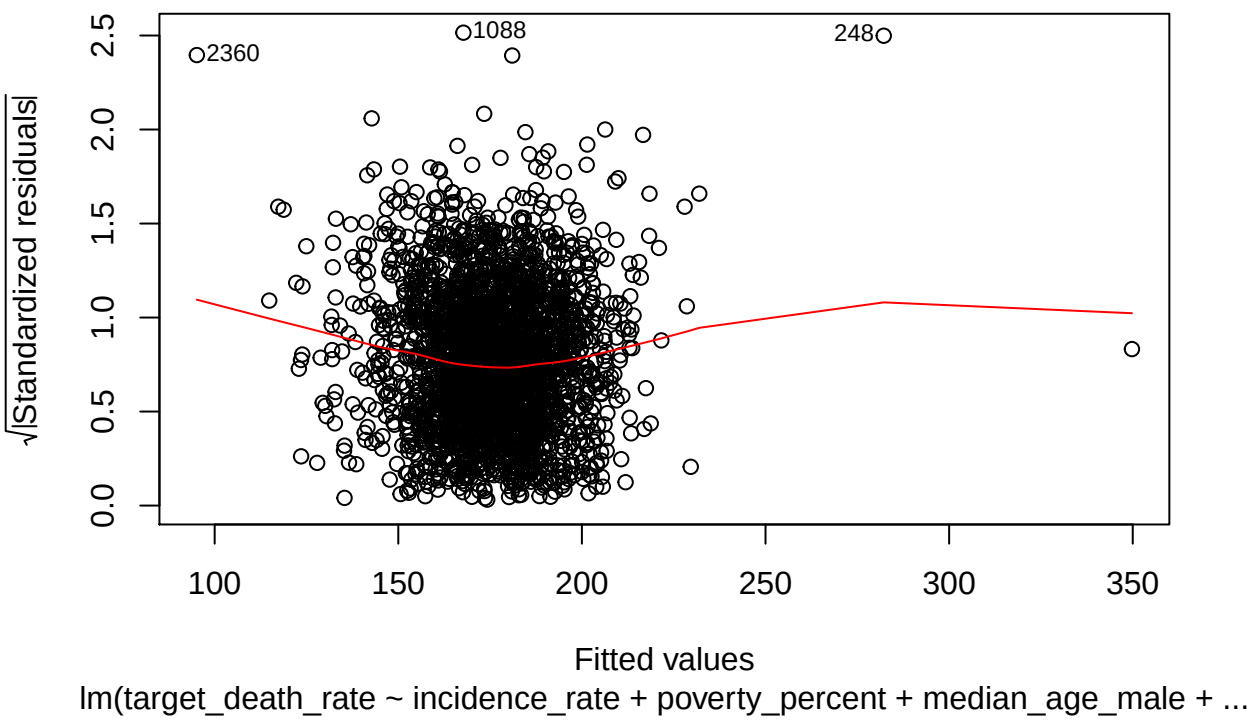

Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...

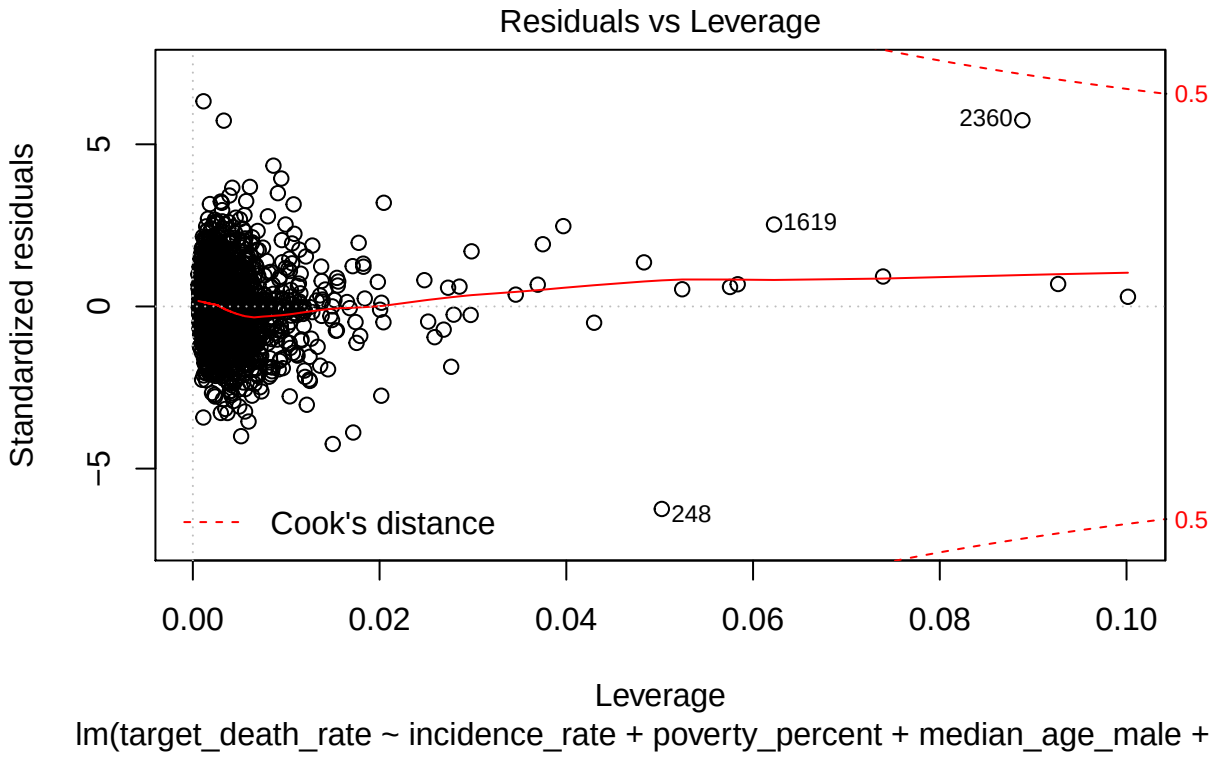



```
plot(backward_model_high)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
1088
2360
248

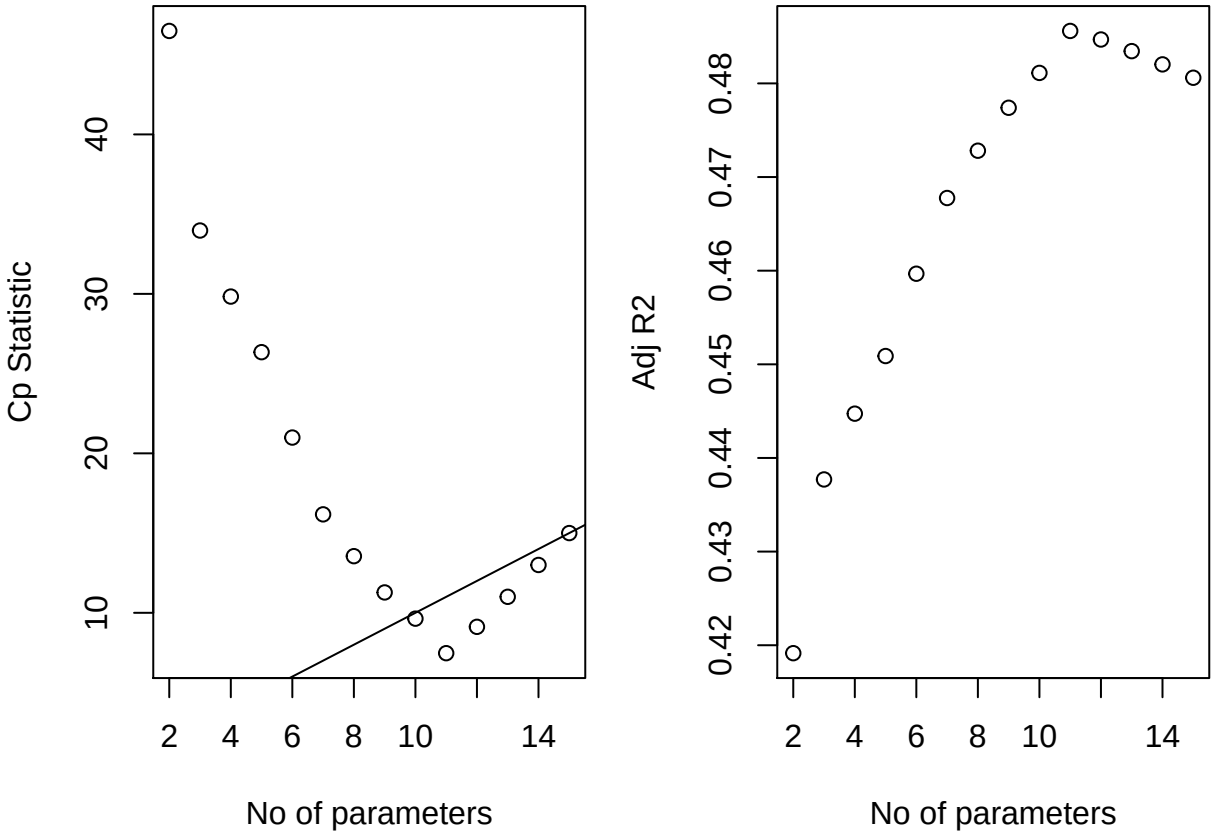

Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
2360
1088
248



Criterion-based Approach

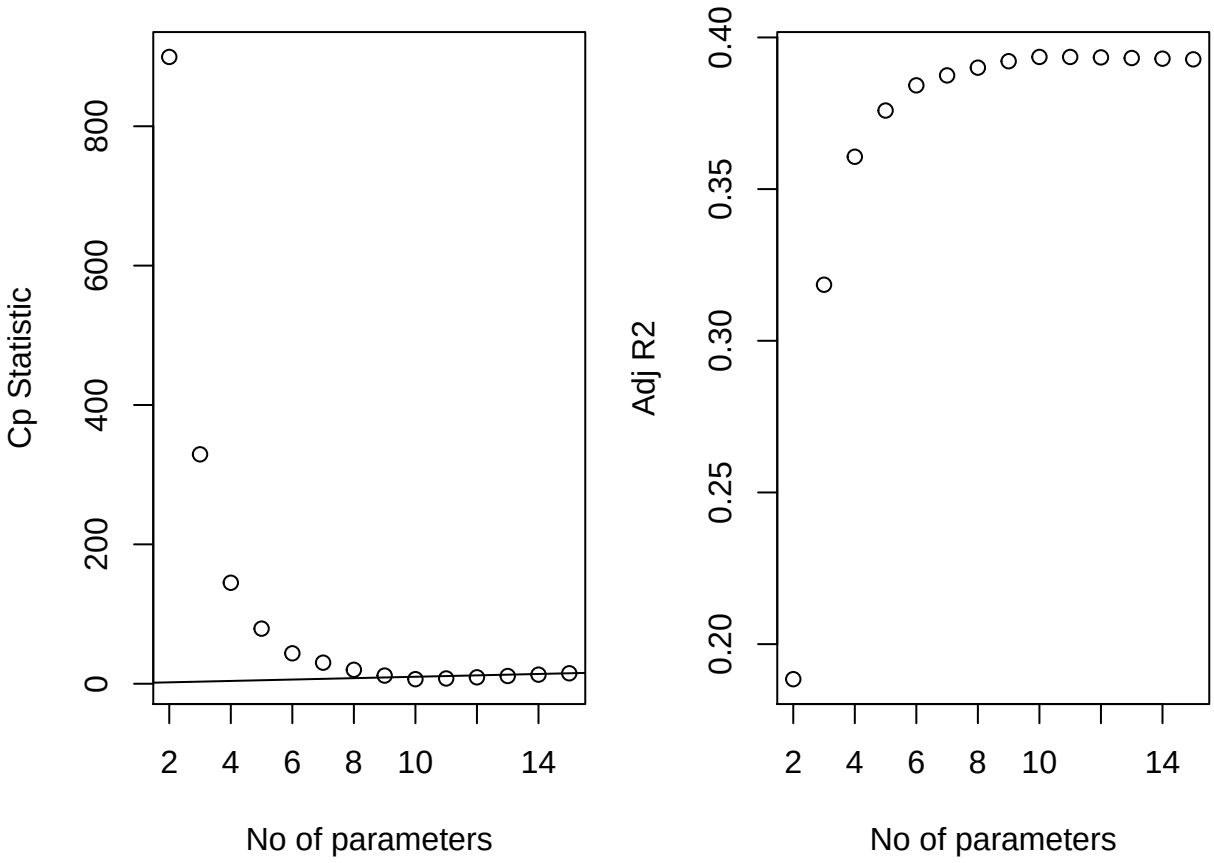
Low income

```
criterion_stats_low =
  regsubsets(target_death_rate ~ ., nvmax = 14, data = income_low_data) %>%
  summary()

par(mar = c(4,4,1,1))
par(mfrow = c(1,2))

plot(2:15, criterion_stats_low$cp, xlab = "No of parameters", ylab = "Cp Statistic")
abline(0,1)

plot(2:15, criterion_stats_low$adjr2, xlab = "No of parameters", ylab = "Adj R2")
```



High income

```
criterion_stats_high =
  regsubsets(target_death_rate ~ ., nvmax = 14, data = income_high_data) %>%
  summary()

par(mar = c(4,4,1,1))
par(mfrow = c(1,2))

plot(2:15, criterion_stats_high$cp, xlab = "No of parameters", ylab = "Cp Statistic")
abline(0,1)

plot(2:15, criterion_stats_high$adjr2, xlab = "No of parameters", ylab = "Adj R2")
```



Cross Validation

```
# low
set.seed(1)
data_train <- trainControl(method = "repeatedcv", number = 10, repeats = 100)

low_cv <- train(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + median_age_female + pct_black + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_low_data,
                    trControl = data_train,
                    method = 'lm',
                    na.action = na.pass)

low_cv
```

```
## Linear Regression
##
## 378 samples
##  10 predictor
##
## No pre-processing
## Resampling: Cross-Validated (10 fold, repeated 100 times)
## Summary of sample sizes: 341, 340, 341, 338, 340, 341, ...
## Resampling results:
```

```
##
##   RMSE      Rsquared   MAE
##   24.22195  0.4715015  18.7237
##
## Tuning parameter 'intercept' was held constant at a value of TRUE
```

```
high_cv <- train(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
    pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
    data = income_high_data,
                  trControl = data_train,
                  method = 'lm',
                  na.action = na.pass)

high_cv
```

```
## Linear Regression
##
## 2669 samples
##    9 predictor
##
## No pre-processing
## Resampling: Cross-Validated (10 fold, repeated 100 times)
## Summary of sample sizes: 2401, 2403, 2402, 2402, 2401, 2402, ...
## Resampling results:
##
##   RMSE      Rsquared   MAE
##   19.78867  0.3918871  14.65232
##
## Tuning parameter 'intercept' was held constant at a value of TRUE
```

Cross Validation

```
cross_df_low = crossv_mc(income_low_data, n = 100, test = 0.2)
cross_df_high = crossv_mc(income_high_data, n = 100, test = 0.2)

cross_result_low =
  cross_df_low %>%
  mutate(
    step_mod = map(train, ~lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + median_age_female + pct_black + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = .x)),
    rmse_train = map2_dbl(step_mod, train, ~rmse(model = .x, data = .y)),
    rmse_test = map2_dbl(step_mod, test, ~rmse(model = .x, data = .y))
    )


mse_results_low = cross_result_low %>%
  dplyr::select(rmse_train, rmse_test) %>%
  summarize(mse_train_low = (mean(rmse_train))^2,
            mse_test_low = (mean(rmse_test))^2) #mse results
```

```
cross_result_high =
  cross_df_high %>%
  mutate(
    step_mod = map(train, ~lm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
    pct_married_households + pct_upto_hs18_24 + pct_with_coverage, data = .x)),
    rmse_train = map2_dbl(step_mod, train, ~rmse(model = .x, data = .y)),
    rmse_test = map2_dbl(step_mod, test, ~rmse(model = .x, data = .y))
    )


mse_results_high = cross_result_high %>%
  dplyr::select(rmse_train, rmse_test) %>%
  summarize(mse_train_high = (mean(rmse_train))^2,
            mse_test_high = (mean(rmse_test))^2)

#LOOCV
glm.fit_low = glm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + median_age_female + pct_black + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_low_data)

cv.err_low = cv.glm(income_low_data, glm.fit_low)

glm.fit_high = glm(target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
    pct_married_households + pct_upto_hs18_24 + pct_with_coverage, data = income_high_data)

cv.err_high = cv.glm(income_high_data, glm.fit_high)

# The two delta values should be similar: we use the first one
# The second value is bias corrected
cv.err_low$delta
```

```
## [1] 595.1885 595.1301
```

```
anova(backward_model_low)[11, 3] #MSE: 431
```

```
## [1] 569.0145
```

```
anova(backward_model_high)[10, 3]
```

```
## [1] 389.4591
```

```
mse_low =
  tibble(
  mse_model = anova(backward_model_low)[11, 3],
  mse_LOOCV = cv.err_low$delta[1],
  mse_CV_train = mse_results_low$mse_train_low,
  mse_CV_test = mse_results_low$mse_test_low
)

mse_high =
  tibble(
  mse_model = anova(backward_model_high)[10, 3],
  mse_LOOCV = cv.err_high$delta[1],
```

```
  mse_CV_train = mse_results_high$mse_train_high,
  mse_CV_test = mse_results_high$mse_test_high
)

rbind(mse_low, mse_high) %>% mutate(dataset = c("low income", "high income")) %>% dplyr::select(dataset
```

dataset	mse_model	mse_LOOCV	mse_CV_train	mse_CV_test
low income	569.014	595.189	550.119	583.890
high income	389.459	393.070	386.918	394.509

Influential points

Low Income

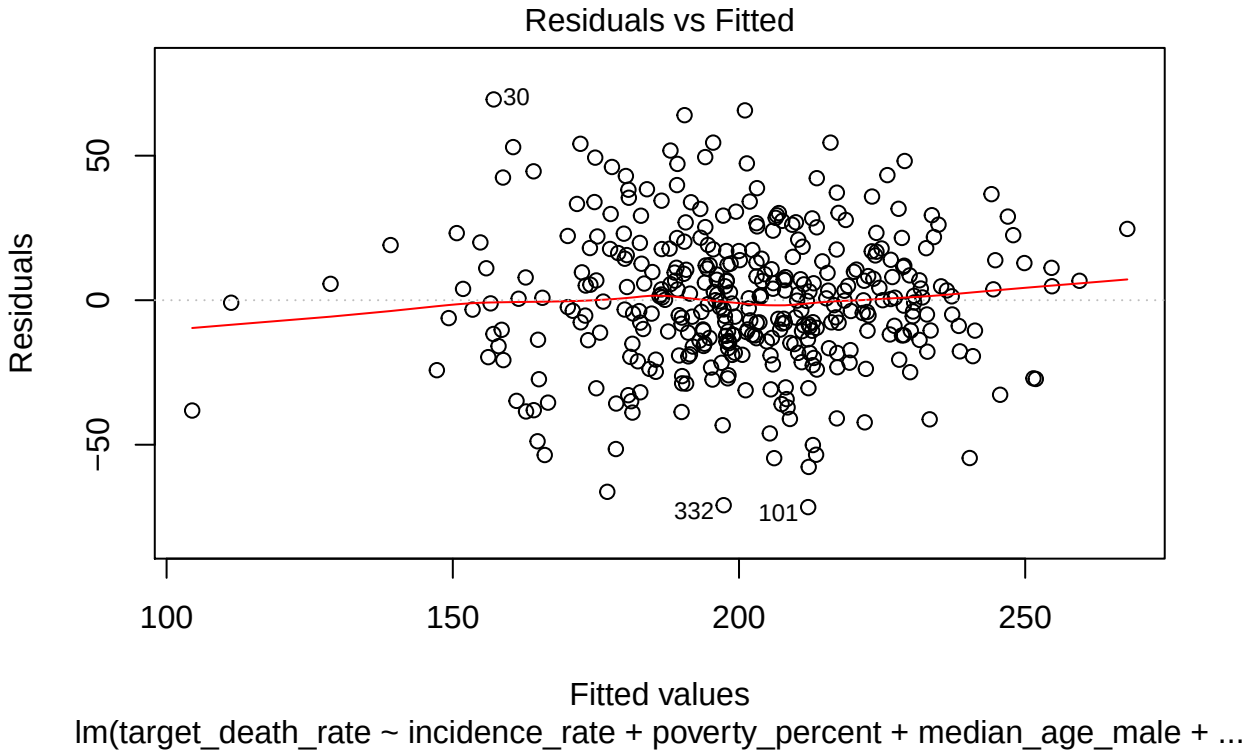
```
influence.measures(backward_model_low) %>% summary()
```

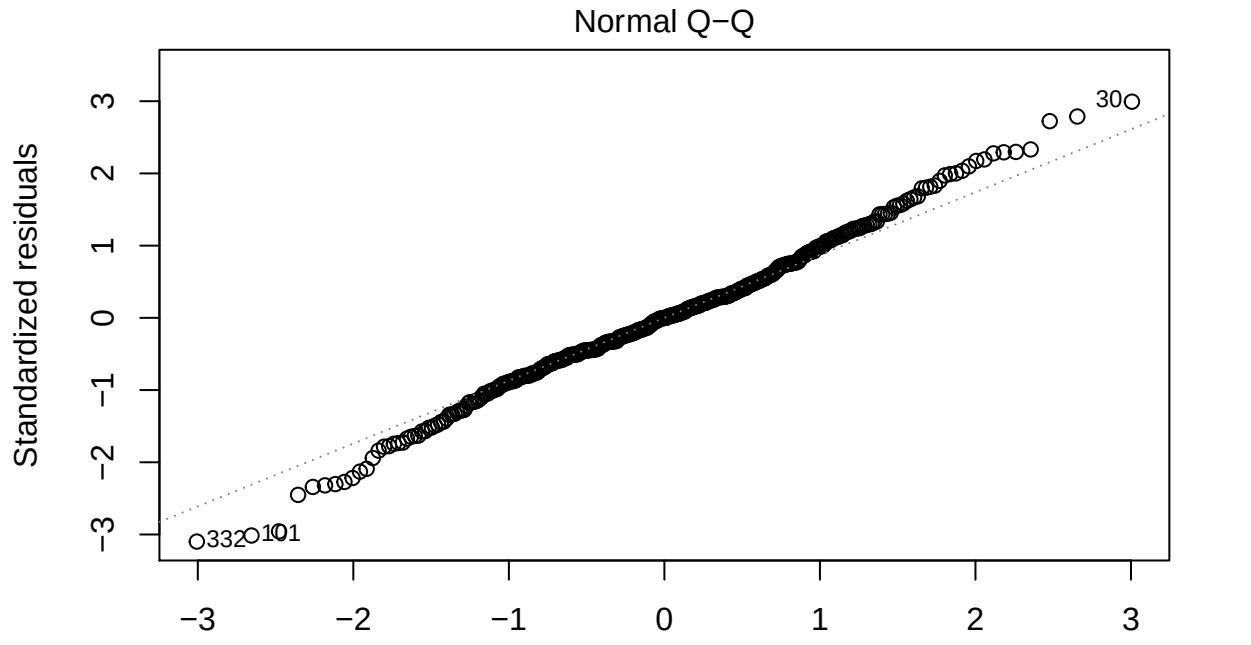
```
## Potentially influential observations of
##   lm(formula = target_death_rate ~ incidence_rate + poverty_percent +      median_age_male + median_a
##
##     dfb.1_ dfb.inc_ dfb.pvr_ dfb.mdn_g_m dfb.mdn_g_f dfb.pct_b dfb.pct_s
## 14  -0.01   0.00    -0.02    -0.01        -0.03        0.01      0.00
## 15  -0.05   0.05    -0.08     0.40        -0.34       -0.05     -0.13
## 20   0.00   0.01     0.01     0.03        -0.02        0.01     -0.04
## 22   0.00   0.00     0.00     0.00         0.00        0.00      0.00
## 23   0.02   0.00    -0.01     0.04        -0.01       -0.06     -0.07
## 26   0.00   0.00     0.00     0.00         0.00        0.00      0.00
## 30   0.26  -0.52    -0.23    -0.19         0.14       -0.36     -0.04
## 32   0.05   0.03    -0.06     0.25        -0.21       -0.07      0.46
## 34  -0.07   0.06     0.03     0.03         0.05        0.13      0.00
## 91   0.21  -0.09     0.00     0.01        -0.03       -0.14     -0.03
## 95  -0.04  -0.02     0.01     0.10        -0.10        0.05     -0.04
## 101 -0.14  -0.09     0.07     0.09        -0.07        0.02      0.08
## 112 -0.18   0.14    -0.04     0.12         0.03        0.00      0.09
## 123  0.27   0.24    -0.59    -0.77         0.82       -0.15      0.13
## 142  0.13  -0.03     0.14     0.15        -0.08        0.15     -0.12
## 173  0.01  -0.07    -0.07    -0.14         0.04       -0.17      0.05
## 187  0.22  -0.11    -0.10     0.03         0.01       -0.14      0.01
## 189  0.00   0.00    -0.01     0.03         0.01        0.06     -0.13
## 199  0.05  -0.02    -0.02    -0.24         0.28       -0.02     -0.03
## 200  0.00  -0.01    -0.01    -0.02         0.00        0.01     -0.01
## 204  0.00   0.01     0.00    -0.01         0.01        0.00      0.00
## 206 -0.02   0.00     0.01     0.01         0.00       -0.01      0.00
## 208 -0.23   0.19     0.13    -0.01        -0.02        0.01     -0.48
## 211 -0.11   0.00    -0.05     0.00         0.02       -0.01      0.02
## 216  0.08   0.07     0.05    -0.04         0.07       -0.09     -0.06
## 231 -0.02  -0.01     0.00     0.00         0.01        0.01      0.00
## 243  0.08  -0.23    -0.05    -0.14         0.09        0.05     -0.05
## 263  0.06   0.05    -0.06     0.06        -0.06       -0.01      0.00
## 275  0.14   0.10    -0.17     0.17        -0.22       -0.15     -0.35
## 277 -0.01   0.02     0.01    -0.03         0.04       -0.02      0.02
## 290  0.12  -0.04     0.02     0.01        -0.05        0.12     -0.08
## 302 -0.10   0.03     0.13     0.01         0.01        0.00      0.00
```

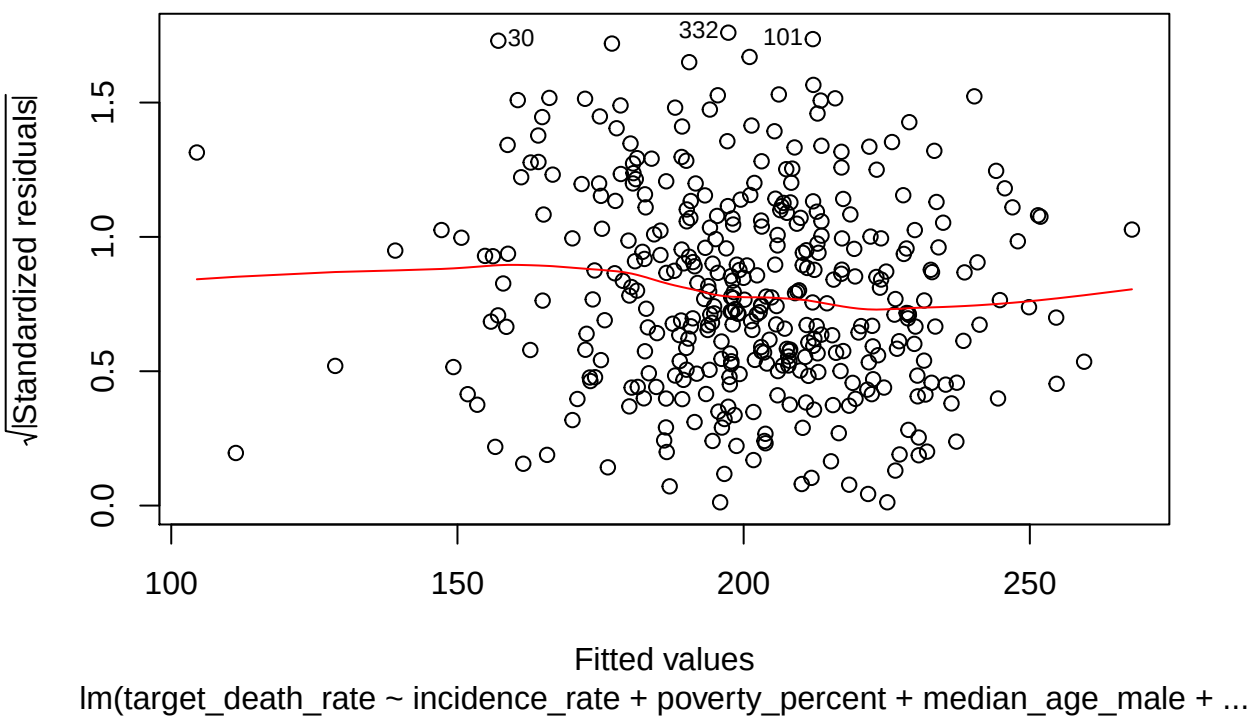
```
## 332 -0.15  -0.45    -0.01    -0.44        0.48       -0.23      0.10
## 336  0.15   0.05    -0.07     0.14       -0.21        0.15     -0.12
## 344 -0.01   0.00    -0.09    -0.04        0.06        0.05     -0.33
## 366 -0.01   0.00     0.00     0.00        0.00        0.00      0.00
## 369  0.16  -0.07     0.08    -0.01       -0.04       -0.26     -0.06
##     dfb.pct_t_ dfb.pct_m_ dfb.p__1 dfb.pct_w_ dffit   cov.r   cook.d
## 14   0.01       0.00       0.08     0.04      -0.10    1.13_*  0.00
## 15   0.36      -0.21       0.15     0.12       0.68_*  0.98    0.04
## 20   0.13       0.01      -0.05    -0.01       0.15    1.34_*  0.00
## 22  -0.01       0.00       0.00     0.00      -0.01    1.09_*  0.00
## 23   0.40      -0.10      -0.06     0.02       0.47    1.28_*  0.02
## 26   0.01       0.00       0.00     0.00       0.01    1.37_*  0.00
## 30  -0.21      -0.42       0.04     0.26       0.72_*  0.83_*  0.05
## 32  -0.13      -0.15       0.07    -0.03       0.60_*  1.31_*  0.03
## 34   0.07       0.12       0.06    -0.13      -0.30    1.12_*  0.01
## 91  -0.06      -0.25      -0.07    -0.05      -0.38    0.91_*  0.01
## 95  -0.03       0.01       0.02     0.04      -0.15    1.14_*  0.00
## 101  0.07       0.03       0.04     0.14      -0.29    0.79_*  0.01
## 112  0.04      -0.18       0.00     0.16      -0.52_*  0.92    0.02
## 123 -0.18      -0.21       0.07    -0.24      -1.09_*  0.89_*  0.11
## 142 -0.05      -0.02      -0.25    -0.21       0.48    0.85_*  0.02
## 173  0.02       0.05       0.13     0.09      -0.41    0.88_*  0.02
## 187 -0.12      -0.15       0.02    -0.17       0.34    0.90_*  0.01
## 189  0.05       0.02       0.07    -0.07      -0.25    1.11_*  0.01
## 199  0.02       0.06      -0.18    -0.09       0.35    1.13_*  0.01
## 200  0.04       0.02       0.01     0.01       0.05    1.13_*  0.00
## 204  0.00       0.00       0.00     0.00      -0.01    1.10_*  0.00
## 206  0.00      -0.01       0.01     0.02      -0.04    1.09_*  0.00
## 208  0.14       0.00      -0.20     0.30      -0.70_*  1.10_*  0.04
## 211 -0.01      -0.09       0.08     0.17      -0.25    1.10_*  0.01
## 216 -0.06      -0.07      -0.04    -0.12       0.24    0.89_*  0.01
## 231  0.01       0.01       0.01     0.02      -0.03    1.09_*  0.00
## 243  0.02       0.01      -0.16     0.08      -0.38    0.90_*  0.01
## 263  0.00      -0.04      -0.04    -0.04      -0.13    1.09_*  0.00
## 275  0.07      -0.16      -0.09     0.02      -0.53_*  0.94    0.02
## 277  0.03      -0.02       0.03     0.00       0.08    1.19_*  0.00
## 290 -0.07      -0.07      -0.21     0.00       0.45    0.84_*  0.02
## 302  0.02       0.06       0.00     0.04       0.14    1.11_*  0.00
## 332 -0.41      -0.30       0.14     0.50      -0.92_*  0.84_*  0.07
## 336  0.33       0.13      -0.02    -0.22       0.52_*  0.93    0.02
## 344  0.08       0.03       0.09    -0.03      -0.46    1.11_*  0.02
## 366  0.00       0.01       0.00     0.01      -0.01    1.13_*  0.00
## 369 -0.12      -0.23       0.06    -0.03       0.39    1.11_*  0.01
##     hat
## 14   0.09_*
## 15   0.09_*
## 20   0.23_*
## 22   0.06
## 23   0.21_*
## 26   0.25_*
## 30   0.05
## 32   0.24_*
## 34   0.10_*
## 91   0.03
```

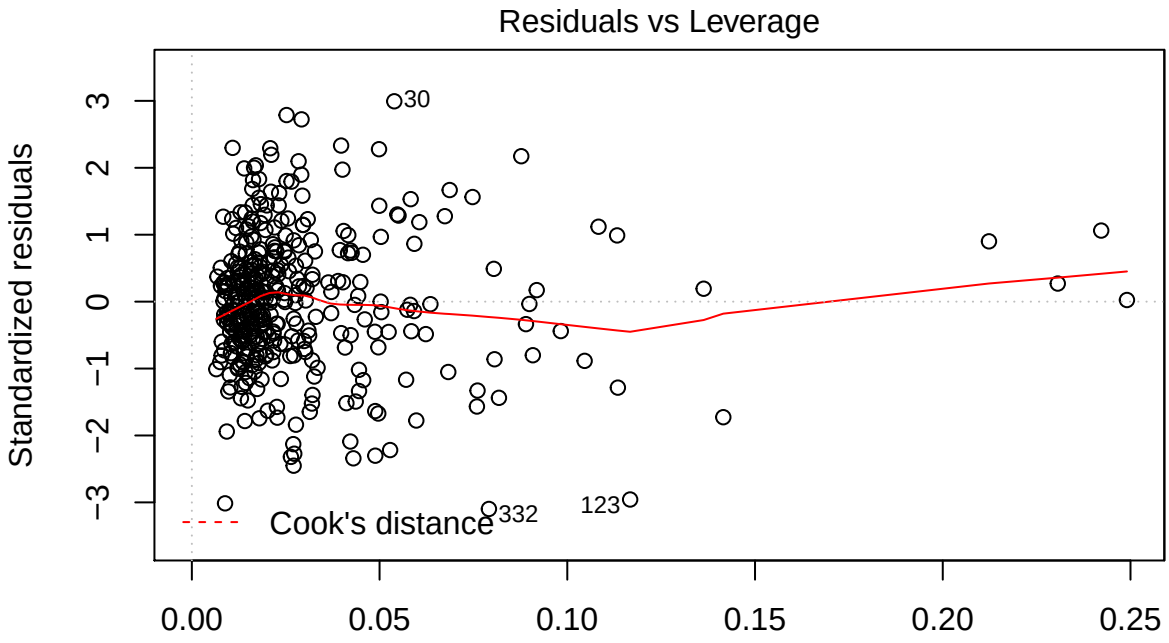
```
## 95   0.10_*
## 101  0.01
## 112  0.05
## 123  0.12_*
## 142  0.03
## 173  0.03
## 187  0.02
## 189  0.09_*
## 199  0.11_*
## 200  0.09_*
## 204  0.06
## 206  0.06
## 208  0.14_*
## 211  0.08
## 216  0.01
## 231  0.06
## 243  0.03
## 263  0.06
## 275  0.05
## 277  0.14_*
## 290  0.03
## 302  0.08
## 332  0.08
## 336  0.05
## 344  0.11_*
## 366  0.09_*
## 369  0.11_*
```

```
plot(backward_model_low)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
30
332
101

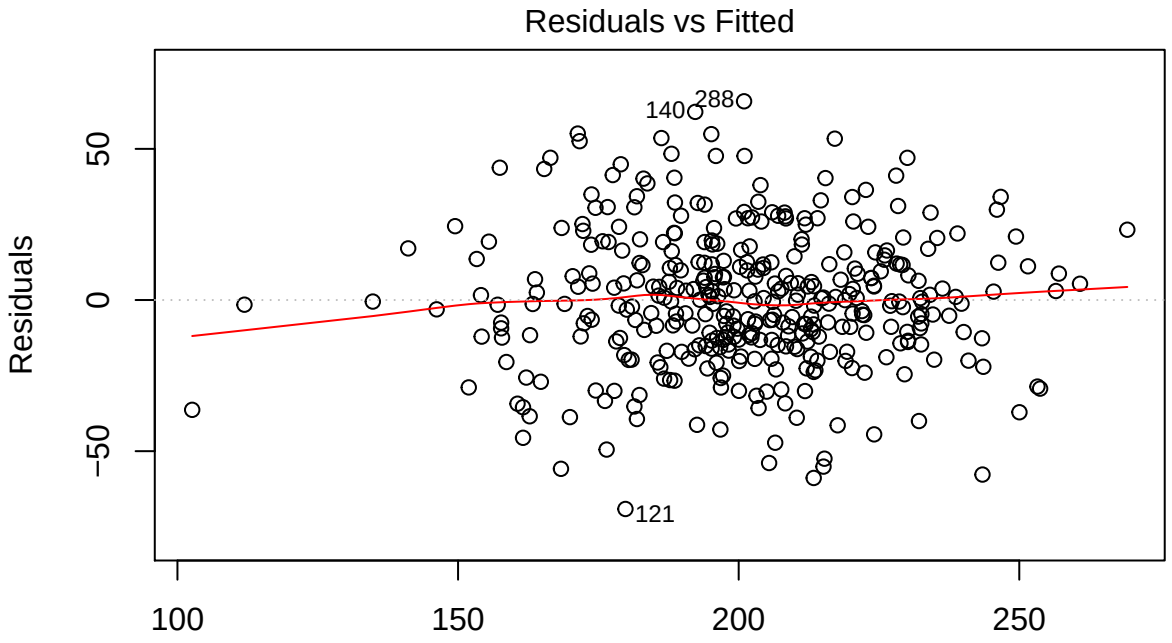

Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
30
332
101

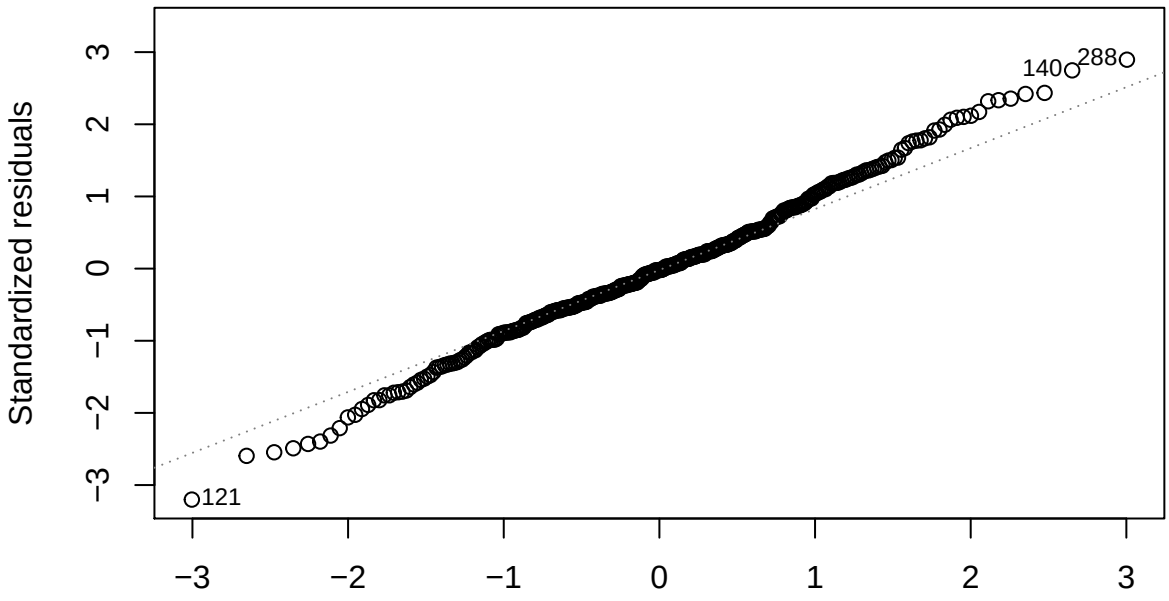


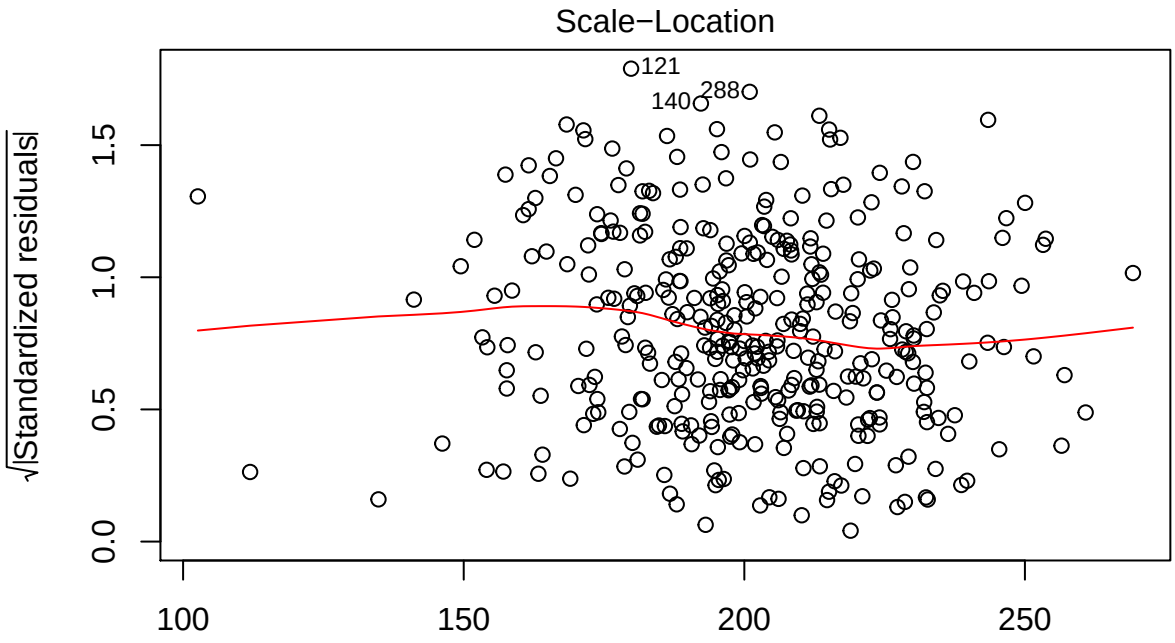

```
income_low_rm <- income_low_data[-c(332,101,30),]

backward_model_low_rm <- lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + median_age_female + pct_black + pct_asian +
    pct_other_race + pct_married_households + pct_upto_hs18_24 +
    pct_with_coverage, data = income_low_rm)

cbind(summary(backward_model_low_rm) %>% tidy %>% dplyr::select(-statistic),
      summary(backward_model_low) %>% tidy %>% dplyr::select(-statistic)) %>%
  knitr::kable()
```

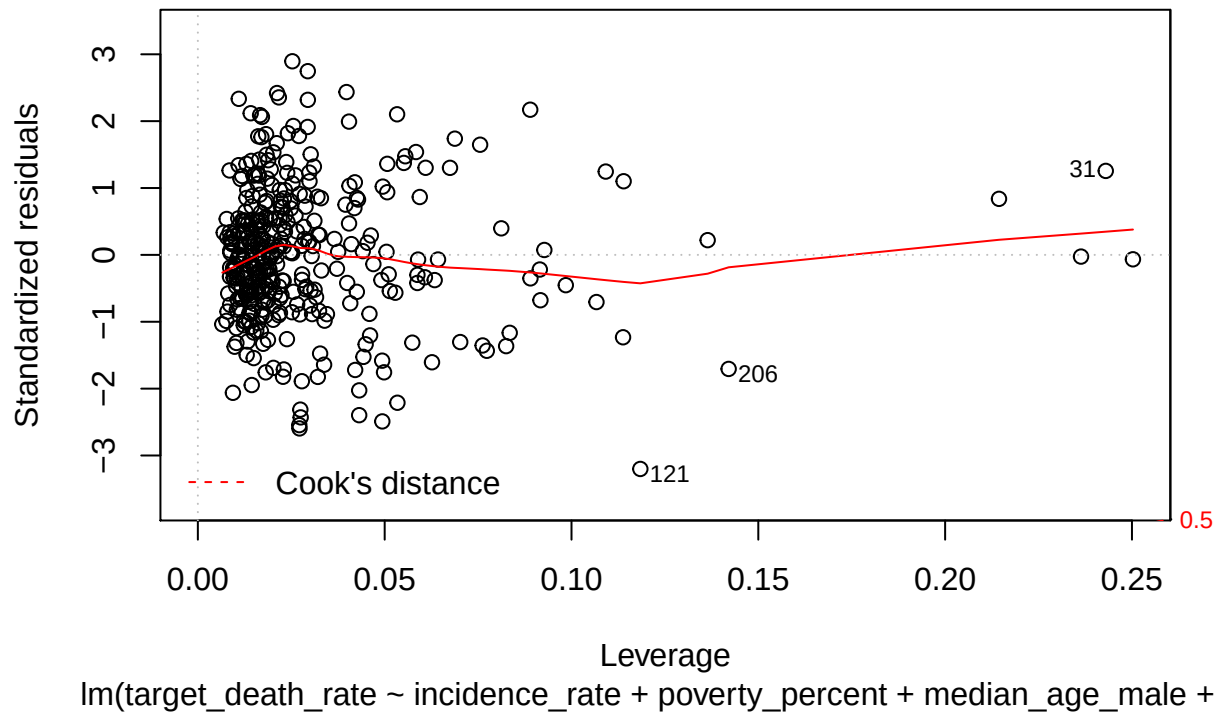
term	estimate	std.error	p.value	term	estimate	std.error	
(Intercept)	-6.0167646	31.2444460	0.8474026	(Intercept)	-6.7837317	32.2180572	0.
incidence_rate	0.3055177	0.0200670	0.0000000	incidence_rate	0.2831379	0.0202753	0.
poverty_percent	0.7194054	0.2949757	0.0152108	poverty_percent	0.6630969	0.3049711	0.
median_age_male	-1.2645667	0.5869468	0.0318580	median_age_male	-1.5990211	0.6013537	0.
median_age_female	1.3151201	0.5631914	0.0200799	median_age_female	1.6474232	0.5764589	0.
pct_black	-0.2665368	0.0799427	0.0009437	pct_black	-0.3151240	0.0820959	0.
pct_asian	-5.4112789	1.9188836	0.0050650	pct_asian	-5.1184441	1.9883473	0.
pct_other_race	-0.9219624	0.3132796	0.0034595	pct_other_race	-1.1093338	0.3211770	0.
pct_married_households	-0.4126216	0.2907166	0.1566597	pct_married_households	-0.6252937	0.2971143	0.
pct_upto_hs18_24	0.2094353	0.1108083	0.0595430	pct_upto_hs18_24	0.2354264	0.1147949	0.
pct_with_coverage	0.7954130	0.2846906	0.0054822	pct_with_coverage	1.0621260	0.2901767	0.

```
plot(backward_model_low_rm)
```


Residuals vs Fitted
Residuals
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
140
288
121
50
0
−50
100
150
200
250


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
140
288
121
3
2
1
0
−1
−2
−3





High Income

```
influence.measures(backward_model_high) %>% summary()
```

```
## Potentially influential observations of
##   lm(formula = target_death_rate ~ incidence_rate + poverty_percent +      median_age_male + pct_unem
##
```

```
##      dfb.1_ dfb.inc_ dfb.pvr_ dfb.md__ dfb.p_16 dfb.pct_ dfb.pct_t_
## 21    0.04   0.05    -0.09     0.04     0.02    -0.04     0.02
## 27    0.01  -0.15     0.01    -0.03    -0.01     0.01    -0.05
## 93    0.00   0.00    -0.01     0.01     0.00     0.00     0.01
## 103   0.22   0.03    -0.27     0.07     0.12    -0.10     0.12
## 106  -0.05   0.00     0.15     0.10    -0.15     0.02     0.03
## 107  -0.01  -0.01     0.06     0.07    -0.11     0.02     0.05
## 109   0.08  -0.02    -0.12     0.17     0.16     0.03     0.06
## 111  -0.01  -0.02     0.01     0.01    -0.02     0.01    -0.01
## 127   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 134   0.00   0.00     0.00     0.00     0.00     0.01     0.01
## 137   0.00   0.01     0.00     0.01     0.00     0.09    -0.01
## 143  -0.01   0.01     0.00     0.01     0.00     0.04     0.00
## 151   0.00   0.00     0.00     0.00     0.00     0.00    -0.01
## 159   0.00  -0.02     0.02     0.00     0.01    -0.03     0.08
## 163   0.00   0.02     0.01    -0.04    -0.01     0.02    -0.08
## 164   0.12  -0.13    -0.14    -0.07     0.02    -0.02    -0.04
## 165   0.03  -0.03     0.02     0.02    -0.05    -0.02     0.07
## 166   0.01   0.00    -0.01     0.00     0.00     0.00    -0.02
## 175  -0.03   0.05    -0.02    -0.13     0.07    -0.02     0.00
## 182  -0.01  -0.02     0.00     0.00     0.00     0.07    -0.01
## 189   0.00   0.01    -0.02     0.01     0.01    -0.01     0.00
## 208   0.03  -0.07     0.01     0.03     0.01    -0.01    -0.03
## 216   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 221  -0.01  -0.10     0.05    -0.01     0.05    -0.01    -0.04
## 224   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 226   0.04  -0.26    -0.13     0.03     0.20    -0.10     0.00
## 229   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 233  -0.01  -0.15    -0.14     0.08     0.14    -0.04     0.02
## 241   0.01   0.00     0.00     0.00     0.00     0.00     0.00
## 247   0.00  -0.01     0.00     0.00     0.00     0.00     0.00
## 248   0.18  -1.33_*  -0.10     0.13     0.21    -0.13    -0.10
## 250   0.01   0.01    -0.01     0.01     0.00     0.01    -0.07
## 258   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 260   0.00   0.00     0.00     0.00     0.00     0.00     0.02
## 262  -0.01   0.01    -0.01     0.00     0.02    -0.02     0.09
## 266   0.00   0.00     0.00     0.00     0.00    -0.02     0.00
## 285   0.00   0.01    -0.02     0.01     0.00     0.00     0.00
## 313   0.00   0.00     0.00    -0.01     0.00     0.00     0.00
## 356  -0.01   0.00     0.00    -0.02     0.01    -0.03    -0.04
## 409  -0.02   0.02    -0.02     0.01    -0.05    -0.02     0.03
## 420   0.11  -0.03    -0.06     0.00    -0.09    -0.03    -0.03
## 425   0.10   0.08    -0.11    -0.03     0.08    -0.02    -0.01
## 430  -0.02   0.02     0.01     0.01     0.00     0.01     0.01
## 435   0.02  -0.01     0.00     0.11    -0.10    -0.01     0.01
## 443   0.03   0.01     0.02    -0.01    -0.04     0.00    -0.02
## 462   0.03   0.07    -0.05    -0.04    -0.07     0.01     0.03
## 469  -0.01  -0.10     0.09    -0.06    -0.02    -0.01    -0.04
## 480   0.04   0.01    -0.01     0.03     0.00    -0.05     0.10
## 494   0.01   0.03     0.02     0.00     0.00    -0.01    -0.02
## 502  -0.03   0.00     0.02     0.02     0.00    -0.04     0.17
## 507  -0.01   0.00     0.02     0.02    -0.01     0.13     0.00
## 512   0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 515   0.03   0.00    -0.03    -0.01     0.00    -0.02    -0.05
```

```
## 518   0.03   0.02   -0.01    0.00   -0.12    0.05   -0.17
## 527   0.00  -0.04   -0.01   -0.03    0.03   -0.01    0.00
## 541   0.05  -0.10    0.01   -0.05    0.04   -0.02   -0.01
## 547   0.09  -0.07   -0.03    0.17   -0.07   -0.01   -0.01
## 567  -0.04   0.00    0.01    0.00    0.00   -0.01    0.16
## 570  -0.09   0.03    0.05   -0.07    0.03    0.04    0.00
## 580   0.06   0.01   -0.07   -0.07    0.09   -0.06    0.01
## 586   0.03   0.02    0.01    0.09   -0.10    0.00   -0.01
## 590   0.02  -0.08   -0.01    0.05   -0.02   -0.03   -0.01
## 631   0.00   0.00    0.00    0.00   -0.01    0.00    0.00
## 658  -0.08   0.02    0.07    0.04    0.04    0.00    0.00
## 664  -0.04   0.01    0.04    0.02    0.01    0.00   -0.01
## 667  -0.04   0.03    0.04   -0.01   -0.03    0.00   -0.01
## 681  -0.01  -0.04    0.09   -0.04   -0.13    0.03   -0.02
## 686  -0.09   0.03    0.07    0.02   -0.09    0.01    0.05
## 689  -0.05   0.03   -0.02    0.04    0.11   -0.01   -0.10
## 707   0.11  -0.07   -0.04    0.03    0.00   -0.01   -0.01
## 774   0.00   0.00    0.00    0.00    0.00   -0.03    0.01
## 776   0.00   0.01    0.01   -0.01    0.00   -0.05   -0.01
## 790  -0.05   0.04   -0.11    0.05    0.09   -0.02    0.04
## 803   0.02   0.05   -0.05    0.10   -0.01    0.01    0.01
## 808  -0.09   0.04    0.09    0.05   -0.07    0.01    0.08
## 809  -0.01   0.00    0.01    0.00    0.00    0.00    0.01
## 810   0.00   0.02   -0.06    0.08   -0.04    0.01    0.03
## 812  -0.09   0.04    0.11    0.04    0.00    0.01    0.05
## 814   0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 817  -0.03   0.14   -0.10    0.09    0.04   -0.03    0.09
## 818   0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 824  -0.05   0.00    0.06    0.09   -0.01    0.01    0.05
## 848   0.01  -0.01   -0.01    0.00    0.00    0.01    0.00
## 867   0.00   0.00    0.00    0.00    0.00   -0.01    0.00
## 884   0.00   0.00    0.00    0.00    0.00    0.01    0.01
## 889  -0.01   0.00    0.00    0.00    0.01    0.00    0.01
## 891  -0.15   0.09    0.17   -0.03   -0.14    0.06   -0.05
## 895   0.00   0.00    0.00    0.01    0.00    0.03    0.01
## 897   0.00   0.00    0.00   -0.01   -0.01    0.00    0.00
## 898   0.00   0.00    0.00    0.00   -0.01    0.00   -0.01
## 899   0.00   0.00    0.00    0.00    0.00    0.01    0.00
## 901  -0.01   0.00    0.00    0.00    0.01    0.00    0.02
## 904   0.01   0.00    0.01    0.04   -0.02    0.16   -0.01
## 905  -0.01   0.00    0.01    0.00    0.01    0.02    0.01
## 907  -0.01   0.00    0.00    0.01    0.00    0.06    0.00
## 909  -0.02   0.00    0.02    0.02   -0.01    0.14    0.00
## 912   0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 915  -0.01   0.01    0.00    0.01    0.02    0.06    0.02
## 918   0.00   0.00    0.00    0.00   -0.01   -0.01    0.00
## 923  -0.01   0.00    0.01    0.00    0.00    0.02    0.01
## 928  -0.04   0.01    0.04   -0.12   -0.02    0.00   -0.09
## 930   0.02   0.01   -0.03    0.00    0.01   -0.01    0.00
## 937  -0.01  -0.01    0.02   -0.08   -0.05    0.00    0.00
## 940   0.00   0.01    0.00    0.00    0.00    0.00    0.00
## 943  -0.14   0.08    0.14    0.06    0.00    0.06   -0.05
## 950  -0.12   0.14    0.06    0.04   -0.03    0.05    0.05
## 952   0.08  -0.05    0.01    0.04   -0.08   -0.02   -0.03
```

```
## 969  -0.33   0.27    0.36   -0.03   -0.11    0.10    0.05
## 980   0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1014  0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1049  0.08  -0.01   -0.10   -0.11   -0.01   -0.04   -0.03
## 1055  0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1076 -0.05   0.01    0.16    0.06   -0.07    0.04   -0.02
## 1085  0.00   0.06    0.03   -0.04   -0.02   -0.01   -0.02
## 1088  0.03   0.01   -0.01   -0.08   -0.05   -0.01   -0.01
## 1104  0.01   0.01   -0.03    0.01    0.01    0.00    0.01
## 1106  0.09  -0.09   -0.06    0.04   -0.05    0.00   -0.04
## 1123  0.02   0.07    0.02    0.04   -0.06    0.00   -0.01
## 1135 -0.04   0.06   -0.03   -0.02    0.02   -0.06    0.22
## 1137 -0.04   0.02    0.05    0.09   -0.02   -0.02    0.08
## 1142  0.00  -0.05    0.02    0.07    0.04    0.01   -0.08
## 1148 -0.08   0.05    0.07   -0.07   -0.08   -0.05    0.15
## 1149 -0.02  -0.01    0.04    0.00    0.00    0.02    0.02
## 1154 -0.04  -0.01    0.02    0.02    0.02   -0.01    0.00
## 1169  0.03  -0.01   -0.06   -0.03    0.10    0.01   -0.02
## 1183 -0.01   0.01    0.02   -0.09    0.01    0.03   -0.01
## 1188  0.00   0.02   -0.01    0.00    0.00   -0.02    0.10
## 1194  0.03  -0.02   -0.02   -0.01    0.03    0.02   -0.10
## 1195  0.01  -0.02    0.00    0.01    0.01    0.01   -0.03
## 1204  0.09   0.03    0.04    0.18   -0.19    0.01   -0.02
## 1231 -0.14   0.11    0.12   -0.01   -0.02    0.05    0.03
## 1233 -0.14   0.12    0.10    0.02    0.00    0.04    0.00
## 1250  0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1312 -0.06   0.22    0.03    0.02   -0.03    0.02    0.03
## 1318 -0.08   0.10    0.11    0.10   -0.24   -0.01    0.29
## 1356  0.02  -0.02    0.03   -0.02    0.00    0.00   -0.03
## 1367  0.00   0.01    0.00    0.00   -0.02   -0.01    0.10
## 1381  0.07   0.00   -0.01   -0.06   -0.10    0.00   -0.03
## 1444 -0.09   0.01    0.05    0.06    0.02   -0.01    0.06
## 1469 -0.03  -0.01    0.00   -0.01    0.01   -0.01    0.01
## 1497 -0.05  -0.03    0.01    0.04   -0.04   -0.04    0.20
## 1532 -0.02   0.00    0.02   -0.01   -0.02    0.01    0.00
## 1556  0.00   0.00    0.00    0.00    0.00    0.01    0.00
## 1597 -0.01   0.00    0.01    0.00    0.01    0.01   -0.02
## 1603 -0.02   0.00    0.00    0.00    0.01    0.00    0.00
## 1615  0.03   0.01   -0.04    0.00    0.02   -0.01    0.00
## 1618 -0.02   0.01   -0.04    0.02   -0.01   -0.08    0.29
## 1619 -0.15   0.05    0.08    0.10   -0.11   -0.11    0.62
## 1625  0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1629  0.00   0.00    0.00    0.00    0.00    0.00    0.00
## 1641  0.00   0.00    0.00    0.00    0.00   -0.01    0.00
## 1644  0.01   0.00    0.00   -0.01    0.00    0.00    0.00
## 1646 -0.01  -0.04    0.06    0.01   -0.05    0.01    0.01
## 1648  0.05  -0.01   -0.02   -0.04   -0.01    0.02   -0.12
## 1649 -0.03   0.02    0.00    0.07   -0.04   -0.07    0.36
## 1657 -0.01  -0.03   -0.01    0.04    0.08    0.00    0.00
## 1665  0.10   0.04   -0.07   -0.01   -0.02   -0.03    0.05
## 1678  0.01  -0.03   -0.01    0.02    0.00    0.01    0.01
## 1684 -0.04   0.01    0.03    0.01   -0.03   -0.02    0.12
## 1694  0.00   0.03   -0.04   -0.01    0.02    0.02   -0.08
## 1708  0.01  -0.01   -0.01   -0.01   -0.01   -0.01    0.01
```

```
## 1726  0.01   0.00    -0.01     0.04     0.00     0.00     0.01
## 1737  0.01   0.02    -0.01     0.02    -0.02    -0.02     0.11
## 1738  0.00   0.00     0.00     0.01     0.00     0.00     0.00
## 1748  0.07   0.09    -0.05     0.08    -0.08    -0.10     0.39
## 1752  0.09  -0.10    -0.01     0.01    -0.03    -0.01    -0.01
## 1757  0.00   0.00     0.00     0.00     0.00     0.00    -0.01
## 1768 -0.02  -0.01    -0.01     0.05    -0.05    -0.11     0.47
## 1795  0.01   0.02     0.00     0.00    -0.01     0.00     0.02
## 1815  0.02  -0.07    -0.01     0.03     0.02    -0.01    -0.03
## 1834  0.01   0.00     0.00     0.00     0.00     0.00     0.00
## 1836 -0.23  -0.01     0.07     0.13    -0.23     0.01     0.19
## 1837 -0.12  -0.05     0.04     0.02    -0.03     0.02     0.06
## 1848 -0.02   0.10     0.08     0.13    -0.10     0.04     0.00
## 1856  0.00   0.00     0.00    -0.01     0.00    -0.04    -0.01
## 1870  0.00   0.00    -0.01     0.01     0.01    -0.02     0.01
## 1926 -0.02  -0.04     0.04     0.00     0.00    -0.03    -0.02
## 1955 -0.08  -0.02     0.05     0.04     0.01     0.00     0.04
## 2018 -0.02   0.01     0.01     0.00    -0.06    -0.01     0.00
## 2036  0.00   0.01     0.00     0.01     0.00     0.00     0.00
## 2047  0.01   0.01    -0.01    -0.01     0.00    -0.04     0.01
## 2048 -0.02   0.00     0.02     0.01    -0.01     0.10    -0.02
## 2049 -0.05  -0.01     0.06     0.04    -0.04     0.26    -0.05
## 2050  0.02   0.01    -0.02    -0.01     0.01    -0.10     0.02
## 2052 -0.06   0.00     0.11    -0.11    -0.09    -0.02     0.04
## 2057 -0.06   0.05     0.07    -0.03     0.04     0.02    -0.08
## 2062 -0.04   0.09     0.01     0.01    -0.01     0.00     0.04
## 2081  0.14   0.05    -0.20     0.08    -0.03    -0.01     0.03
## 2085 -0.03  -0.03    -0.01     0.01    -0.02     0.00     0.00
## 2087  0.04   0.06     0.01     0.07    -0.05     0.06    -0.10
## 2089 -0.07   0.06     0.10     0.08    -0.05     0.04    -0.01
## 2145  0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 2154  0.01  -0.01     0.02     0.01    -0.06     0.01     0.02
## 2232  0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 2282 -0.03   0.13     0.04     0.00    -0.04     0.01    -0.02
## 2287 -0.22   0.10     0.23     0.12    -0.10     0.04     0.04
## 2311  0.02   0.01     0.07     0.03    -0.03     0.03    -0.06
## 2322  0.03  -0.10    -0.18    -0.04     0.16    -0.07     0.04
## 2332  0.00   0.00     0.01    -0.01     0.00     0.00     0.00
## 2340 -0.07   0.02     0.03    -0.08     0.09     0.01    -0.01
## 2358 -0.01   0.00    -0.01    -0.01     0.05     0.00    -0.01
## 2360  0.27  -0.43     0.01     0.21    -0.38     1.63_*  -0.35
## 2362  0.04  -0.06    -0.04    -0.08     0.07    -0.01    -0.05
## 2366 -0.19  -0.02     0.14    -0.03     0.08    -0.05     0.06
## 2370  0.10   0.02    -0.06    -0.01    -0.02     0.25    -0.09
## 2372  0.10   0.03    -0.07    -0.13     0.09    -0.01    -0.09
## 2373  0.20   0.06    -0.23    -0.07     0.02     0.06    -0.06
## 2374 -0.03   0.02     0.03     0.03    -0.05     0.01     0.02
## 2375  0.03  -0.02    -0.02    -0.01    -0.01     0.01    -0.01
## 2378 -0.10  -0.02     0.07     0.02    -0.05     0.00     0.05
## 2387  0.04   0.12    -0.04     0.04    -0.15     0.02     0.01
## 2390  0.01   0.03    -0.02     0.00    -0.01     0.01    -0.05
## 2419  0.00   0.00     0.00     0.00     0.00     0.00     0.00
## 2424  0.05   0.06    -0.01     0.02     0.04     0.01     0.01
## 2425  0.00   0.00     0.00     0.00     0.00     0.00     0.00
```

```
## 2442 -0.03  -0.04    -0.08     0.06     0.10    -0.03     0.07
## 2443 -0.01   0.00     0.01     0.00    -0.05    -0.02     0.00
## 2444  0.02   0.18    -0.04    -0.08     0.00    -0.01     0.02
## 2469 -0.01   0.09    -0.02     0.00     0.02    -0.02     0.01
## 2482 -0.03   0.08     0.04     0.02    -0.05     0.00    -0.01
## 2493  0.00   0.00     0.00     0.00     0.00     0.00     0.02
## 2544 -0.03   0.04     0.00     0.03     0.04    -0.01     0.00
## 2626  0.01   0.01    -0.02     0.02     0.01    -0.01     0.01
## 2662  0.04   0.04    -0.02     0.06    -0.07    -0.01     0.04
##      dfb.pct_m_ dfb.p__1 dfb.pct_w_ dffit   cov.r   cook.d hat
## 21   -0.01       0.02    -0.06      -0.14    1.01_*  0.00   0.01_*
## 27   -0.03       0.11     0.05       0.19_*  1.00    0.00   0.01_*
## 93    0.00       0.00     0.00      -0.02    1.01_*  0.00   0.01
## 103  -0.23       0.00    -0.19       0.39_*  0.96_*  0.01   0.01
## 106   0.01      -0.11     0.04      -0.24_*  0.97_*  0.01   0.01
## 107  -0.07      -0.04     0.04      -0.19_*  0.97_*  0.00   0.00
## 109  -0.18      -0.05    -0.05       0.34_*  0.97_*  0.01   0.01
## 111   0.00      -0.05     0.02      -0.12    0.96_*  0.00   0.00
## 127   0.00       0.00     0.00       0.00    1.02_*  0.00   0.01_*
## 134  -0.01       0.00     0.00       0.02    1.02_*  0.00   0.01_*
## 137   0.02      -0.01    -0.02       0.10    1.03_*  0.00   0.03_*
## 143   0.01       0.00     0.00       0.04    1.02_*  0.00   0.01_*
## 151   0.00       0.00     0.00      -0.01    1.01_*  0.00   0.01
## 159   0.00      -0.04     0.02       0.11    1.02_*  0.00   0.02_*
## 163   0.03       0.00    -0.01      -0.09    1.02_*  0.00   0.02_*
## 164  -0.09       0.01    -0.01      -0.22_*  0.98_*  0.00   0.01
## 165  -0.02      -0.03    -0.01       0.11    1.01_*  0.00   0.01_*
## 166   0.00       0.00    -0.01      -0.03    1.02_*  0.00   0.01_*
## 175   0.01       0.06     0.05      -0.17    1.01    0.00   0.01_*
## 182   0.03       0.01     0.00       0.08    1.02_*  0.00   0.02_*
## 189   0.00       0.01    -0.01      -0.03    1.01_*  0.00   0.01
## 208   0.01      -0.03    -0.02       0.11    0.98_*  0.00   0.00
## 216   0.00       0.01     0.01       0.01    1.02_*  0.00   0.01_*
## 221   0.02      -0.02     0.04       0.15    0.98_*  0.00   0.00
## 224   0.00       0.00     0.00       0.00    1.02_*  0.00   0.01_*
## 226   0.07       0.01     0.00      -0.40_*  1.00    0.02   0.02_*
## 229   0.00       0.00     0.00       0.00    1.01_*  0.00   0.01
## 233   0.03       0.10     0.02      -0.34_*  0.98_*  0.01   0.01_*
## 241  -0.02       0.00     0.00       0.02    1.01_*  0.00   0.01
## 247   0.01      -0.01     0.00      -0.01    1.01_*  0.00   0.01
## 248  -0.06       0.25     0.20      -1.45_*  0.91_*  0.21   0.05_*
## 250  -0.01      -0.01    -0.01      -0.08    1.03_*  0.00   0.03_*
## 258   0.00       0.00     0.00       0.00    1.02_*  0.00   0.01_*
## 260   0.00       0.00     0.00       0.02    1.02_*  0.00   0.02_*
## 262   0.00       0.01     0.01       0.10    1.02_*  0.00   0.02_*
## 266   0.00       0.00     0.00      -0.02    1.01_*  0.00   0.01
## 285   0.00       0.01    -0.01      -0.03    1.01_*  0.00   0.01
## 313   0.00       0.00     0.00      -0.01    1.01_*  0.00   0.01
## 356   0.06       0.00    -0.01      -0.09    1.02_*  0.00   0.02_*
## 409  -0.03       0.04     0.03       0.12    0.99_*  0.00   0.00
## 420  -0.08      -0.02    -0.07       0.16    0.99_*  0.00   0.00
## 425  -0.07      -0.07    -0.10      -0.20_*  0.99    0.00   0.01
## 430   0.01       0.00     0.01      -0.03    1.01_*  0.00   0.01
## 435  -0.06      -0.04    -0.02       0.18    0.99_*  0.00   0.01
```

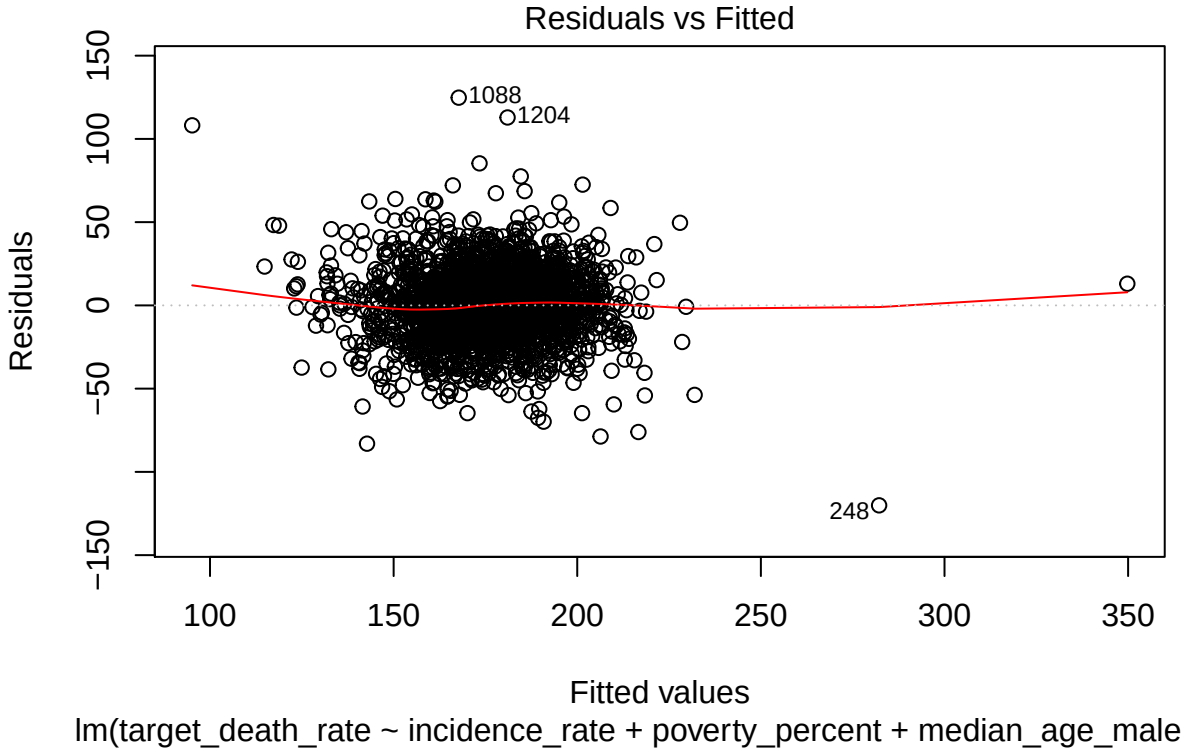
```
## 443  -0.01      -0.01    -0.03       0.06    1.02_*  0.00   0.01_*
## 462   0.01      -0.01    -0.04      -0.17    0.98_*  0.00   0.00
## 469  -0.08       0.06     0.09       0.21_*  0.98_*  0.00   0.01
## 480  -0.02      -0.07    -0.04       0.15    0.98_*  0.00   0.00
## 494  -0.01       0.00    -0.03       0.09    0.98_*  0.00   0.00
## 502   0.00       0.00     0.03       0.18    1.02_*  0.00   0.02_*
## 507   0.01       0.01     0.00       0.13    1.04_*  0.00   0.04_*
## 512   0.00       0.00     0.00       0.00    1.02_*  0.00   0.01
## 515  -0.01       0.00    -0.02      -0.06    1.02_*  0.00   0.02_*
## 518  -0.04       0.04    -0.02      -0.24_*  1.00    0.01   0.01_*
## 527   0.00      -0.01     0.02      -0.06    1.01_*  0.00   0.01
## 541  -0.07      -0.04     0.03      -0.18    0.98_*  0.00   0.00
## 547  -0.05      -0.09    -0.09       0.25_*  0.97_*  0.01   0.01
## 567   0.02       0.01     0.04       0.17    1.01    0.00   0.01_*
## 570   0.03       0.11     0.08      -0.16    0.99_*  0.00   0.00
## 580  -0.03      -0.08    -0.02      -0.17    0.99_*  0.00   0.01
## 586   0.02      -0.08    -0.06       0.18    0.97_*  0.00   0.00
## 590  -0.04      -0.04     0.02       0.13    0.98_*  0.00   0.00
## 631   0.00      -0.01    -0.01      -0.02    1.01_*  0.00   0.01
## 658   0.07      -0.01     0.03       0.12    0.98_*  0.00   0.00
## 664   0.05      -0.01     0.01       0.08    0.99_*  0.00   0.00
## 667   0.04       0.02     0.02       0.08    0.99_*  0.00   0.00
## 681   0.00       0.12     0.02       0.21_*  0.96_*  0.00   0.00
## 686   0.11       0.04     0.04       0.19_*  0.98_*  0.00   0.01
## 689  -0.02      -0.12     0.07      -0.28_*  0.99_*  0.01   0.01
## 707  -0.11      -0.06    -0.05      -0.17    0.98_*  0.00   0.00
## 774  -0.01       0.00     0.00      -0.03    1.02_*  0.00   0.01_*
## 776   0.00       0.00     0.00      -0.06    1.01_*  0.00   0.01
## 790  -0.07       0.04     0.07      -0.21_*  1.00    0.00   0.01_*
## 803  -0.11       0.06    -0.03      -0.19_*  1.00    0.00   0.01
## 808  -0.03       0.00     0.09      -0.18    0.97_*  0.00   0.00
## 809   0.01      -0.01     0.01      -0.02    1.01_*  0.00   0.01
## 810  -0.12       0.07     0.02      -0.18_*  0.99    0.00   0.01
## 812   0.09      -0.13     0.05      -0.19_*  0.99_*  0.00   0.01
## 814  -0.01       0.00     0.00      -0.01    1.02_*  0.00   0.01_*
## 817  -0.06      -0.03     0.00      -0.24_*  1.00    0.01   0.01_*
## 818   0.00       0.00     0.00       0.01    1.01_*  0.00   0.01
## 824  -0.06       0.01     0.05      -0.16    0.99_*  0.00   0.00
## 848  -0.01       0.00     0.00       0.02    1.01_*  0.00   0.01
## 867   0.00       0.00     0.00      -0.01    1.02_*  0.00   0.02_*
## 884   0.00       0.00     0.00       0.02    1.02_*  0.00   0.02_*
## 889   0.00       0.00     0.00       0.02    1.02_*  0.00   0.02_*
## 891   0.08       0.08     0.11      -0.25_*  1.00    0.01   0.01_*
## 895   0.01       0.00     0.00       0.03    1.02_*  0.00   0.02_*
## 897   0.00       0.01     0.00      -0.01    1.01_*  0.00   0.01
## 898   0.00       0.00     0.00      -0.02    1.01_*  0.00   0.01
## 899   0.00       0.00     0.00       0.01    1.01_*  0.00   0.01
## 901   0.00       0.00     0.00       0.02    1.01_*  0.00   0.01
## 904  -0.02       0.00    -0.01       0.17    1.06_*  0.00   0.06_*
## 905   0.01       0.00     0.00       0.03    1.02_*  0.00   0.01_*
## 907   0.01       0.00     0.00       0.07    1.04_*  0.00   0.03_*
## 909   0.03       0.01     0.00       0.15    1.06_*  0.00   0.06_*
## 912   0.00       0.00     0.00       0.00    1.01_*  0.00   0.01
## 915   0.00       0.01     0.01       0.08    1.01_*  0.00   0.01_*
```

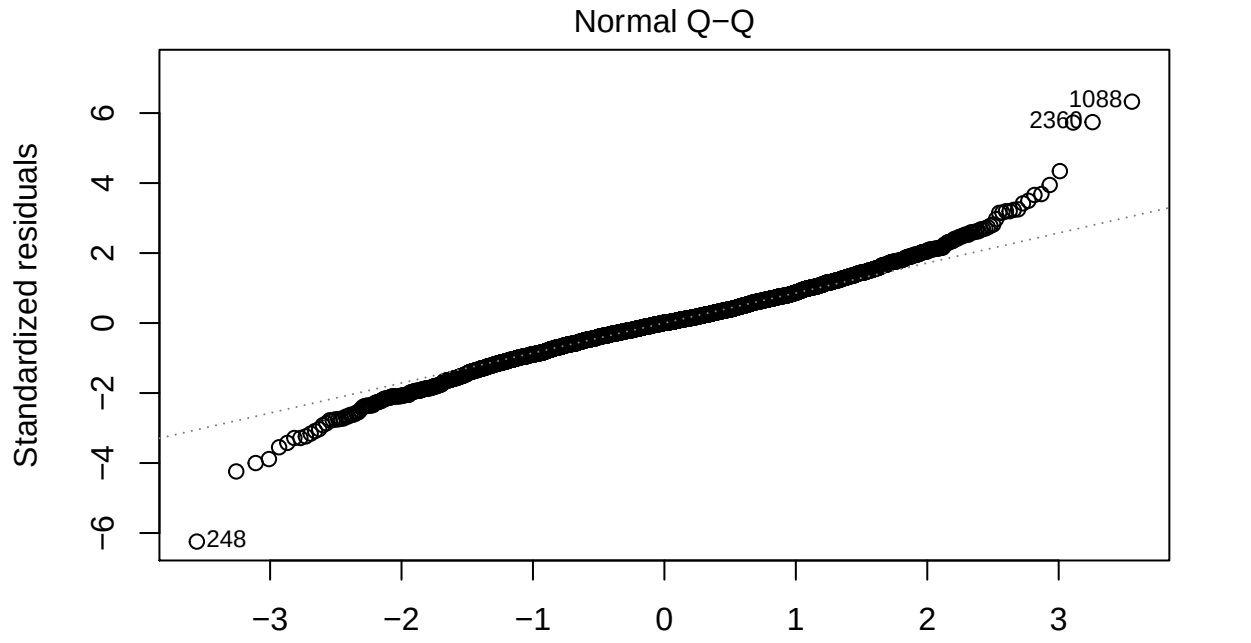
```
## 918   0.00       0.00     0.00      -0.02    1.02_*  0.00   0.01_*
## 923   0.00       0.00     0.01       0.03    1.01_*  0.00   0.01
## 928  -0.02       0.03     0.09      -0.19_*  0.98_*  0.00   0.00
## 930  -0.01      -0.02    -0.02      -0.04    1.02_*  0.00   0.01_*
## 937  -0.03       0.04     0.05      -0.11    1.01_*  0.00   0.01_*
## 940   0.00       0.00     0.00      -0.01    1.01_*  0.00   0.01
## 943   0.07       0.00     0.07      -0.22_*  0.97_*  0.00   0.00
## 950   0.09       0.05     0.02      -0.19_*  1.00    0.00   0.01
## 952   0.02      -0.12    -0.07       0.19_*  0.98_*  0.00   0.00
## 969   0.41       0.00     0.08      -0.52_*  0.95_*  0.03   0.01_*
## 980   0.00       0.00     0.00       0.01    1.01_*  0.00   0.01
## 1014  0.00       0.00     0.00       0.00    1.02_*  0.00   0.01_*
## 1049 -0.04       0.05    -0.03       0.16    0.98_*  0.00   0.00
## 1055  0.00       0.00     0.00      -0.01    1.01_*  0.00   0.01
## 1076  0.01       0.03     0.01       0.21_*  1.00    0.00   0.01_*
## 1085  0.00      -0.01    -0.01       0.11    0.98_*  0.00   0.00
## 1088 -0.02      -0.07     0.02       0.22_*  0.86_*  0.00   0.00
## 1104 -0.01       0.02    -0.01      -0.05    1.01_*  0.00   0.01
## 1106 -0.10       0.03    -0.03       0.18    0.97_*  0.00   0.00
## 1123  0.04      -0.07    -0.07       0.13    0.99_*  0.00   0.00
## 1135  0.05       0.03     0.02       0.26_*  1.01    0.01   0.02_*
## 1137  0.07      -0.12    -0.01       0.17    1.02_*  0.00   0.02_*
## 1142 -0.05      -0.08     0.02      -0.19_*  0.99    0.00   0.01
## 1148  0.11      -0.01     0.06       0.25_*  0.98_*  0.01   0.01
## 1149  0.01      -0.01     0.02      -0.07    0.99_*  0.00   0.00
## 1154  0.02       0.01     0.04       0.07    0.99_*  0.00   0.00
## 1169 -0.01       0.02    -0.03      -0.14    0.98_*  0.00   0.00
## 1183  0.05       0.05     0.00      -0.13    0.98_*  0.00   0.00
## 1188 -0.01       0.00     0.01       0.10    1.03_*  0.00   0.03_*
## 1194 -0.02       0.01    -0.02      -0.11    1.01_*  0.00   0.01_*
## 1195 -0.03      -0.01     0.00      -0.06    1.01_*  0.00   0.01
## 1204 -0.14      -0.03    -0.11       0.33_*  0.89_*  0.01   0.00
## 1231  0.15       0.05     0.04      -0.21_*  0.99_*  0.00   0.01
## 1233  0.07       0.05     0.08      -0.19_*  1.00    0.00   0.01
## 1250  0.00       0.00     0.00      -0.01    1.02_*  0.00   0.01_*
## 1312  0.04       0.01    -0.03       0.22_*  1.10_*  0.00   0.09_*
## 1318 -0.03       0.11     0.02       0.41_*  0.94_*  0.02   0.01
## 1356  0.01       0.00    -0.02       0.09    0.98_*  0.00   0.00
## 1367 -0.01       0.01     0.00       0.11    1.02_*  0.00   0.02_*
## 1381 -0.04      -0.03    -0.04      -0.15    0.99_*  0.00   0.00
## 1444 -0.04      -0.01     0.11      -0.15    1.03_*  0.00   0.03_*
## 1469  0.01       0.03     0.04       0.07    0.99_*  0.00   0.00
## 1497  0.01       0.03     0.05       0.23_*  1.00    0.01   0.01
## 1532  0.00       0.04     0.03       0.04    1.01_*  0.00   0.01_*
## 1556 -0.01       0.00     0.00       0.02    1.01_*  0.00   0.01
## 1597  0.01      -0.01     0.01      -0.04    1.01_*  0.00   0.01
## 1603 -0.01       0.00     0.02      -0.03    1.01_*  0.00   0.01
## 1615 -0.02      -0.02    -0.02      -0.05    1.02_*  0.00   0.01_*
## 1618 -0.03       0.03     0.04       0.31_*  1.05_*  0.01   0.05_*
## 1619  0.05       0.03     0.10       0.65_*  1.04_*  0.04   0.06_*
## 1625  0.00       0.00     0.00       0.00    1.01_*  0.00   0.01
## 1629  0.00       0.00     0.00      -0.01    1.01_*  0.00   0.01
## 1641 -0.01       0.00     0.00      -0.01    1.02_*  0.00   0.02_*
## 1644  0.00       0.00    -0.01       0.02    1.02_*  0.00   0.01_*
```

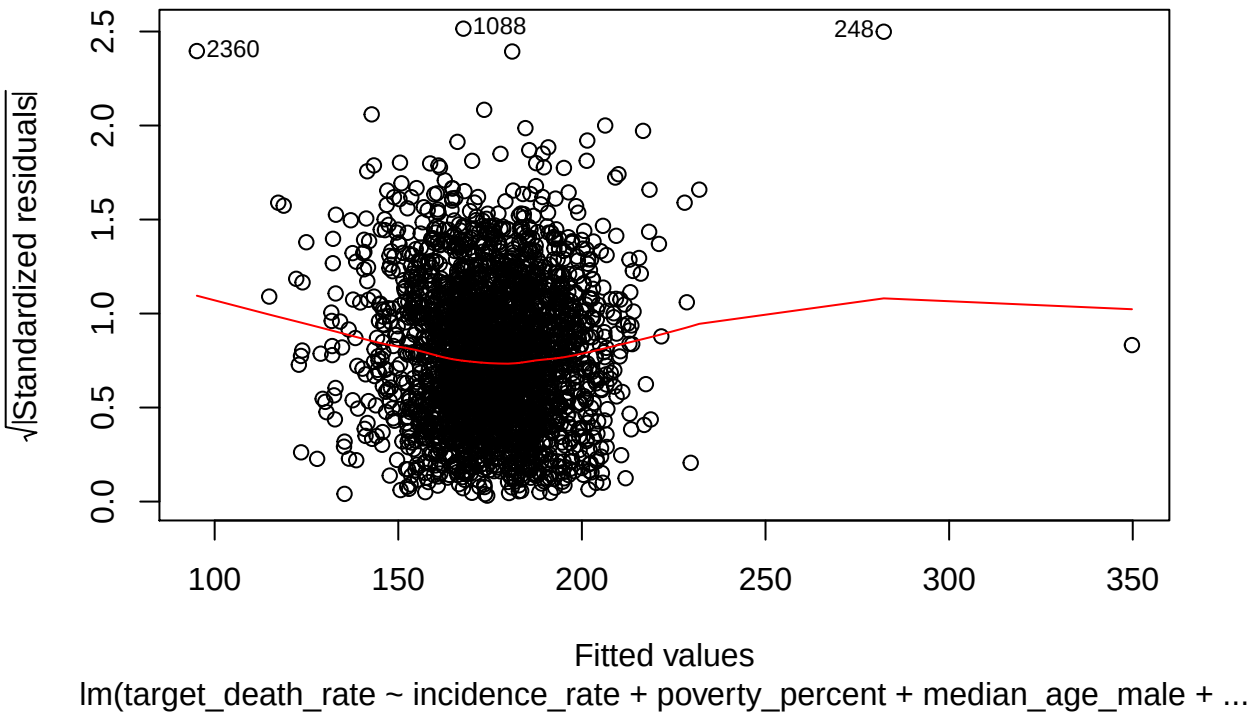
```
## 1646  0.02       0.01     0.01       0.09    1.02_*  0.00   0.01_*
## 1648 -0.01      -0.01    -0.04      -0.12    1.02_*  0.00   0.02_*
## 1649 -0.03       0.02     0.01       0.38_*  1.03_*  0.01   0.04_*
## 1657 -0.03      -0.05     0.03      -0.13    0.99_*  0.00   0.00
## 1665  0.07      -0.09    -0.14       0.20_*  1.00    0.00   0.01
## 1678 -0.02       0.03    -0.01       0.07    1.01_*  0.00   0.01_*
## 1684 -0.01       0.03     0.04       0.13    1.03_*  0.00   0.02_*
## 1694 -0.01       0.01     0.00      -0.11    1.01_*  0.00   0.01_*
## 1708 -0.01       0.01    -0.01       0.02    1.01_*  0.00   0.01
## 1726 -0.02      -0.02    -0.01      -0.05    1.01_*  0.00   0.01
## 1737  0.00       0.00    -0.02       0.12    1.06_*  0.00   0.05_*
## 1738  0.00       0.00    -0.01       0.01    1.01_*  0.00   0.01
## 1748  0.03      -0.12    -0.13       0.46_*  0.99_*  0.02   0.02_*
## 1752  0.06      -0.07    -0.09       0.19_*  0.99    0.00   0.01
## 1757 -0.01       0.00     0.01      -0.02    1.02_*  0.00   0.01_*
## 1768  0.00      -0.01     0.01       0.50_*  1.02_*  0.03   0.04_*
## 1795  0.02      -0.05    -0.02      -0.07    0.99_*  0.00   0.00
## 1815  0.06      -0.05    -0.02       0.13    0.98_*  0.00   0.00
## 1834 -0.03       0.00     0.00       0.04    1.01_*  0.00   0.01
## 1836 -0.11       0.10     0.31      -0.52_*  0.96_*  0.03   0.02_*
## 1837  0.00       0.07     0.15      -0.18_*  1.00    0.00   0.01
## 1848  0.07      -0.06    -0.08       0.20_*  1.00    0.00   0.01
## 1856  0.00       0.00     0.01      -0.05    1.03_*  0.00   0.03_*
## 1870  0.00       0.01    -0.01      -0.04    1.01_*  0.00   0.01
## 1926  0.07      -0.07     0.03       0.14    0.97_*  0.00   0.00
## 1955 -0.02       0.00     0.10      -0.12    1.03_*  0.00   0.03_*
## 2018 -0.04       0.05     0.04       0.10    0.99_*  0.00   0.00
## 2036  0.01      -0.01    -0.01       0.02    1.02_*  0.00   0.01_*
## 2047  0.00      -0.01    -0.01      -0.04    1.03_*  0.00   0.03_*
## 2048  0.01       0.02     0.00       0.10    1.12_*  0.00   0.10_*
## 2049  0.04       0.04     0.01       0.26_*  1.08_*  0.01   0.07_*
## 2050 -0.01      -0.03    -0.01      -0.11    1.05_*  0.00   0.04_*
## 2052  0.04      -0.09     0.11      -0.28_*  0.96_*  0.01   0.01
## 2057  0.07      -0.02     0.03      -0.16    0.98_*  0.00   0.00
## 2062 -0.01      -0.01     0.02      -0.12    0.98_*  0.00   0.00
## 2081 -0.24       0.10    -0.10      -0.31_*  1.02_*  0.01   0.03_*
## 2085 -0.03      -0.02     0.08      -0.15    0.99_*  0.00   0.00
## 2087  0.01      -0.07    -0.09      -0.18    0.98_*  0.00   0.00
## 2089  0.05      -0.08     0.01      -0.17    0.98_*  0.00   0.00
## 2145  0.00       0.00     0.00       0.00    1.01_*  0.00   0.01
## 2154 -0.03      -0.01     0.00      -0.09    0.99_*  0.00   0.00
## 2232  0.00       0.00     0.00       0.00    1.01_*  0.00   0.01
## 2282  0.05       0.03    -0.04       0.17    0.97_*  0.00   0.00
## 2287  0.09       0.03     0.12       0.29_*  0.96_*  0.01   0.01
## 2311  0.18      -0.15    -0.10       0.24_*  0.96_*  0.01   0.00
## 2322 -0.04      -0.04     0.06      -0.29_*  0.95_*  0.01   0.01
## 2332  0.00      -0.01     0.00       0.02    1.01_*  0.00   0.01
## 2340  0.11       0.00     0.04       0.16    1.02_*  0.00   0.02_*
## 2358  0.01       0.00     0.00       0.05    1.01_*  0.00   0.01
## 2360 -0.19       0.38    -0.25       1.80_*  0.97_*  0.32   0.09_*
## 2362 -0.03       0.06     0.00       0.15    1.01_*  0.00   0.01_*
## 2366  0.11      -0.03     0.19      -0.26_*  1.00    0.01   0.01_*
## 2370  0.03       0.00    -0.14       0.30_*  1.02_*  0.01   0.03_*
## 2372 -0.08       0.09    -0.07       0.25_*  0.99    0.01   0.01
```

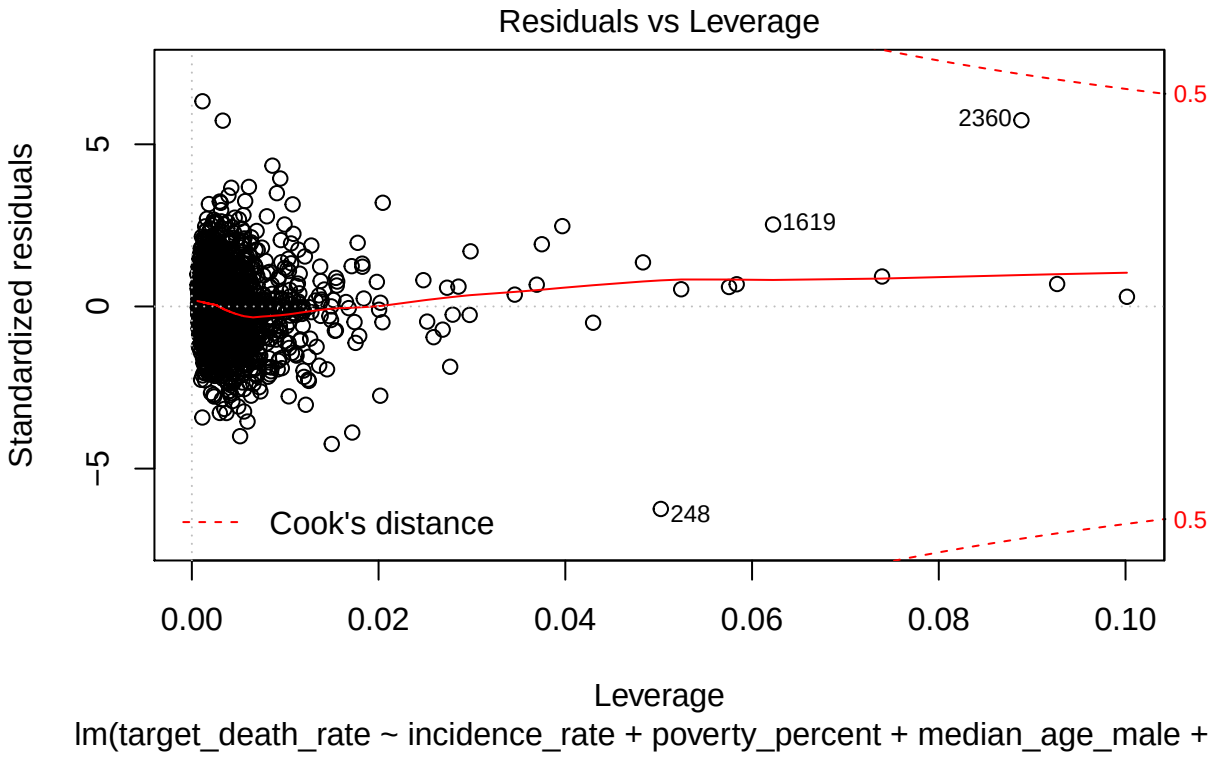
```
## 2373 -0.22       0.12    -0.15       0.33_*  0.98_*  0.01    0.01
## 2374  0.01      -0.02     0.02      -0.07    1.02_*  0.00    0.02_*
## 2375 -0.02       0.02    -0.01       0.04    1.01_*  0.00    0.01
## 2378  0.05      -0.01     0.10      -0.15    1.02_*  0.00    0.02_*
## 2387 -0.01      -0.04    -0.08      -0.22_*  1.00    0.00    0.01_*
## 2390 -0.01       0.01    -0.02      -0.07    1.01_*  0.00    0.01_*
## 2419  0.00       0.00     0.00       0.01    1.01_*  0.00    0.01
## 2424  0.02      -0.10    -0.09      -0.15    0.99_*  0.00    0.00
## 2425  0.00       0.00     0.00       0.00    1.01_*  0.00    0.01
## 2442  0.01      -0.06     0.04      -0.20_*  0.97_*  0.00    0.00
## 2443  0.01      -0.01     0.02       0.09    0.99_*  0.00    0.00
## 2444  0.05      -0.05    -0.08      -0.23_*  0.99_*  0.01    0.01
## 2469  0.04      -0.03    -0.03       0.12    0.98_*  0.00    0.00
## 2482  0.07      -0.04    -0.02       0.13    0.98_*  0.00    0.00
## 2493  0.00       0.00     0.00       0.02    1.01_*  0.00    0.01
## 2544  0.03      -0.03     0.01       0.09    0.98_*  0.00    0.00
## 2626  0.00       0.01    -0.02      -0.05    1.01_*  0.00    0.01
## 2662  0.00      -0.06    -0.07       0.14    0.99_*  0.00    0.00
```

```
plot(backward_model_high)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
1088
2360
248


Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
2360
1088
248




```
income_high_rm <- income_high_data[-c(1088,2360,248),]

backward_model_high_rm <- lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
    median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
    pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
    data = income_high_rm)
summary(backward_model_high_rm)
```

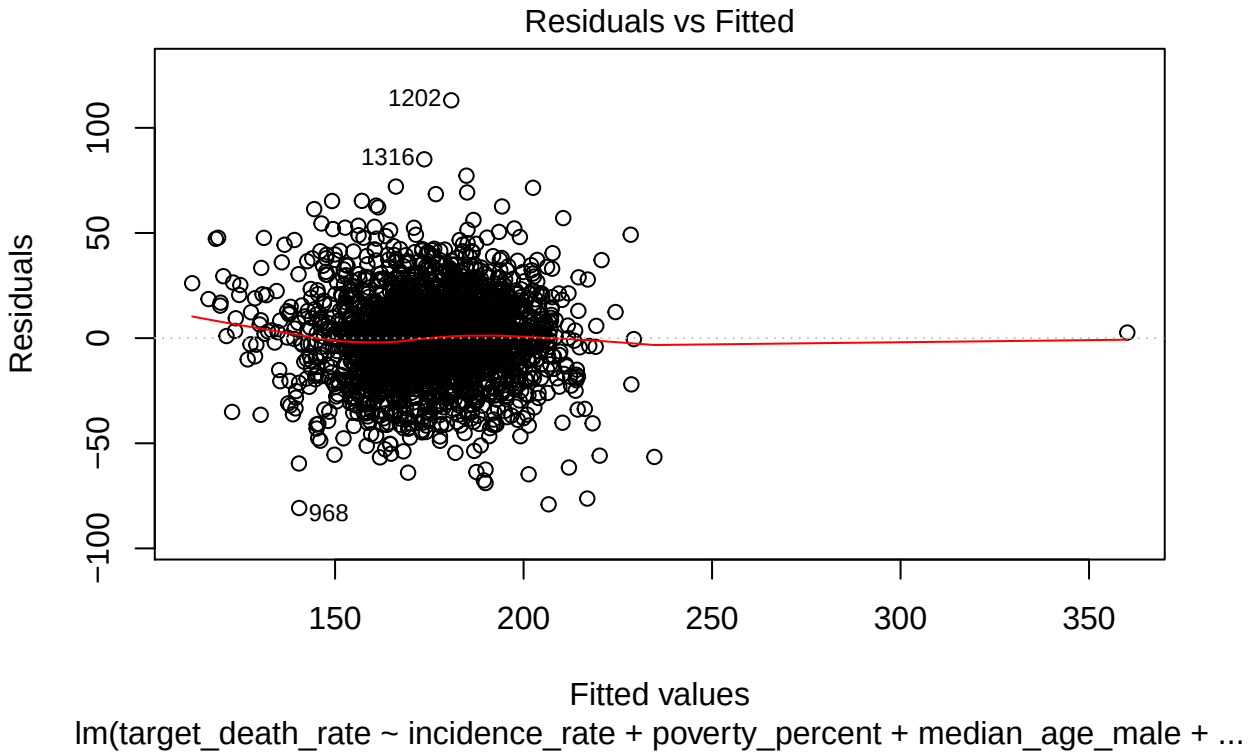
```
##
## Call:
## lm(formula = target_death_rate ~ incidence_rate + poverty_percent +
##     median_age_male + pct_unemployed16_over + pct_asian + pct_other_race +
##     pct_married_households + pct_upto_hs18_24 + pct_with_coverage,
##     data = income_high_rm)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -80.779 -11.178   0.048  11.373 113.085
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)             88.984965  11.931213   7.458 1.18e-13 ***
## incidence_rate           0.214122   0.007945  26.949  < 2e-16 ***
## poverty_percent          0.955402   0.125446   7.616 3.61e-14 ***
## median_age_male         -0.306979   0.083133  -3.693 0.000226 ***
## pct_unemployed16_over    1.035570   0.157925   6.557 6.56e-11 ***
## pct_asian               -0.983436   0.157993  -6.225 5.59e-10 ***
## pct_other_race          -1.006896   0.123860  -8.129 6.55e-16 ***
## pct_married_households -0.247956   0.081267  -3.051 0.002302 **
## pct_upto_hs18_24         0.385275   0.037974  10.146  < 2e-16 ***
```

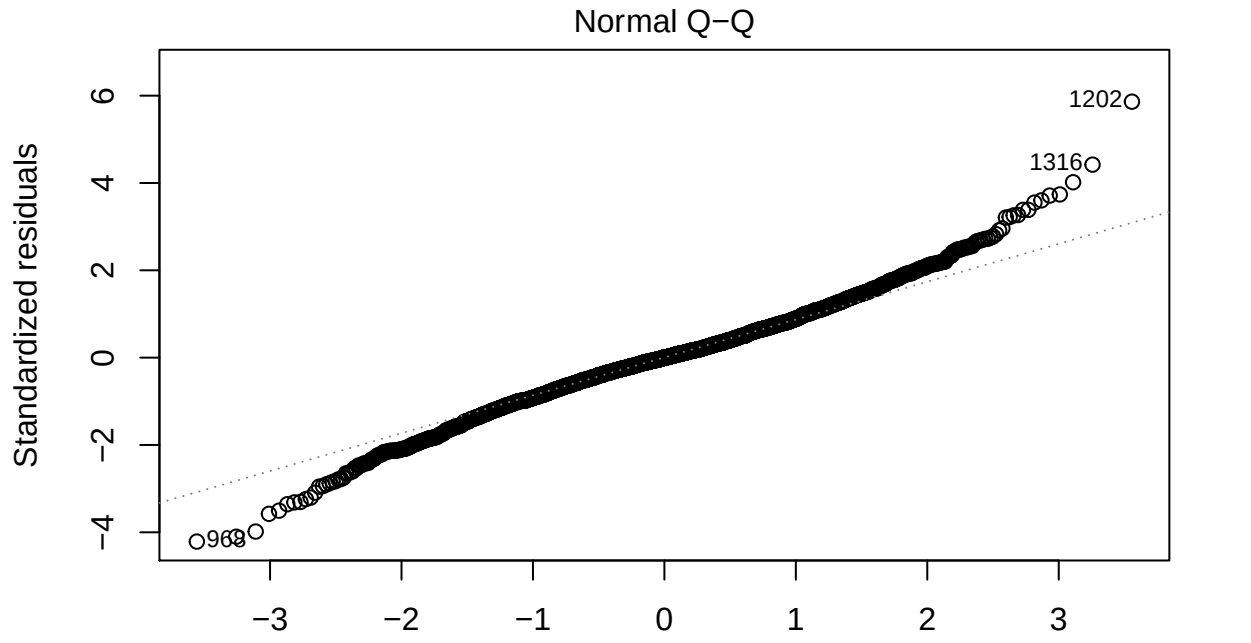
```
## pct_with_coverage      -0.277761   0.102610  -2.707 0.006834 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.32 on 2656 degrees of freedom
## Multiple R-squared:  0.4163, Adjusted R-squared:  0.4143
## F-statistic: 210.4 on 9 and 2656 DF,  p-value: < 2.2e-16
```

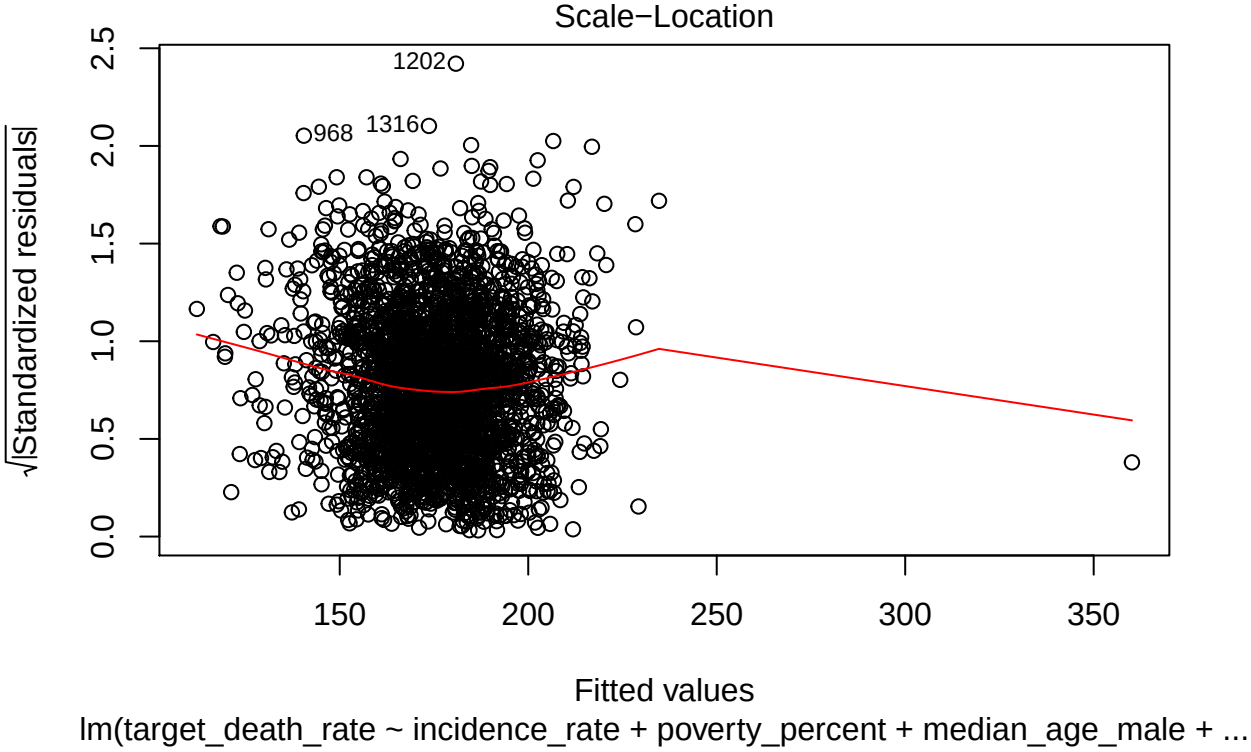
```
cbind(summary(backward_model_high_rm) %>% tidy %>% dplyr::select(-statistic),
      summary(backward_model_high) %>% tidy %>% dplyr::select(-statistic)) %>%
  knitr::kable()
```

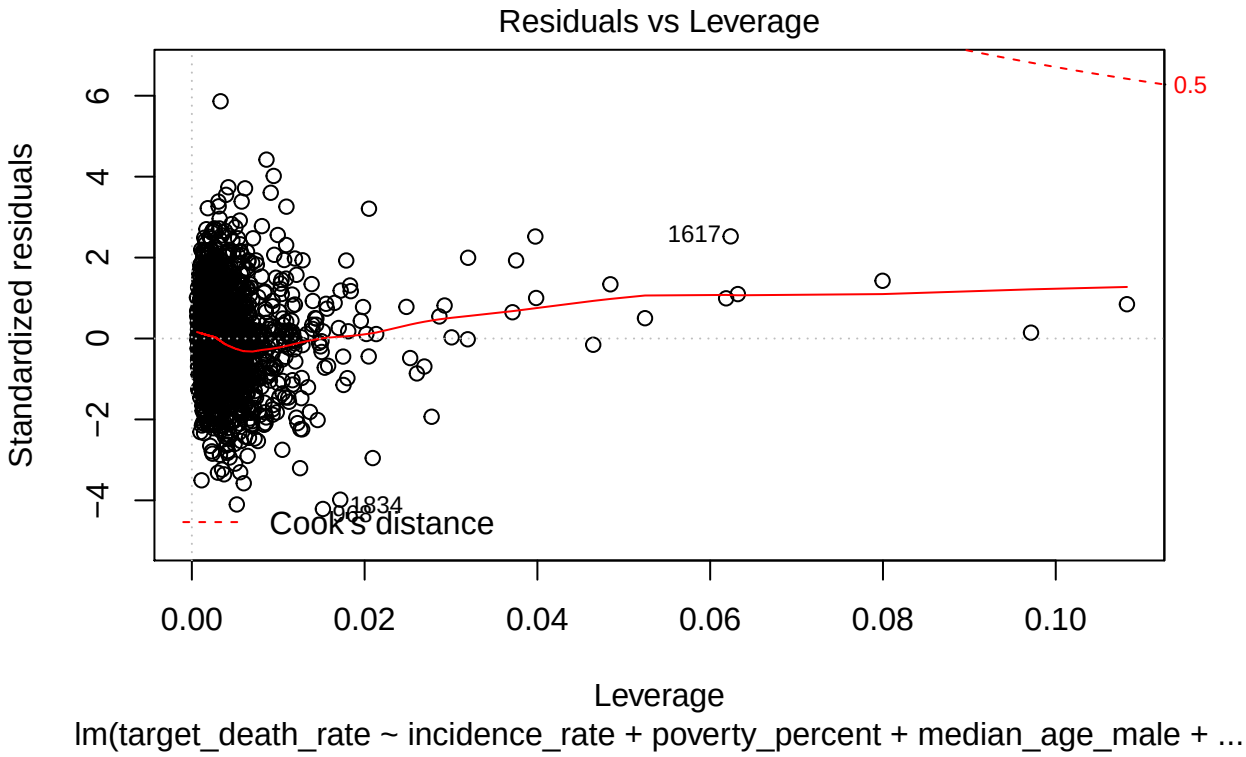
term	estimate	std.error	p.value	term	estimate	std.error	
(Intercept)	88.9849652	11.9312133	0.0000000	(Intercept)	94.8142834	12.1673029	0
incidence_rate	0.2141222	0.0079454	0.0000000	incidence_rate	0.2002120	0.0079169	0
poverty_percent	0.9554022	0.1254455	0.0000000	poverty_percent	0.9427978	0.1281059	0
median_age_male	-0.3069793	0.0831330	0.0002264	median_age_male	-0.2846952	0.0848240	0
pct_unemployed16_over	1.0355703	0.1579250	0.0000000	pct_unemployed16_over	1.0011861	0.1608617	0
pct_asian	-0.9834361	0.1579927	0.0000000	pct_asian	-0.7500694	0.1553122	0
pct_other_race	-1.0068963	0.1238602	0.0000000	pct_other_race	-1.0655150	0.1262476	0
pct_married_households	-0.2479565	0.0812670	0.0023023	pct_married_households	-0.2694759	0.0829536	0
pct_upto_hs18_24	0.3852755	0.0379742	0.0000000	pct_upto_hs18_24	0.4069440	0.0386684	0
pct_with_coverage	-0.2777608	0.1026097	0.0068336	pct_with_coverage	-0.2800928	0.1046493	0

```
plot(backward_model_high_rm)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
1202
1316
968


Scale−Location
√|Standardized residuals|
Fitted values
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...
1202
968
1316


Residuals vs Leverage
Standardized residuals
6
4
2
0
−2
−4
0.5
1617
1834
968
Cook's distance
0.00
0.02
0.04
0.06
0.08
0.10
Leverage
lm(target_death_rate ~ incidence_rate + poverty_percent + median_age_male + ...