Solution 2

```r
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.1      v purrr   1.0.1
## v tibble  3.1.8      v dplyr   1.1.0
## v tidyr   1.3.0      v stringr 1.5.0
## v readr   2.1.4      v forcats 1.0.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```r
library(miceadds)
```

```
## Loading required package: mice
##
## Attaching package: 'mice'
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following objects are masked from 'package:base':
##
##     cbind, rbind
##
## * miceadds 3.16-18 (2023-01-06 10:54:00)
```

```r
df <- read.csv('https://raw.githubusercontent.com/rjblake34/waenroll/main/waenrolldf.csv', header=TRUE)
```

Run regressions

```r
mod1 <- miceadds::glm.cluster(data=df,
                              formula = TwoYear ~ LowIncomePct + WhitePct + ELLPct + HighlyCapablePct +
                                TotalStudents + factor(District) + factor(Year),
                              cluster = "District",
                              family='gaussian')
```

```
## Loading required namespace: sandwich
```

```r
mod2 <- miceadds::glm.cluster(data=df,
                              formula = FourYear ~ LowIncomePct + WhitePct + ELLPct + HighlyCapablePct +
                                TotalStudents + factor(District) + factor(Year),
                              cluster = "District",
```

```
                                 family='gaussian')

mod3 <- miceadds::glm.cluster(data=df,
                              formula = TwoYear+FourYear ~ LowIncomePct + WhitePct + ELLPct + HighlyCapa
                                TotalStudents + factor(District) + factor(Year),
                              cluster = "District",
                              family='gaussian')
```

Print results of model 1

```
summary(mod1$glm_res)
```

```
##
## Call:
## stats::glm(formula = formula, family = family, data = data, weights = wgt__)
##
## Deviance Residuals:
##       Min        1Q     Median        3Q       Max
## -0.194189  -0.022226  -0.000744   0.020912   0.179524
##
## Coefficients:
##                                             Estimate Std. Error
## (Intercept)                                1.054e-01  1.496e-01
## LowIncomePct                               3.116e-02  4.608e-02
## WhitePct                                   2.111e-01  1.273e-01
## ELLPct                                     6.922e-02  7.372e-02
## HighlyCapablePct                           8.894e-02  8.034e-02
## FemalePct                                  2.304e-01  2.395e-01
## TotalStudents                             -6.614e-07  6.130e-06
## factor(District)Adna                       8.019e-03  5.205e-02
## factor(District)Anacortes                 -1.207e-01  4.514e-02
## factor(District)Arlington                 -9.018e-02  4.439e-02
## factor(District)Asotin-Anatone            -2.538e-01  5.171e-02
## factor(District)Auburn                    -1.719e-02  8.270e-02
## factor(District)Bainbridge Island         -2.706e-01  4.872e-02
## factor(District)Battle Ground             -1.005e-01  8.149e-02
## factor(District)Bellevue                  -8.998e-02  1.075e-01
## factor(District)Bellingham                -8.071e-02  6.310e-02
## factor(District)Bethel                    -9.554e-02  1.021e-01
## factor(District)Blaine                    -9.718e-02  3.683e-02
## factor(District)Bremerton                 -3.335e-02  2.893e-02
## factor(District)Brewster                   5.119e-02  7.066e-02
## factor(District)Burlington-Edison          3.762e-03  2.952e-02
## factor(District)Camas                     -1.371e-01  5.049e-02
## factor(District)Cape Flattery              6.202e-02  6.787e-02
## factor(District)Cascade                   -6.831e-02  3.320e-02
## factor(District)Castle Rock               -1.005e-01  4.508e-02
## factor(District)Central Kitsap             1.356e-02  5.815e-02
## factor(District)Central Valley            -1.515e-01  8.737e-02
## factor(District)Centralia                  8.709e-03  2.745e-02
## factor(District)Chehalis                   1.045e-02  3.582e-02
## factor(District)Cheney                    -1.683e-01  4.169e-02
## factor(District)Chewelah                  -1.760e-01  5.010e-02
```

```
## factor(District)Chimacum                                       -1.680e-01  4.296e-02
## factor(District)Clarkston                                      -2.355e-01  4.413e-02
## factor(District)Cle Elum-Roslyn                                 -2.608e-01  4.497e-02
## factor(District)Clover Park                                     -5.009e-02  6.548e-02
## factor(District)Colfax                                          -1.828e-01  5.197e-02
## factor(District)College Place                                    1.296e-01  4.136e-02
## factor(District)Columbia (Walla Walla)                           1.938e-02  3.237e-02
## factor(District)Colville                                        -2.102e-01  4.748e-02
## factor(District)Concrete                                        -8.760e-02  6.348e-02
## factor(District)Coupeville                                      -1.553e-01  3.826e-02
## factor(District)Davenport                                       -2.549e-01  5.207e-02
## factor(District)Deer Park                                       -2.158e-01  5.116e-02
## factor(District)East Valley (Spokane)                           -1.078e-01  4.123e-02
## factor(District)East Valley (Yakima)                            -2.641e-02  2.961e-02
## factor(District)Eastmont                                         1.037e-02  3.181e-02
## factor(District)Eatonville                                      -1.738e-01  4.490e-02
## factor(District)Edmonds                                          1.240e-02  1.100e-01
## factor(District)Ellensburg                                      -2.681e-01  3.887e-02
## factor(District)Elma                                            -5.883e-02  3.267e-02
## factor(District)Enumclaw                                        -1.439e-01  4.259e-02
## factor(District)Ephrata                                         -6.373e-02  3.022e-02
## factor(District)Everett                                         -2.372e-02  1.069e-01
## factor(District)Evergreen (Clark)                               -6.093e-02  1.405e-01
## factor(District)Federal Way                                     -2.653e-02  1.196e-01
## factor(District)Ferndale                                        -5.236e-02  3.367e-02
## factor(District)Fife                                            -5.796e-03  3.055e-02
## factor(District)Finley                                          -5.448e-02  3.299e-02
## factor(District)Franklin Pierce                                 -9.798e-02  4.208e-02
## factor(District)Goldendale                                      -1.007e-01  3.830e-02
## factor(District)Grand Coulee Dam                                -8.070e-02  4.910e-02
## factor(District)Grandview                                        1.437e-02  6.518e-02
## factor(District)Granger                                         -7.817e-02  7.379e-02
## factor(District)Granite Falls                                   -1.303e-01  4.132e-02
## factor(District)Highland                                         2.195e-02  5.379e-02
## factor(District)Highline                                         1.342e-02  9.993e-02
## factor(District)Hockinson                                       -1.390e-01  5.174e-02
## factor(District)Hoquiam                                          5.415e-02  3.221e-02
## factor(District)Issaquah                                        -1.279e-01  1.088e-01
## factor(District)Kalama                                          -9.528e-02  5.028e-02
## factor(District)Kelso                                           -7.785e-02  3.768e-02
## factor(District)Kennewick                                       -5.074e-02  9.685e-02
## factor(District)Kent                                             4.136e-02  1.456e-01
## factor(District)Kettle Falls                                    -2.145e-01  4.564e-02
## factor(District)Kittitas                                        -2.102e-01  3.855e-02
## factor(District)La Center                                       -5.980e-02  5.229e-02
## factor(District)La Conner                                       -4.623e-02  3.540e-02
## factor(District)Lake Chelan                                     -4.425e-02  3.673e-02
## factor(District)Lake Stevens                                    -5.172e-02  5.356e-02
## factor(District)Lake Washington                                 -1.350e-01  1.619e-01
## factor(District)Lake Washington Institute of Technology         -1.883e-02  5.207e-02
## factor(District)Lakewood                                        -7.689e-02  3.469e-02
## factor(District)Liberty                                         -1.537e-01  5.131e-02
## factor(District)Longview                                        -5.255e-02  3.924e-02
## factor(District)Lynden                                          -4.219e-02  3.435e-02
```

```
## factor(District)Mabton             -3.940e-02  7.752e-02
## factor(District)Manson              3.590e-02  4.809e-02
## factor(District)Marysville         -1.027e-02  5.400e-02
## factor(District)Mead               -1.514e-01  6.719e-02
## factor(District)Medical Lake       -1.329e-01  4.006e-02
## factor(District)Mercer Island      -2.561e-01  4.404e-02
## factor(District)Meridian           -1.480e-02  3.486e-02
## factor(District)Methow Valley      -2.737e-01  5.129e-02
## factor(District)Monroe             -1.124e-01  4.462e-02
## factor(District)Montesano           5.293e-02  4.210e-02
## factor(District)Moses Lake         -3.276e-02  4.009e-02
## factor(District)Mount Adams        -1.195e-01  7.492e-02
## factor(District)Mount Vernon        2.081e-03  3.648e-02
## factor(District)Mukilteo            1.011e-02  7.695e-02
## factor(District)Napavine           -1.858e-02  4.313e-02
## factor(District)Newport            -2.281e-01  5.012e-02
## factor(District)Nine Mile Falls    -6.419e-02  4.870e-02
## factor(District)Nooksack Valley     1.161e-02  2.956e-02
## factor(District)North Franklin     -2.843e-02  4.852e-02
## factor(District)North Kitsap       -9.099e-02  3.853e-02
## factor(District)North Mason        -8.641e-02  3.212e-02
## factor(District)Northshore         -8.694e-02  1.212e-01
## factor(District)Oak Harbor         -9.840e-02  3.463e-02
## factor(District)Ocean Beach        -1.716e-01  3.699e-02
## factor(District)Ocosta             -6.012e-02  3.288e-02
## factor(District)Okanogan           -4.197e-02  3.091e-02
## factor(District)Olympia            -1.236e-01  5.608e-02
## factor(District)Omak               -1.457e-01  3.414e-02
## factor(District)Onalaska            1.587e-02  4.400e-02
## factor(District)Orcas Island       -2.301e-01  4.796e-02
## factor(District)Oroville           -1.325e-01  3.201e-02
## factor(District)Orting             -1.681e-01  3.782e-02
## factor(District)Othello             1.770e-02  6.190e-02
## factor(District)Pasco               2.998e-02  9.185e-02
## factor(District)Peninsula          -1.638e-01  6.048e-02
## factor(District)Port Angeles       -7.217e-02  3.655e-02
## factor(District)Port Townsend      -1.761e-01  4.251e-02
## factor(District)Prosser            -2.699e-02  4.030e-02
## factor(District)Pullman            -2.285e-01  3.598e-02
## factor(District)Puyallup           -8.683e-02  1.216e-01
## factor(District)Quillayute Valley  -1.081e-01  3.050e-02
## factor(District)Quincy              4.282e-02  6.301e-02
## factor(District)Rainier            -1.113e-01  4.215e-02
## factor(District)Raymond             7.972e-03  3.232e-02
## factor(District)Reardan-Edwall     -1.564e-01  4.813e-02
## factor(District)Renton              5.374e-02  7.990e-02
## factor(District)Richland           -1.347e-01  7.641e-02
## factor(District)Ridgefield         -5.593e-02  4.404e-02
## factor(District)Ritzville          -1.839e-01  4.668e-02
## factor(District)Riverside          -1.553e-01  4.968e-02
## factor(District)Riverview          -1.722e-01  4.531e-02
## factor(District)Rochester          -3.759e-02  3.221e-02
## factor(District)Royal               7.026e-02  6.024e-02
## factor(District)San Juan Island    -2.090e-01  3.876e-02
```

```
## factor(District)Sedro-Woolley                           -9.615e-02  3.597e-02
## factor(District)Selah                                   -6.404e-02  3.166e-02
## factor(District)Sequim                                  -1.002e-01  3.900e-02
## factor(District)Shelton                                 -1.197e-01  2.793e-02
## factor(District)Shoreline                               -4.604e-02  4.871e-02
## factor(District)Snohomish                               -8.928e-02  6.337e-02
## factor(District)Snoqualmie Valley                       -1.591e-01  5.510e-02
## factor(District)South Bend                               7.392e-02  3.838e-02
## factor(District)South Kitsap                            -9.449e-02  5.487e-02
## factor(District)South Whidbey                           -1.931e-01  4.649e-02
## factor(District)Spokane                                 -1.132e-01  1.742e-01
## factor(District)Stanwood-Camano                         -1.017e-01  4.715e-02
## factor(District)Stevenson-Carson                        -2.010e-01  3.987e-02
## factor(District)Summit Public School: Olympus           -1.334e-01  6.720e-02
## factor(District)Summit Public School: Sierra            -6.921e-02  6.671e-02
## factor(District)Sumner                                  -1.287e-01  5.759e-02
## factor(District)Sunnyside                               -2.570e-02  6.405e-02
## factor(District)Tacoma                                  -6.907e-02  1.623e-01
## factor(District)Tahoma                                  -6.799e-02  5.482e-02
## factor(District)Tenino                                  -6.778e-02  4.754e-02
## factor(District)Toledo                                  -8.804e-02  4.370e-02
## factor(District)Tonasket                                -1.755e-01  3.042e-02
## factor(District)Toppenish                               -2.739e-02  5.814e-02
## factor(District)Tukwila                                  3.888e-02  6.106e-02
## factor(District)Tumwater                                -6.380e-02  4.497e-02
## factor(District)University Place                        -3.273e-02  3.356e-02
## factor(District)Vancouver                               -8.947e-02  1.264e-01
## factor(Year)2015                                        -7.835e-03  5.350e-03
## factor(Year)2016                                        -5.936e-03  5.662e-03
## factor(Year)2017                                        -1.590e-02  6.258e-03
## factor(Year)2018                                        -2.594e-02  6.708e-03
## factor(Year)2019                                        -2.672e-02  7.239e-03
##                                                         t value Pr(>|t|)
## (Intercept)                                               0.704 0.481560
## LowIncomePct                                              0.676 0.499196
## WhitePct                                                  1.658 0.097691 .
## ELLPct                                                    0.939 0.348054
## HighlyCapablePct                                          1.107 0.268638
## FemalePct                                                 0.962 0.336293
## TotalStudents                                            -0.108 0.914113
## factor(District)Adna                                      0.154 0.877607
## factor(District)Anacortes                                -2.674 0.007653 **
## factor(District)Arlington                                -2.032 0.042546 *
## factor(District)Asotin-Anatone                           -4.908 1.13e-06 ***
## factor(District)Auburn                                   -0.208 0.835420
## factor(District)Bainbridge Island                        -5.555 3.85e-08 ***
## factor(District)Battle Ground                            -1.233 0.218051
## factor(District)Bellevue                                 -0.837 0.403044
## factor(District)Bellingham                               -1.279 0.201265
## factor(District)Bethel                                   -0.936 0.349576
## factor(District)Blaine                                   -2.639 0.008489 **
## factor(District)Bremerton                                -1.152 0.249491
## factor(District)Brewster                                  0.725 0.468947
## factor(District)Burlington-Edison                         0.127 0.898635
```

```
## factor(District)Camas                          -2.715 0.006788 **
## factor(District)Cape Flattery                    0.914 0.361104
## factor(District)Cascade                         -2.057 0.040000 *
## factor(District)Castle Rock                     -2.229 0.026105 *
## factor(District)Central Kitsap                   0.233 0.815718
## factor(District)Central Valley                  -1.734 0.083273 .
## factor(District)Centralia                        0.317 0.751138
## factor(District)Chehalis                         0.292 0.770538
## factor(District)Cheney                          -4.036 5.98e-05 ***
## factor(District)Chewelah                        -3.514 0.000468 ***
## factor(District)Chimacum                        -3.910 0.000100 ***
## factor(District)Clarkston                       -5.337 1.25e-07 ***
## factor(District)Cle Elum-Roslyn                 -5.800 9.77e-09 ***
## factor(District)Clover Park                     -0.765 0.444552
## factor(District)Colfax                          -3.517 0.000463 ***
## factor(District)College Place                    3.133 0.001798 **
## factor(District)Columbia (Walla Walla)           0.599 0.549624
## factor(District)Colville                        -4.426 1.10e-05 ***
## factor(District)Concrete                        -1.380 0.168040
## factor(District)Coupeville                      -4.059 5.44e-05 ***
## factor(District)Davenport                       -4.895 1.20e-06 ***
## factor(District)Deer Park                       -4.217 2.77e-05 ***
## factor(District)East Valley (Spokane)           -2.615 0.009091 **
## factor(District)East Valley (Yakima)            -0.892 0.372774
## factor(District)Eastmont                         0.326 0.744401
## factor(District)Eatonville                      -3.871 0.000118 ***
## factor(District)Edmonds                          0.113 0.910253
## factor(District)Ellensburg                      -6.898 1.12e-11 ***
## factor(District)Elma                            -1.801 0.072138 .
## factor(District)Enumclaw                        -3.379 0.000765 ***
## factor(District)Ephrata                         -2.109 0.035308 *
## factor(District)Everett                         -0.222 0.824395
## factor(District)Evergreen (Clark)               -0.434 0.664753
## factor(District)Federal Way                     -0.222 0.824591
## factor(District)Ferndale                        -1.555 0.120389
## factor(District)Fife                            -0.190 0.849567
## factor(District)Finley                          -1.651 0.099074 .
## factor(District)Franklin Pierce                 -2.328 0.020152 *
## factor(District)Goldendale                      -2.631 0.008693 **
## factor(District)Grand Coulee Dam                -1.644 0.100695
## factor(District)Grandview                        0.220 0.825606
## factor(District)Granger                         -1.059 0.289777
## factor(District)Granite Falls                   -3.153 0.001681 **
## factor(District)Highland                         0.408 0.683416
## factor(District)Highline                         0.134 0.893183
## factor(District)Hockinson                       -2.685 0.007402 **
## factor(District)Hoquiam                          1.681 0.093206 .
## factor(District)Issaquah                        -1.176 0.239991
## factor(District)Kalama                          -1.895 0.058455 .
## factor(District)Kelso                           -2.066 0.039187 *
## factor(District)Kennewick                       -0.524 0.600534
## factor(District)Kent                             0.284 0.776359
## factor(District)Kettle Falls                    -4.701 3.08e-06 ***
## factor(District)Kittitas                        -5.453 6.72e-08 ***
```

```
## factor(District)La Center                                 -1.144 0.253125
## factor(District)La Conner                                 -1.306 0.191988
## factor(District)Lake Chelan                               -1.205 0.228701
## factor(District)Lake Stevens                              -0.966 0.334568
## factor(District)Lake Washington                           -0.833 0.404873
## factor(District)Lake Washington Institute of Technology   -0.362 0.717728
## factor(District)Lakewood                                  -2.217 0.026948 *
## factor(District)Liberty                                   -2.996 0.002825 **
## factor(District)Longview                                  -1.339 0.180879
## factor(District)Lynden                                    -1.228 0.219807
## factor(District)Mabton                                    -0.508 0.611464
## factor(District)Manson                                     0.746 0.455613
## factor(District)Marysville                                -0.190 0.849161
## factor(District)Mead                                      -2.254 0.024497 *
## factor(District)Medical Lake                              -3.316 0.000956 ***
## factor(District)Mercer Island                             -5.815 8.94e-09 ***
## factor(District)Meridian                                  -0.424 0.671381
## factor(District)Methow Valley                             -5.336 1.26e-07 ***
## factor(District)Monroe                                    -2.519 0.011974 *
## factor(District)Montesano                                  1.257 0.209097
## factor(District)Moses Lake                                -0.817 0.414052
## factor(District)Mount Adams                               -1.595 0.111185
## factor(District)Mount Vernon                               0.057 0.954519
## factor(District)Mukilteo                                   0.131 0.895530
## factor(District)Napavine                                  -0.431 0.666791
## factor(District)Newport                                   -4.550 6.24e-06 ***
## factor(District)Nine Mile Falls                           -1.318 0.187825
## factor(District)Nooksack Valley                            0.393 0.694646
## factor(District)North Franklin                            -0.586 0.558117
## factor(District)North Kitsap                              -2.361 0.018461 *
## factor(District)North Mason                               -2.691 0.007288 **
## factor(District)Northshore                                -0.717 0.473506
## factor(District)Oak Harbor                                -2.841 0.004613 **
## factor(District)Ocean Beach                               -4.640 4.11e-06 ***
## factor(District)Ocosta                                    -1.829 0.067843 .
## factor(District)Okanogan                                  -1.358 0.174959
## factor(District)Olympia                                   -2.204 0.027827 *
## factor(District)Omak                                      -4.268 2.22e-05 ***
## factor(District)Onalaska                                   0.361 0.718503
## factor(District)Orcas Island                              -4.799 1.92e-06 ***
## factor(District)Oroville                                  -4.140 3.86e-05 ***
## factor(District)Orting                                    -4.446 1.01e-05 ***
## factor(District)Othello                                    0.286 0.774966
## factor(District)Pasco                                      0.326 0.744252
## factor(District)Peninsula                                 -2.708 0.006915 **
## factor(District)Port Angeles                              -1.975 0.048657 *
## factor(District)Port Townsend                             -4.142 3.83e-05 ***
## factor(District)Prosser                                   -0.670 0.503254
## factor(District)Pullman                                   -6.351 3.70e-10 ***
## factor(District)Puyallup                                  -0.714 0.475384
## factor(District)Quillayute Valley                         -3.542 0.000421 ***
## factor(District)Quincy                                     0.680 0.496974
## factor(District)Rainier                                   -2.640 0.008469 **
## factor(District)Raymond                                    0.247 0.805236
```

```
## factor(District)Reardan-Edwall                          -3.250 0.001203 **
## factor(District)Renton                                    0.673 0.501376
## factor(District)Richland                                 -1.763 0.078331 .
## factor(District)Ridgefield                               -1.270 0.204463
## factor(District)Ritzville                                -3.940 8.92e-05 ***
## factor(District)Riverside                                -3.127 0.001835 **
## factor(District)Riverview                                -3.800 0.000157 ***
## factor(District)Rochester                                -1.167 0.243561
## factor(District)Royal                                     1.166 0.243800
## factor(District)San Juan Island                          -5.391 9.36e-08 ***
## factor(District)Sedro-Woolley                            -2.673 0.007682 **
## factor(District)Selah                                    -2.022 0.043480 *
## factor(District)Sequim                                   -2.570 0.010360 *
## factor(District)Shelton                                  -4.287 2.05e-05 ***
## factor(District)Shoreline                                -0.945 0.344845
## factor(District)Snohomish                                -1.409 0.159254
## factor(District)Snoqualmie Valley                        -2.887 0.004005 **
## factor(District)South Bend                                1.926 0.054455 .
## factor(District)South Kitsap                             -1.722 0.085487 .
## factor(District)South Whidbey                            -4.153 3.66e-05 ***
## factor(District)Spokane                                  -0.650 0.516124
## factor(District)Stanwood-Camano                          -2.156 0.031387 *
## factor(District)Stevenson-Carson                         -5.041 5.80e-07 ***
## factor(District)Summit Public School: Olympus            -1.985 0.047518 *
## factor(District)Summit Public School: Sierra             -1.037 0.299852
## factor(District)Sumner                                   -2.235 0.025730 *
## factor(District)Sunnyside                                -0.401 0.688399
## factor(District)Tacoma                                   -0.426 0.670514
## factor(District)Tahoma                                   -1.240 0.215266
## factor(District)Tenino                                   -1.426 0.154356
## factor(District)Toledo                                   -2.014 0.044322 *
## factor(District)Tonasket                                 -5.769 1.16e-08 ***
## factor(District)Toppenish                                -0.471 0.637763
## factor(District)Tukwila                                   0.637 0.524537
## factor(District)Tumwater                                 -1.419 0.156425
## factor(District)University Place                         -0.975 0.329705
## factor(District)Vancouver                                -0.708 0.479341
## factor(Year)2015                                         -1.465 0.143459
## factor(Year)2016                                         -1.048 0.294832
## factor(Year)2017                                         -2.541 0.011243 *
## factor(Year)2018                                         -3.867 0.000120 ***
## factor(Year)2019                                         -3.691 0.000240 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.002104546)
##
##     Null deviance: 5.7568  on 926  degrees of freedom
## Residual deviance: 1.5910  on 756  degrees of freedom
## AIC: -2928
##
## Number of Fisher Scoring iterations: 2
```

```r
with(summary(mod1$glm_res), 1 - deviance/null.deviance) #print r squared
```

```
## [1] 0.7236251
```

Print results of model 2

```r
summary(mod2$glm_res)
```

```
##
## Call:
## stats::glm(formula = formula, family = family, data = data, weights = wgt__)
##
## Deviance Residuals:
##       Min        1Q     Median        3Q       Max
## -0.217301  -0.023803  -0.000227   0.023125   0.174403
##
## Coefficients:
##                                         Estimate Std. Error
## (Intercept)                             3.398e-01  1.573e-01
## LowIncomePct                           -2.570e-02  4.846e-02
## WhitePct                               -1.615e-01  1.339e-01
## ELLPct                                 -3.402e-02  7.751e-02
## HighlyCapablePct                       -9.106e-02  8.448e-02
## FemalePct                              -1.558e-01  2.518e-01
## TotalStudents                           3.389e-06  6.446e-06
## factor(District)Adna                    6.415e-02  5.473e-02
## factor(District)Anacortes               3.037e-01  4.747e-02
## factor(District)Arlington               1.188e-01  4.668e-02
## factor(District)Asotin-Anatone          3.569e-01  5.437e-02
## factor(District)Auburn                  7.603e-02  8.696e-02
## factor(District)Bainbridge Island       5.463e-01  5.123e-02
## factor(District)Battle Ground           8.063e-02  8.568e-02
## factor(District)Bellevue                3.671e-01  1.131e-01
## factor(District)Bellingham              2.482e-01  6.635e-02
## factor(District)Bethel                 -2.403e-02  1.073e-01
## factor(District)Blaine                  1.292e-01  3.872e-02
## factor(District)Bremerton               1.768e-02  3.042e-02
## factor(District)Brewster                5.817e-02  7.429e-02
## factor(District)Burlington-Edison       9.236e-02  3.104e-02
## factor(District)Camas                   2.953e-01  5.309e-02
## factor(District)Cape Flattery          -2.371e-02  7.137e-02
## factor(District)Cascade                 2.090e-01  3.491e-02
## factor(District)Castle Rock             4.454e-02  4.740e-02
## factor(District)Central Kitsap          1.062e-01  6.114e-02
## factor(District)Central Valley          2.017e-01  9.187e-02
## factor(District)Centralia              -1.992e-02  2.886e-02
## factor(District)Chehalis                1.065e-01  3.766e-02
## factor(District)Cheney                  2.160e-01  4.384e-02
## factor(District)Chewelah                1.578e-01  5.268e-02
## factor(District)Chimacum                1.256e-01  4.517e-02
## factor(District)Clarkston               2.239e-01  4.640e-02
## factor(District)Cle Elum-Roslyn         2.815e-01  4.729e-02
```

```
## factor(District)Clover Park                                    4.153e-02  6.885e-02
## factor(District)Colfax                                         3.461e-01  5.465e-02
## factor(District)College Place                                  4.613e-02  4.349e-02
## factor(District)Columbia (Walla Walla)                         9.844e-02  3.404e-02
## factor(District)Colville                                       1.800e-01  4.993e-02
## factor(District)Concrete                                       7.026e-02  6.675e-02
## factor(District)Coupeville                                     2.042e-01  4.023e-02
## factor(District)Davenport                                      2.621e-01  5.475e-02
## factor(District)Deer Park                                      8.145e-02  5.379e-02
## factor(District)East Valley (Spokane)                          1.008e-01  4.336e-02
## factor(District)East Valley (Yakima)                           7.060e-02  3.114e-02
## factor(District)Eastmont                                       1.380e-02  3.345e-02
## factor(District)Eatonville                                     1.407e-01  4.721e-02
## factor(District)Edmonds                                        1.521e-01  1.156e-01
## factor(District)Ellensburg                                     2.998e-01  4.087e-02
## factor(District)Elma                                           6.734e-03  3.435e-02
## factor(District)Enumclaw                                       1.826e-01  4.478e-02
## factor(District)Ephrata                                        8.642e-02  3.178e-02
## factor(District)Everett                                        1.152e-01  1.124e-01
## factor(District)Evergreen (Clark)                              2.803e-02  1.478e-01
## factor(District)Federal Way                                    8.506e-02  1.258e-01
## factor(District)Ferndale                                       1.404e-01  3.541e-02
## factor(District)Fife                                           1.138e-01  3.212e-02
## factor(District)Finley                                        -3.656e-02  3.469e-02
## factor(District)Franklin Pierce                                9.872e-02  4.424e-02
## factor(District)Goldendale                                     8.494e-02  4.027e-02
## factor(District)Grand Coulee Dam                               4.364e-02  5.163e-02
## factor(District)Grandview                                     -2.505e-02  6.853e-02
## factor(District)Granger                                        6.228e-02  7.759e-02
## factor(District)Granite Falls                                  4.206e-02  4.344e-02
## factor(District)Highland                                       3.455e-02  5.656e-02
## factor(District)Highline                                       1.947e-02  1.051e-01
## factor(District)Hockinson                                      3.084e-01  5.441e-02
## factor(District)Hoquiam                                        1.502e-02  3.387e-02
## factor(District)Issaquah                                       4.239e-01  1.144e-01
## factor(District)Kalama                                         1.017e-01  5.286e-02
## factor(District)Kelso                                          4.153e-02  3.962e-02
## factor(District)Kennewick                                      5.218e-02  1.018e-01
## factor(District)Kent                                           5.960e-02  1.531e-01
## factor(District)Kettle Falls                                   1.343e-01  4.799e-02
## factor(District)Kittitas                                       3.176e-01  4.054e-02
## factor(District)La Center                                      1.409e-01  5.498e-02
## factor(District)La Conner                                      2.867e-01  3.722e-02
## factor(District)Lake Chelan                                    1.852e-01  3.862e-02
## factor(District)Lake Stevens                                   1.194e-01  5.632e-02
## factor(District)Lake Washington                                3.837e-01  1.703e-01
## factor(District)Lake Washington Institute of Technology -1.199e-02  5.475e-02
## factor(District)Lakewood                                       6.769e-02  3.647e-02
## factor(District)Liberty                                        3.225e-01  5.396e-02
## factor(District)Longview                                       8.756e-02  4.126e-02
## factor(District)Lynden                                         1.194e-01  3.612e-02
## factor(District)Mabton                                        -3.429e-02  8.151e-02
## factor(District)Manson                                         9.681e-02  5.057e-02
## factor(District)Marysville                                     2.948e-02  5.678e-02
```

```
## factor(District)Mead                         2.764e-01  7.065e-02
## factor(District)Medical Lake                 1.661e-01  4.212e-02
## factor(District)Mercer Island                6.008e-01  4.631e-02
## factor(District)Meridian                     1.395e-01  3.666e-02
## factor(District)Methow Valley                3.785e-01  5.393e-02
## factor(District)Monroe                       1.782e-01  4.692e-02
## factor(District)Montesano                    1.050e-01  4.427e-02
## factor(District)Moses Lake                   5.706e-02  4.215e-02
## factor(District)Mount Adams                  4.708e-02  7.878e-02
## factor(District)Mount Vernon                 9.134e-02  3.836e-02
## factor(District)Mukilteo                     1.262e-01  8.091e-02
## factor(District)Napavine                     1.306e-02  4.535e-02
## factor(District)Newport                      1.850e-01  5.270e-02
## factor(District)Nine Mile Falls              2.448e-01  5.120e-02
## factor(District)Nooksack Valley              7.294e-02  3.108e-02
## factor(District)North Franklin               2.570e-02  5.101e-02
## factor(District)North Kitsap                 2.150e-01  4.052e-02
## factor(District)North Mason                  4.278e-02  3.377e-02
## factor(District)Northshore                   2.547e-01  1.275e-01
## factor(District)Oak Harbor                   1.199e-01  3.641e-02
## factor(District)Ocean Beach                  1.658e-01  3.890e-02
## factor(District)Ocosta                       5.582e-02  3.457e-02
## factor(District)Okanogan                     1.610e-01  3.250e-02
## factor(District)Olympia                      3.160e-01  5.896e-02
## factor(District)Omak                         1.127e-01  3.589e-02
## factor(District)Onalaska                     3.396e-02  4.627e-02
## factor(District)Orcas Island                 3.817e-01  5.043e-02
## factor(District)Oroville                     9.771e-02  3.366e-02
## factor(District)Orting                       1.016e-01  3.977e-02
## factor(District)Othello                      2.388e-02  6.509e-02
## factor(District)Pasco                       -9.202e-02  9.658e-02
## factor(District)Peninsula                    2.951e-01  6.359e-02
## factor(District)Port Angeles                 1.149e-01  3.843e-02
## factor(District)Port Townsend                2.510e-01  4.470e-02
## factor(District)Prosser                      9.685e-02  4.237e-02
## factor(District)Pullman                      4.249e-01  3.784e-02
## factor(District)Puyallup                     1.205e-01  1.279e-01
## factor(District)Quillayute Valley            1.233e-02  3.207e-02
## factor(District)Quincy                       1.705e-03  6.625e-02
## factor(District)Rainier                      9.082e-02  4.432e-02
## factor(District)Raymond                      9.822e-02  3.398e-02
## factor(District)Reardan-Edwall               2.048e-01  5.061e-02
## factor(District)Renton                       7.482e-02  8.401e-02
## factor(District)Richland                     1.678e-01  8.035e-02
## factor(District)Ridgefield                   1.932e-01  4.631e-02
## factor(District)Ritzville                    2.001e-01  4.908e-02
## factor(District)Riverside                    1.206e-01  5.223e-02
## factor(District)Riverview                    3.647e-01  4.765e-02
## factor(District)Rochester                   -2.034e-02  3.387e-02
## factor(District)Royal                        6.891e-04  6.334e-02
## factor(District)San Juan Island              3.672e-01  4.076e-02
## factor(District)Sedro-Woolley                6.117e-02  3.782e-02
## factor(District)Selah                        1.434e-01  3.329e-02
## factor(District)Sequim                       1.627e-01  4.101e-02
```

```
## factor(District)Shelton                          6.993e-03  2.937e-02
## factor(District)Shoreline                        3.297e-01  5.121e-02
## factor(District)Snohomish                        2.470e-01  6.663e-02
## factor(District)Snoqualmie Valley                3.955e-01  5.794e-02
## factor(District)South Bend                       2.158e-02  4.035e-02
## factor(District)South Kitsap                     7.244e-02  5.770e-02
## factor(District)South Whidbey                    3.044e-01  4.888e-02
## factor(District)Spokane                          1.103e-01  1.832e-01
## factor(District)Stanwood-Camano                  1.506e-01  4.957e-02
## factor(District)Stevenson-Carson                 1.378e-01  4.192e-02
## factor(District)Summit Public School: Olympus    2.893e-01  7.066e-02
## factor(District)Summit Public School: Sierra     4.736e-01  7.014e-02
## factor(District)Sumner                           2.097e-01  6.056e-02
## factor(District)Sunnyside                       -3.893e-02  6.735e-02
## factor(District)Tacoma                           7.841e-02  1.706e-01
## factor(District)Tahoma                           2.507e-01  5.764e-02
## factor(District)Tenino                           3.423e-02  4.999e-02
## factor(District)Toledo                           7.180e-02  4.595e-02
## factor(District)Tonasket                         1.177e-01  3.198e-02
## factor(District)Toppenish                        4.523e-02  6.113e-02
## factor(District)Tukwila                          8.801e-02  6.421e-02
## factor(District)Tumwater                         1.724e-01  4.729e-02
## factor(District)University Place                 2.521e-01  3.529e-02
## factor(District)Vancouver                        1.293e-01  1.329e-01
## factor(Year)2015                                 2.611e-04  5.625e-03
## factor(Year)2016                                -5.492e-03  5.954e-03
## factor(Year)2017                                 6.182e-03  6.580e-03
## factor(Year)2018                                 3.566e-03  7.054e-03
## factor(Year)2019                                -1.120e-03  7.611e-03
##                                                 t value Pr(>|t|)
## (Intercept)                                       2.160 0.031096 *
## LowIncomePct                                     -0.530 0.596018
## WhitePct                                         -1.206 0.228140
## ELLPct                                           -0.439 0.660866
## HighlyCapablePct                                 -1.078 0.281408
## FemalePct                                        -0.619 0.536264
## TotalStudents                                     0.526 0.599255
## factor(District)Adna                              1.172 0.241581
## factor(District)Anacortes                         6.398 2.75e-10 ***
## factor(District)Arlington                         2.544 0.011147 *
## factor(District)Asotin-Anatone                    6.565 9.68e-11 ***
## factor(District)Auburn                            0.874 0.382220
## factor(District)Bainbridge Island                10.664  < 2e-16 ***
## factor(District)Battle Ground                     0.941 0.347023
## factor(District)Bellevue                          3.246 0.001221 **
## factor(District)Bellingham                        3.741 0.000197 ***
## factor(District)Bethel                           -0.224 0.822927
## factor(District)Blaine                            3.337 0.000887 ***
## factor(District)Bremerton                         0.581 0.561390
## factor(District)Brewster                          0.783 0.433909
## factor(District)Burlington-Edison                 2.975 0.003020 **
## factor(District)Camas                             5.562 3.69e-08 ***
## factor(District)Cape Flattery                    -0.332 0.739768
## factor(District)Cascade                           5.986 3.31e-09 ***
```

```
## factor(District)Castle Rock                          0.940 0.347753
## factor(District)Central Kitsap                        1.737 0.082870 .
## factor(District)Central Valley                        2.195 0.028454 *
## factor(District)Centralia                            -0.690 0.490244
## factor(District)Chehalis                              2.826 0.004831 **
## factor(District)Cheney                                4.928 1.02e-06 ***
## factor(District)Chewelah                              2.996 0.002828 **
## factor(District)Chimacum                              2.780 0.005563 **
## factor(District)Clarkston                             4.825 1.69e-06 ***
## factor(District)Cle Elum-Roslyn                       5.952 4.04e-09 ***
## factor(District)Clover Park                           0.603 0.546585
## factor(District)Colfax                                6.333 4.13e-10 ***
## factor(District)College Place                         1.061 0.289106
## factor(District)Columbia (Walla Walla)                2.892 0.003936 **
## factor(District)Colville                              3.605 0.000333 ***
## factor(District)Concrete                              1.053 0.292893
## factor(District)Coupeville                            5.075 4.88e-07 ***
## factor(District)Davenport                             4.787 2.03e-06 ***
## factor(District)Deer Park                             1.514 0.130432
## factor(District)East Valley (Spokane)                 2.326 0.020299 *
## factor(District)East Valley (Yakima)                  2.267 0.023651 *
## factor(District)Eastmont                              0.413 0.679918
## factor(District)Eatonville                            2.980 0.002970 **
## factor(District)Edmonds                               1.316 0.188619
## factor(District)Ellensburg                            7.336 5.69e-13 ***
## factor(District)Elma                                  0.196 0.844631
## factor(District)Enumclaw                              4.078 5.03e-05 ***
## factor(District)Ephrata                               2.719 0.006690 **
## factor(District)Everett                               1.025 0.305801
## factor(District)Evergreen (Clark)                     0.190 0.849617
## factor(District)Federal Way                           0.676 0.499157
## factor(District)Ferndale                              3.964 8.06e-05 ***
## factor(District)Fife                                  3.542 0.000422 ***
## factor(District)Finley                               -1.054 0.292260
## factor(District)Franklin Pierce                       2.231 0.025954 *
## factor(District)Goldendale                            2.110 0.035227 *
## factor(District)Grand Coulee Dam                      0.845 0.398291
## factor(District)Grandview                            -0.366 0.714803
## factor(District)Granger                               0.803 0.422399
## factor(District)Granite Falls                         0.968 0.333324
## factor(District)Highland                              0.611 0.541454
## factor(District)Highline                              0.185 0.853030
## factor(District)Hockinson                             5.668 2.06e-08 ***
## factor(District)Hoquiam                               0.443 0.657573
## factor(District)Issaquah                              3.707 0.000225 ***
## factor(District)Kalama                                1.923 0.054866 .
## factor(District)Kelso                                 1.048 0.294966
## factor(District)Kennewick                             0.512 0.608514
## factor(District)Kent                                  0.389 0.697095
## factor(District)Kettle Falls                          2.799 0.005263 **
## factor(District)Kittitas                              7.834 1.60e-14 ***
## factor(District)La Center                             2.562 0.010592 *
## factor(District)La Conner                             7.704 4.16e-14 ***
## factor(District)Lake Chelan                           4.796 1.95e-06 ***
```

```
## factor(District)Lake Stevens                                2.121 0.034249 *
## factor(District)Lake Washington                             2.253 0.024547 *
## factor(District)Lake Washington Institute of Technology    -0.219 0.826681
## factor(District)Lakewood                                    1.856 0.063842 .
## factor(District)Liberty                                     5.977 3.51e-09 ***
## factor(District)Longview                                    2.122 0.034146 *
## factor(District)Lynden                                      3.304 0.000997 ***
## factor(District)Mabton                                     -0.421 0.674091
## factor(District)Manson                                      1.915 0.055923 .
## factor(District)Marysville                                  0.519 0.603829
## factor(District)Mead                                        3.912 9.97e-05 ***
## factor(District)Medical Lake                                3.944 8.76e-05 ***
## factor(District)Mercer Island                              12.974  < 2e-16 ***
## factor(District)Meridian                                    3.806 0.000153 ***
## factor(District)Methow Valley                               7.018 5.00e-12 ***
## factor(District)Monroe                                      3.798 0.000157 ***
## factor(District)Montesano                                   2.372 0.017954 *
## factor(District)Moses Lake                                  1.354 0.176252
## factor(District)Mount Adams                                 0.598 0.550304
## factor(District)Mount Vernon                                2.381 0.017504 *
## factor(District)Mukilteo                                    1.560 0.119203
## factor(District)Napavine                                    0.288 0.773432
## factor(District)Newport                                     3.510 0.000475 ***
## factor(District)Nine Mile Falls                             4.780 2.11e-06 ***
## factor(District)Nooksack Valley                             2.347 0.019203 *
## factor(District)North Franklin                              0.504 0.614589
## factor(District)North Kitsap                                5.306 1.47e-07 ***
## factor(District)North Mason                                 1.267 0.205649
## factor(District)Northshore                                  1.998 0.046062 *
## factor(District)Oak Harbor                                  3.294 0.001035 **
## factor(District)Ocean Beach                                 4.264 2.27e-05 ***
## factor(District)Ocosta                                      1.615 0.106819
## factor(District)Okanogan                                    4.954 9.00e-07 ***
## factor(District)Olympia                                     5.360 1.11e-07 ***
## factor(District)Omak                                        3.140 0.001757 **
## factor(District)Onalaska                                    0.734 0.463128
## factor(District)Orcas Island                                7.569 1.10e-13 ***
## factor(District)Oroville                                    2.903 0.003799 **
## factor(District)Orting                                      2.555 0.010822 *
## factor(District)Othello                                     0.367 0.713786
## factor(District)Pasco                                      -0.953 0.340991
## factor(District)Peninsula                                   4.640 4.11e-06 ***
## factor(District)Port Angeles                                2.990 0.002878 **
## factor(District)Port Townsend                               5.614 2.78e-08 ***
## factor(District)Prosser                                     2.285 0.022561 *
## factor(District)Pullman                                    11.230  < 2e-16 ***
## factor(District)Puyallup                                    0.942 0.346263
## factor(District)Quillayute Valley                           0.384 0.700763
## factor(District)Quincy                                      0.026 0.979476
## factor(District)Rainier                                     2.049 0.040807 *
## factor(District)Raymond                                     2.890 0.003958 **
## factor(District)Reardan-Edwall                              4.047 5.72e-05 ***
## factor(District)Renton                                      0.891 0.373428
## factor(District)Richland                                    2.088 0.037094 *
```

```
## factor(District)Ridgefield                                4.172 3.37e-05 ***
## factor(District)Ritzville                                 4.077 5.04e-05 ***
## factor(District)Riverside                                 2.309 0.021210 *
## factor(District)Riverview                                 7.654 5.95e-14 ***
## factor(District)Rochester                                -0.600 0.548373
## factor(District)Royal                                     0.011 0.991322
## factor(District)San Juan Island                           9.009  < 2e-16 ***
## factor(District)Sedro-Woolley                             1.617 0.106234
## factor(District)Selah                                     4.307 1.87e-05 ***
## factor(District)Sequim                                    3.966 8.00e-05 ***
## factor(District)Shelton                                   0.238 0.811860
## factor(District)Shoreline                                 6.437 2.17e-10 ***
## factor(District)Snohomish                                 3.707 0.000225 ***
## factor(District)Snoqualmie Valley                         6.825 1.80e-11 ***
## factor(District)South Bend                                0.535 0.592983
## factor(District)South Kitsap                              1.256 0.209648
## factor(District)South Whidbey                             6.228 7.84e-10 ***
## factor(District)Spokane                                   0.602 0.547292
## factor(District)Stanwood-Camano                           3.037 0.002470 **
## factor(District)Stevenson-Carson                          3.286 0.001063 **
## factor(District)Summit Public School: Olympus             4.095 4.68e-05 ***
## factor(District)Summit Public School: Sierra              6.752 2.91e-11 ***
## factor(District)Sumner                                    3.463 0.000565 ***
## factor(District)Sunnyside                                -0.578 0.563389
## factor(District)Tacoma                                    0.460 0.645996
## factor(District)Tahoma                                    4.348 1.56e-05 ***
## factor(District)Tenino                                    0.685 0.493707
## factor(District)Toledo                                    1.563 0.118583
## factor(District)Tonasket                                  3.679 0.000251 ***
## factor(District)Toppenish                                 0.740 0.459649
## factor(District)Tukwila                                   1.371 0.170886
## factor(District)Tumwater                                  3.645 0.000285 ***
## factor(District)University Place                          7.144 2.14e-12 ***
## factor(District)Vancouver                                 0.972 0.331164
## factor(Year)2015                                          0.046 0.962994
## factor(Year)2016                                         -0.922 0.356591
## factor(Year)2017                                          0.940 0.347750
## factor(Year)2018                                          0.506 0.613292
## factor(Year)2019                                         -0.147 0.883101
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.002326807)
##
##     Null deviance: 14.7365  on 926  degrees of freedom
## Residual deviance:  1.7591  on 756  degrees of freedom
## AIC: -2835
##
## Number of Fisher Scoring iterations: 2
```

```r
with(summary(mod2$glm_res), 1 - deviance/null.deviance) #print r squared
```

```
## [1] 0.8806317
```

Print results of model 3

```r
summary(mod3$glm_res)
```

```
##
## Call:
## stats::glm(formula = formula, family = family, data = data, weights = wgt__)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -0.24450  -0.02355   0.00000   0.02549   0.25246
##
## Coefficients:
##                                          Estimate Std. Error
## (Intercept)                             4.451e-01  1.784e-01
## LowIncomePct                            5.457e-03  5.494e-02
## WhitePct                                4.966e-02  1.518e-01
## ELLPct                                  3.520e-02  8.788e-02
## HighlyCapablePct                       -2.121e-03  9.578e-02
## FemalePct                               7.461e-02  2.855e-01
## TotalStudents                           2.727e-06  7.308e-06
## factor(District)Adna                    7.217e-02  6.206e-02
## factor(District)Anacortes               1.830e-01  5.381e-02
## factor(District)Arlington               2.857e-02  5.292e-02
## factor(District)Asotin-Anatone          1.031e-01  6.164e-02
## factor(District)Auburn                  5.884e-02  9.859e-02
## factor(District)Bainbridge Island       2.757e-01  5.808e-02
## factor(District)Battle Ground          -1.983e-02  9.715e-02
## factor(District)Bellevue                2.771e-01  1.282e-01
## factor(District)Bellingham              1.675e-01  7.522e-02
## factor(District)Bethel                 -1.196e-01  1.217e-01
## factor(District)Blaine                  3.205e-02  4.390e-02
## factor(District)Bremerton              -1.567e-02  3.449e-02
## factor(District)Brewster                1.094e-01  8.423e-02
## factor(District)Burlington-Edison       9.612e-02  3.519e-02
## factor(District)Camas                   1.583e-01  6.019e-02
## factor(District)Cape Flattery           3.831e-02  8.091e-02
## factor(District)Cascade                 1.407e-01  3.958e-02
## factor(District)Castle Rock            -5.595e-02  5.374e-02
## factor(District)Central Kitsap          1.197e-01  6.932e-02
## factor(District)Central Valley          5.014e-02  1.042e-01
## factor(District)Centralia              -1.121e-02  3.272e-02
## factor(District)Chehalis                1.169e-01  4.270e-02
## factor(District)Cheney                  4.774e-02  4.970e-02
## factor(District)Chewelah               -1.823e-02  5.973e-02
## factor(District)Chimacum               -4.239e-02  5.121e-02
## factor(District)Clarkston              -1.163e-02  5.261e-02
## factor(District)Cle Elum-Roslyn         2.065e-02  5.362e-02
## factor(District)Clover Park            -8.559e-03  7.806e-02
## factor(District)Colfax                  1.633e-01  6.196e-02
## factor(District)College Place           1.757e-01  4.931e-02
## factor(District)Columbia (Walla Walla)  1.178e-01  3.859e-02
## factor(District)Colville               -3.018e-02  5.661e-02
## factor(District)Concrete               -1.734e-02  7.568e-02
```

```
## factor(District)Coupeville                                  4.887e-02  4.561e-02
## factor(District)Davenport                                   7.212e-03  6.207e-02
## factor(District)Deer Park                                  -1.343e-01  6.099e-02
## factor(District)East Valley (Spokane)                      -7.008e-03  4.916e-02
## factor(District)East Valley (Yakima)                        4.419e-02  3.530e-02
## factor(District)Eastmont                                    2.418e-02  3.792e-02
## factor(District)Eatonville                                 -3.311e-02  5.353e-02
## factor(District)Edmonds                                     1.645e-01  1.311e-01
## factor(District)Ellensburg                                  3.171e-02  4.634e-02
## factor(District)Elma                                       -5.209e-02  3.895e-02
## factor(District)Enumclaw                                    3.870e-02  5.077e-02
## factor(District)Ephrata                                     2.269e-02  3.603e-02
## factor(District)Everett                                     9.144e-02  1.274e-01
## factor(District)Evergreen (Clark)                          -3.290e-02  1.675e-01
## factor(District)Federal Way                                 5.853e-02  1.426e-01
## factor(District)Ferndale                                    8.800e-02  4.014e-02
## factor(District)Fife                                        1.080e-01  3.642e-02
## factor(District)Finley                                     -9.104e-02  3.933e-02
## factor(District)Franklin Pierce                             7.460e-04  5.016e-02
## factor(District)Goldendale                                 -1.580e-02  4.565e-02
## factor(District)Grand Coulee Dam                           -3.707e-02  5.854e-02
## factor(District)Grandview                                  -1.069e-02  7.770e-02
## factor(District)Granger                                    -1.589e-02  8.797e-02
## factor(District)Granite Falls                              -8.821e-02  4.926e-02
## factor(District)Highland                                    5.650e-02  6.413e-02
## factor(District)Highline                                    3.289e-02  1.191e-01
## factor(District)Hockinson                                   1.694e-01  6.168e-02
## factor(District)Hoquiam                                     6.917e-02  3.840e-02
## factor(District)Issaquah                                    2.960e-01  1.297e-01
## factor(District)Kalama                                      6.374e-03  5.994e-02
## factor(District)Kelso                                      -3.632e-02  4.492e-02
## factor(District)Kennewick                                   1.447e-03  1.155e-01
## factor(District)Kent                                        1.010e-01  1.735e-01
## factor(District)Kettle Falls                               -8.024e-02  5.441e-02
## factor(District)Kittitas                                    1.073e-01  4.596e-02
## factor(District)La Center                                   8.107e-02  6.234e-02
## factor(District)La Conner                                   2.405e-01  4.220e-02
## factor(District)Lake Chelan                                 1.410e-01  4.379e-02
## factor(District)Lake Stevens                                6.773e-02  6.385e-02
## factor(District)Lake Washington                             2.487e-01  1.931e-01
## factor(District)Lake Washington Institute of Technology -3.082e-02  6.207e-02
## factor(District)Lakewood                                   -9.194e-03  4.135e-02
## factor(District)Liberty                                     1.687e-01  6.117e-02
## factor(District)Longview                                    3.501e-02  4.678e-02
## factor(District)Lynden                                      7.717e-02  4.096e-02
## factor(District)Mabton                                     -7.369e-02  9.242e-02
## factor(District)Manson                                      1.327e-01  5.733e-02
## factor(District)Marysville                                  1.920e-02  6.438e-02
## factor(District)Mead                                        1.250e-01  8.010e-02
## factor(District)Medical Lake                                3.327e-02  4.776e-02
## factor(District)Mercer Island                               3.447e-01  5.250e-02
## factor(District)Meridian                                    1.247e-01  4.156e-02
## factor(District)Methow Valley                               1.048e-01  6.114e-02
## factor(District)Monroe                                      6.581e-02  5.320e-02
```

```
## factor(District)Montesano                 1.579e-01  5.019e-02
## factor(District)Moses Lake                 2.430e-02  4.779e-02
## factor(District)Mount Adams               -7.240e-02  8.932e-02
## factor(District)Mount Vernon               9.342e-02  4.349e-02
## factor(District)Mukilteo                   1.363e-01  9.173e-02
## factor(District)Napavine                  -5.517e-03  5.142e-02
## factor(District)Newport                   -4.309e-02  5.975e-02
## factor(District)Nine Mile Falls            1.806e-01  5.805e-02
## factor(District)Nooksack Valley            8.455e-02  3.524e-02
## factor(District)North Franklin            -2.728e-03  5.784e-02
## factor(District)North Kitsap               1.240e-01  4.594e-02
## factor(District)North Mason               -4.364e-02  3.829e-02
## factor(District)Northshore                 1.678e-01  1.445e-01
## factor(District)Oak Harbor                 2.153e-02  4.128e-02
## factor(District)Ocean Beach               -5.800e-03  4.410e-02
## factor(District)Ocosta                    -4.306e-03  3.920e-02
## factor(District)Okanogan                   1.190e-01  3.685e-02
## factor(District)Olympia                    1.924e-01  6.685e-02
## factor(District)Omak                      -3.300e-02  4.069e-02
## factor(District)Onalaska                   4.983e-02  5.246e-02
## factor(District)Orcas Island               1.515e-01  5.717e-02
## factor(District)Oroville                  -3.481e-02  3.816e-02
## factor(District)Orting                    -6.654e-02  4.509e-02
## factor(District)Othello                    4.158e-02  7.379e-02
## factor(District)Pasco                     -6.205e-02  1.095e-01
## factor(District)Peninsula                  1.313e-01  7.210e-02
## factor(District)Port Angeles               4.274e-02  4.357e-02
## factor(District)Port Townsend              7.486e-02  5.068e-02
## factor(District)Prosser                    6.986e-02  4.804e-02
## factor(District)Pullman                    1.964e-01  4.290e-02
## factor(District)Puyallup                   3.366e-02  1.450e-01
## factor(District)Quillayute Valley         -9.572e-02  3.636e-02
## factor(District)Quincy                     4.453e-02  7.511e-02
## factor(District)Rainier                   -2.045e-02  5.025e-02
## factor(District)Raymond                    1.062e-01  3.853e-02
## factor(District)Reardan-Edwall             4.837e-02  5.738e-02
## factor(District)Renton                     1.286e-01  9.525e-02
## factor(District)Richland                   3.309e-02  9.110e-02
## factor(District)Ridgefield                 1.373e-01  5.250e-02
## factor(District)Ritzville                  1.623e-02  5.564e-02
## factor(District)Riverside                 -3.472e-02  5.922e-02
## factor(District)Riverview                  1.925e-01  5.402e-02
## factor(District)Rochester                 -5.793e-02  3.840e-02
## factor(District)Royal                      7.095e-02  7.181e-02
## factor(District)San Juan Island            1.582e-01  4.621e-02
## factor(District)Sedro-Woolley             -3.498e-02  4.288e-02
## factor(District)Selah                      7.937e-02  3.775e-02
## factor(District)Sequim                     6.241e-02  4.650e-02
## factor(District)Shelton                   -1.127e-01  3.330e-02
## factor(District)Shoreline                  2.836e-01  5.807e-02
## factor(District)Snohomish                  1.577e-01  7.554e-02
## factor(District)Snoqualmie Valley          2.364e-01  6.569e-02
## factor(District)South Bend                 9.550e-02  4.575e-02
## factor(District)South Kitsap              -2.204e-02  6.541e-02
```

```
## factor(District)South Whidbey                         1.114e-01  5.542e-02
## factor(District)Spokane                               -2.883e-03  2.077e-01
## factor(District)Stanwood-Camano                        4.891e-02  5.620e-02
## factor(District)Stevenson-Carson                      -6.321e-02  4.753e-02
## factor(District)Summit Public School: Olympus          1.559e-01  8.011e-02
## factor(District)Summit Public School: Sierra           4.044e-01  7.952e-02
## factor(District)Sumner                                 8.098e-02  6.866e-02
## factor(District)Sunnyside                             -6.463e-02  7.635e-02
## factor(District)Tacoma                                 9.341e-03  1.935e-01
## factor(District)Tahoma                                 1.827e-01  6.535e-02
## factor(District)Tenino                                -3.355e-02  5.667e-02
## factor(District)Toledo                                -1.623e-02  5.210e-02
## factor(District)Tonasket                              -5.781e-02  3.626e-02
## factor(District)Toppenish                              1.784e-02  6.931e-02
## factor(District)Tukwila                                1.269e-01  7.280e-02
## factor(District)Tumwater                               1.086e-01  5.362e-02
## factor(District)University Place                       2.194e-01  4.001e-02
## factor(District)Vancouver                              3.979e-02  1.507e-01
## factor(Year)2015                                      -7.574e-03  6.378e-03
## factor(Year)2016                                      -1.143e-02  6.750e-03
## factor(Year)2017                                      -9.721e-03  7.460e-03
## factor(Year)2018                                      -2.237e-02  7.997e-03
## factor(Year)2019                                      -2.784e-02  8.629e-03
##                                                       t value Pr(>|t|)
## (Intercept)                                             2.496 0.012783 *
## LowIncomePct                                            0.099 0.920900
## WhitePct                                                0.327 0.743665
## ELLPct                                                  0.401 0.688888
## HighlyCapablePct                                       -0.022 0.982335
## FemalePct                                               0.261 0.793922
## TotalStudents                                           0.373 0.709125
## factor(District)Adna                                    1.163 0.245229
## factor(District)Anacortes                               3.400 0.000709 ***
## factor(District)Arlington                               0.540 0.589371
## factor(District)Asotin-Anatone                          1.673 0.094715 .
## factor(District)Auburn                                  0.597 0.550795
## factor(District)Bainbridge Island                       4.746 2.48e-06 ***
## factor(District)Battle Ground                          -0.204 0.838308
## factor(District)Bellevue                                2.161 0.030979 *
## factor(District)Bellingham                              2.226 0.026275 *
## factor(District)Bethel                                 -0.983 0.326122
## factor(District)Blaine                                  0.730 0.465653
## factor(District)Bremerton                              -0.454 0.649778
## factor(District)Brewster                                1.298 0.194562
## factor(District)Burlington-Edison                       2.731 0.006458 **
## factor(District)Camas                                   2.629 0.008735 **
## factor(District)Cape Flattery                           0.473 0.636019
## factor(District)Cascade                                 3.554 0.000402 ***
## factor(District)Castle Rock                            -1.041 0.298163
## factor(District)Central Kitsap                          1.727 0.084531 .
## factor(District)Central Valley                          0.481 0.630371
## factor(District)Centralia                              -0.343 0.731922
## factor(District)Chehalis                                2.738 0.006332 **
## factor(District)Cheney                                  0.960 0.337141
```

```
## factor(District)Chewelah                                      -0.305 0.760256
## factor(District)Chimacum                                      -0.828 0.408116
## factor(District)Clarkston                                     -0.221 0.825132
## factor(District)Cle Elum-Roslyn                                0.385 0.700181
## factor(District)Clover Park                                   -0.110 0.912713
## factor(District)Colfax                                         2.636 0.008571 **
## factor(District)College Place                                  3.564 0.000389 ***
## factor(District)Columbia (Walla Walla)                         3.053 0.002345 **
## factor(District)Colville                                      -0.533 0.594060
## factor(District)Concrete                                      -0.229 0.818839
## factor(District)Coupeville                                     1.071 0.284335
## factor(District)Davenport                                      0.116 0.907538
## factor(District)Deer Park                                     -2.202 0.027951 *
## factor(District)East Valley (Spokane)                         -0.143 0.886671
## factor(District)East Valley (Yakima)                           1.252 0.211050
## factor(District)Eastmont                                       0.638 0.523910
## factor(District)Eatonville                                    -0.619 0.536414
## factor(District)Edmonds                                        1.255 0.209794
## factor(District)Ellensburg                                     0.684 0.493993
## factor(District)Elma                                          -1.338 0.181417
## factor(District)Enumclaw                                       0.762 0.446236
## factor(District)Ephrata                                        0.630 0.529018
## factor(District)Everett                                        0.718 0.473186
## factor(District)Evergreen (Clark)                             -0.196 0.844376
## factor(District)Federal Way                                    0.410 0.681641
## factor(District)Ferndale                                       2.192 0.028672 *
## factor(District)Fife                                           2.965 0.003126 **
## factor(District)Finley                                        -2.315 0.020890 *
## factor(District)Franklin Pierce                                0.015 0.988138
## factor(District)Goldendale                                    -0.346 0.729335
## factor(District)Grand Coulee Dam                              -0.633 0.526804
## factor(District)Grandview                                     -0.138 0.890650
## factor(District)Granger                                       -0.181 0.856710
## factor(District)Granite Falls                                 -1.791 0.073713 .
## factor(District)Highland                                       0.881 0.378580
## factor(District)Highline                                       0.276 0.782525
## factor(District)Hockinson                                      2.746 0.006167 **
## factor(District)Hoquiam                                        1.801 0.072089 .
## factor(District)Issaquah                                       2.283 0.022714 *
## factor(District)Kalama                                         0.106 0.915342
## factor(District)Kelso                                         -0.808 0.419059
## factor(District)Kennewick                                      0.013 0.990007
## factor(District)Kent                                           0.582 0.560859
## factor(District)Kettle Falls                                  -1.475 0.140684
## factor(District)Kittitas                                       2.336 0.019768 *
## factor(District)La Center                                      1.301 0.193787
## factor(District)La Conner                                      5.699 1.72e-08 ***
## factor(District)Lake Chelan                                    3.219 0.001340 **
## factor(District)Lake Stevens                                   1.061 0.289126
## factor(District)Lake Washington                                1.288 0.198116
## factor(District)Lake Washington Institute of Technology       -0.497 0.619656
## factor(District)Lakewood                                      -0.222 0.824121
## factor(District)Liberty                                        2.758 0.005951 **
## factor(District)Longview                                       0.748 0.454471
```

```
## factor(District)Lynden                                    1.884 0.059900 .
## factor(District)Mabton                                   -0.797 0.425492
## factor(District)Manson                                    2.315 0.020887 *
## factor(District)Marysville                                0.298 0.765570
## factor(District)Mead                                       1.560 0.119170
## factor(District)Medical Lake                              0.697 0.486208
## factor(District)Mercer Island                             6.566 9.62e-11 ***
## factor(District)Meridian                                   3.001 0.002781 **
## factor(District)Methow Valley                             1.714 0.086853 .
## factor(District)Monroe                                     1.237 0.216409
## factor(District)Montesano                                  3.146 0.001718 **
## factor(District)Moses Lake                                0.508 0.611306
## factor(District)Mount Adams                               -0.811 0.417812
## factor(District)Mount Vernon                               2.148 0.032023 *
## factor(District)Mukilteo                                   1.486 0.137685
## factor(District)Napavine                                  -0.107 0.914585
## factor(District)Newport                                   -0.721 0.471009
## factor(District)Nine Mile Falls                           3.110 0.001939 **
## factor(District)Nooksack Valley                           2.399 0.016674 *
## factor(District)North Franklin                           -0.047 0.962394
## factor(District)North Kitsap                               2.700 0.007099 **
## factor(District)North Mason                               -1.140 0.254740
## factor(District)Northshore                                 1.161 0.246086
## factor(District)Oak Harbor                                0.522 0.602150
## factor(District)Ocean Beach                               -0.132 0.895388
## factor(District)Ocosta                                    -0.110 0.912546
## factor(District)Okanogan                                   3.230 0.001291 **
## factor(District)Olympia                                    2.879 0.004105 **
## factor(District)Omak                                      -0.811 0.417615
## factor(District)Onalaska                                  0.950 0.342441
## factor(District)Orcas Island                               2.650 0.008208 **
## factor(District)Oroville                                  -0.912 0.361862
## factor(District)Orting                                    -1.476 0.140380
## factor(District)Othello                                   0.564 0.573247
## factor(District)Pasco                                     -0.567 0.571124
## factor(District)Peninsula                                  1.820 0.069093 .
## factor(District)Port Angeles                              0.981 0.326917
## factor(District)Port Townsend                             1.477 0.140081
## factor(District)Prosser                                    1.454 0.146342
## factor(District)Pullman                                    4.578 5.50e-06 ***
## factor(District)Puyallup                                  0.232 0.816411
## factor(District)Quillayute Valley                         -2.632 0.008649 **
## factor(District)Quincy                                    0.593 0.553519
## factor(District)Rainier                                   -0.407 0.684122
## factor(District)Raymond                                    2.756 0.005987 **
## factor(District)Reardan-Edwall                            0.843 0.399484
## factor(District)Renton                                     1.350 0.177495
## factor(District)Richland                                  0.363 0.716488
## factor(District)Ridgefield                                 2.615 0.009113 **
## factor(District)Ritzville                                 0.292 0.770592
## factor(District)Riverside                                 -0.586 0.557915
## factor(District)Riverview                                  3.564 0.000388 ***
## factor(District)Rochester                                 -1.509 0.131823
## factor(District)Royal                                     0.988 0.323441
```

```
## factor(District)San Juan Island                        3.423 0.000652 ***
## factor(District)Sedro-Woolley                          -0.816 0.414966
## factor(District)Selah                                   2.103 0.035827 *
## factor(District)Sequim                                  1.342 0.179912
## factor(District)Shelton                                -3.386 0.000746 ***
## factor(District)Shoreline                               4.884 1.27e-06 ***
## factor(District)Snohomish                               2.088 0.037155 *
## factor(District)Snoqualmie Valley                       3.598 0.000341 ***
## factor(District)South Bend                              2.087 0.037185 *
## factor(District)South Kitsap                           -0.337 0.736233
## factor(District)South Whidbey                           2.010 0.044822 *
## factor(District)Spokane                                -0.014 0.988929
## factor(District)Stanwood-Camano                         0.870 0.384459
## factor(District)Stevenson-Carson                       -1.330 0.183900
## factor(District)Summit Public School: Olympus           1.947 0.051957 .
## factor(District)Summit Public School: Sierra            5.085 4.64e-07 ***
## factor(District)Sumner                                  1.180 0.238556
## factor(District)Sunnyside                              -0.846 0.397600
## factor(District)Tacoma                                  0.048 0.961501
## factor(District)Tahoma                                  2.795 0.005320 **
## factor(District)Tenino                                 -0.592 0.554032
## factor(District)Toledo                                 -0.312 0.755456
## factor(District)Tonasket                               -1.594 0.111295
## factor(District)Toppenish                               0.257 0.796930
## factor(District)Tukwila                                 1.743 0.081739 .
## factor(District)Tumwater                                2.025 0.043192 *
## factor(District)University Place                        5.483 5.72e-08 ***
## factor(District)Vancouver                               0.264 0.791839
## factor(Year)2015                                       -1.188 0.235371
## factor(Year)2016                                       -1.693 0.090873 .
## factor(Year)2017                                       -1.303 0.192958
## factor(Year)2018                                       -2.798 0.005280 **
## factor(Year)2019                                       -3.226 0.001311 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.002990918)
##
##     Null deviance: 11.0121  on 926  degrees of freedom
## Residual deviance:  2.2611  on 756  degrees of freedom
## AIC: -2602.2
##
## Number of Fisher Scoring iterations: 2
```

```r
with(summary(mod3$glm_res), 1 - deviance/null.deviance) #print r squared
```

```
## [1] 0.7946675
```

NOTE: I AM HAVING A FILEPATH ERROR RELATED TO R MARKDOWN (PANDOC DEPENDENCY FOR KNITR FUNCTION). I AM UNABLE TO PRODUCE AN HTML DOCUMENT, BUT THE CODE CHUNKS DO RUN IN SCRIPT.

This analysis relies on data from the Washington State Office of the Superintendent of Public Instruction (OSPI). The panel data is created by combining datasets on college enrollment and demographics at the

school district level for each year from 2014 to 2019. The purpose of this analysis is estimate the effect of school district demographic characteristics on college enrollment–i.e., does the makeup of a school district predict how many students choose college after high school?

Three models are estimated in this report. Enrollment at two year, enrollment at four year, and enrollment at either are used as the dependent variables in each model, respectively. The independent variables are rate statistics for low income, whiteness, English language learners, highly capable, female, and district size. All variables are calculated at the district level.

The analysis suggests districts that send more students to college tend to be whiter. However, the analysis also suggests that districts that send more students to college tend to have more low income students, more ELL students, and fewer highly capable students. There are many issues with this methodology that could produce these skewed results, but it's likely that college enrollment is being conflated with dual enrollment. For instance, districts with many highly capable students are more likely to have high rates of two year enrollment and low rates of four year enrollment, likely because many highly capable students are attending their local community college while in high school.

A better use for this panel data is to serve as a control for regression analysis on individual-level microdata from ACS.

The next step for this analysis is to perform a cluster analysis to learn if there are any commonalities among school districts with high college go-on rates, and then to incorporate ACS microdata.