# The Community Eligibility Provision: Food Insecurity in Durham Public Schools

Julia Donheiser

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## Exploratory Data Analysis

```
## # A tibble: 8 x 4
##   year    total_debt mean_debt_per_student fullprice_lunches
##   <fct>        <dbl>                 <dbl>             <dbl>
## 1 2010-11    204692.                  7.34            70584.
## 2 2011-12    111567.                  4.53            38472.
## 3 2012-13    117526.                  4.54            40526.
## 4 2013-14    108231.                  3.76            37321.
## 5 2014-15     85093.                  2.51            29342.
## 6 2015-16     78428.                  2.25            27044.
## 7 2016-17    127940.                  3.38            44117.
## 8 2017-18    209022.                  5.10            72076.
```
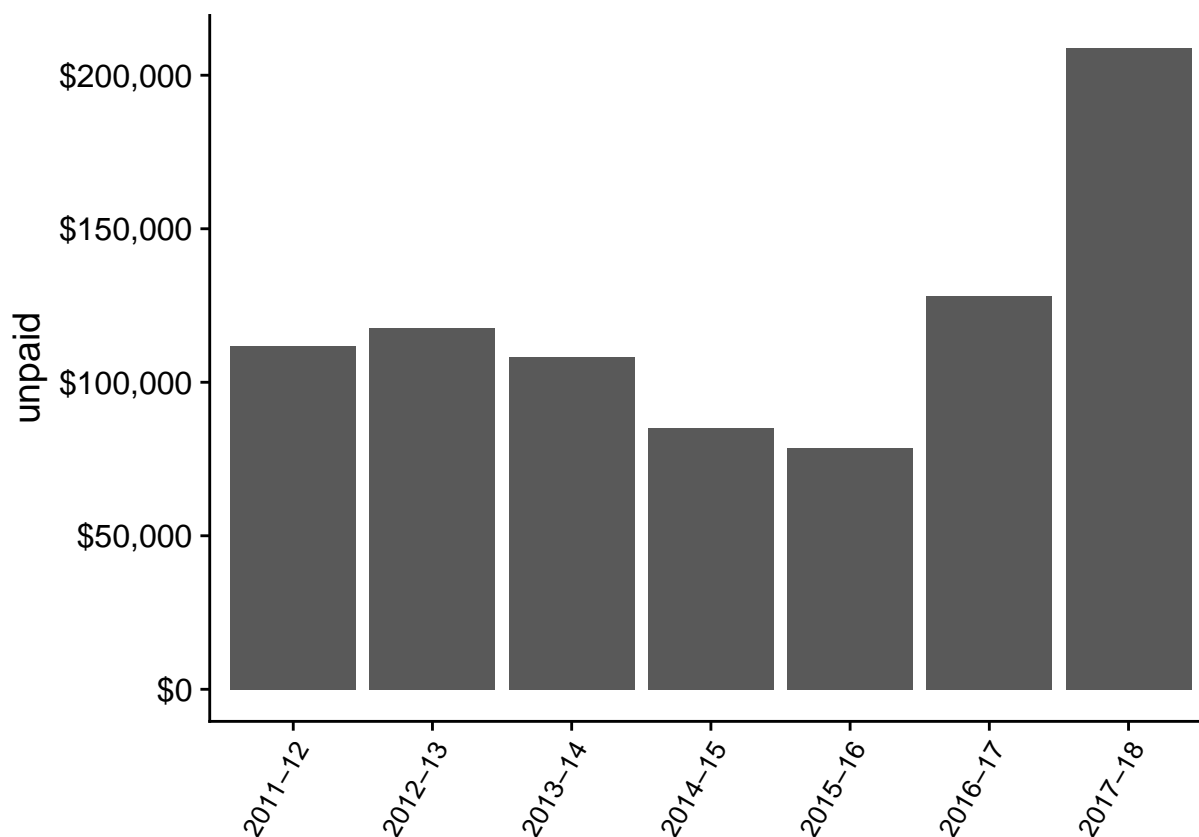


```
## [1] 2.036936
```

At the end of the 2017-18 academic year, DPS had over $211,000 in school lunch debt. That's over 72,000 unpaid lunches, with an average of $5.10 of debt per student. It's also the most debt the school district has seen in the past eight years.
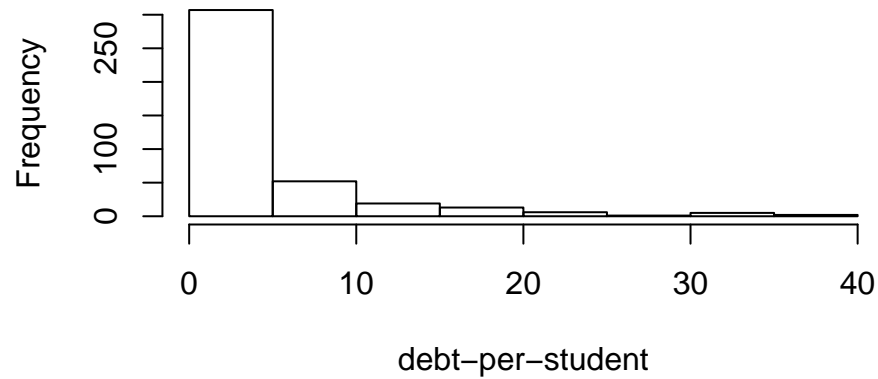
Most schools have less than \$5 of lunch debt per student. In Durham, a full-priced lunch costs \$2.90, and a reduced-price lunch cost \$0.40, according to the Durham Public Schools website. That's about two unpaid full-priced lunches per student, or just over 12 unpaid reduced-price lunches per student. For the rest of my EDA, I'll delve into which schools have more debt and whether we can find systematic issues. I'll also be looking at schools that are part of the Community Eligibility Provision, which means all students receive free lunch.
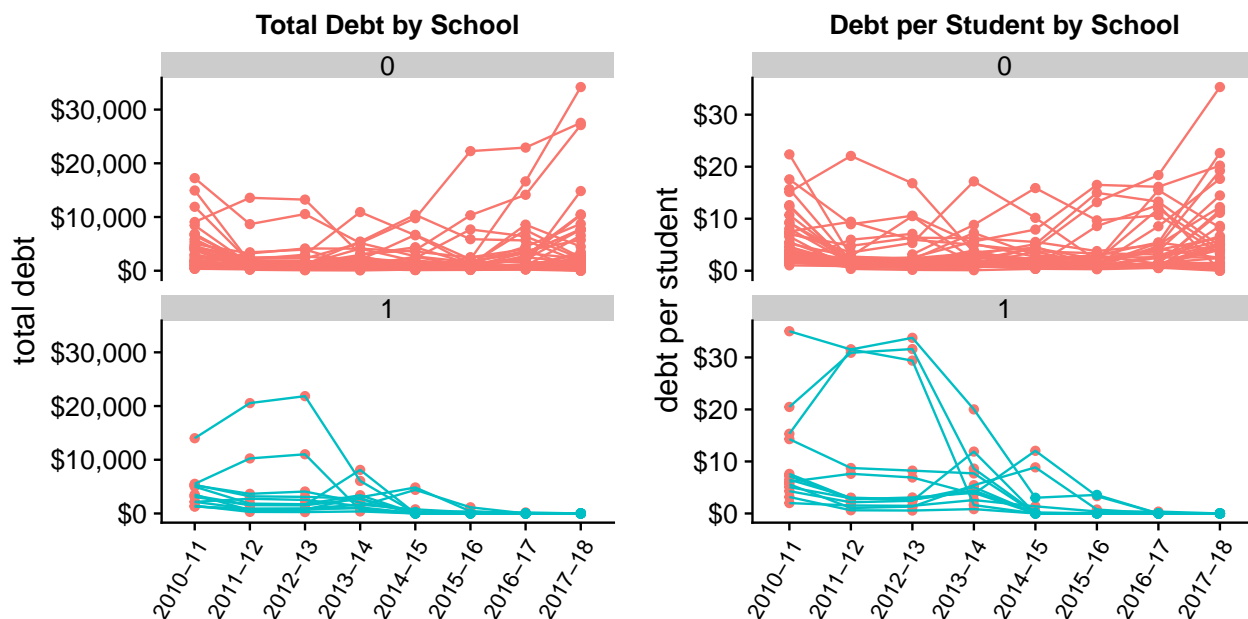
Debt and Demographics
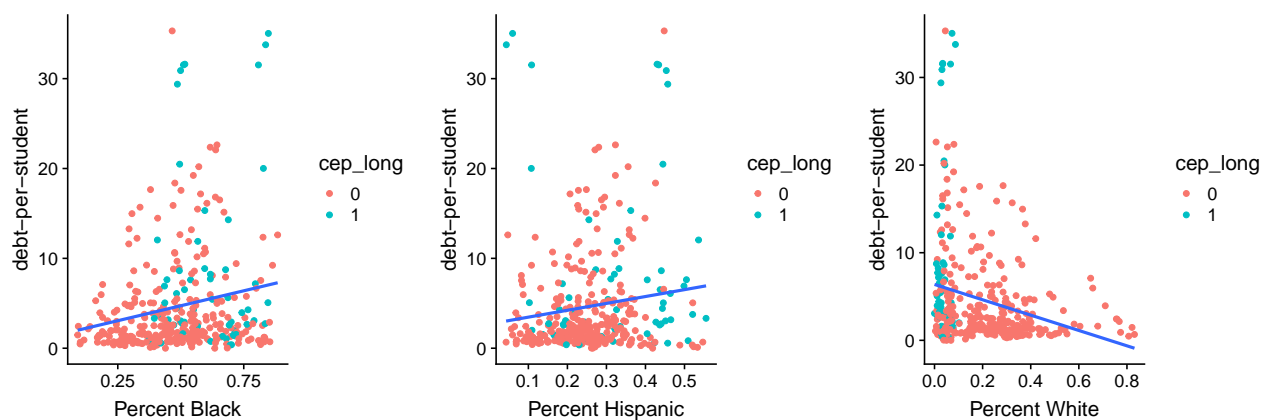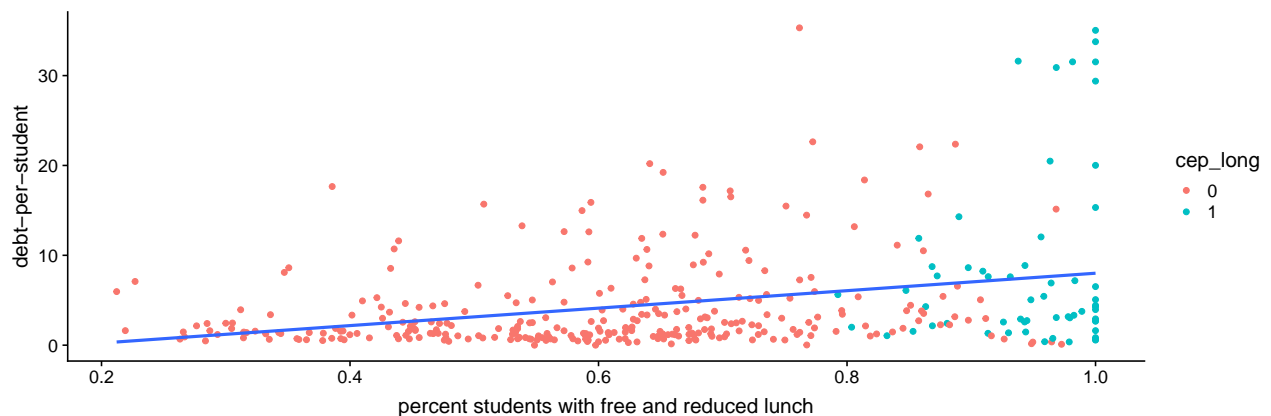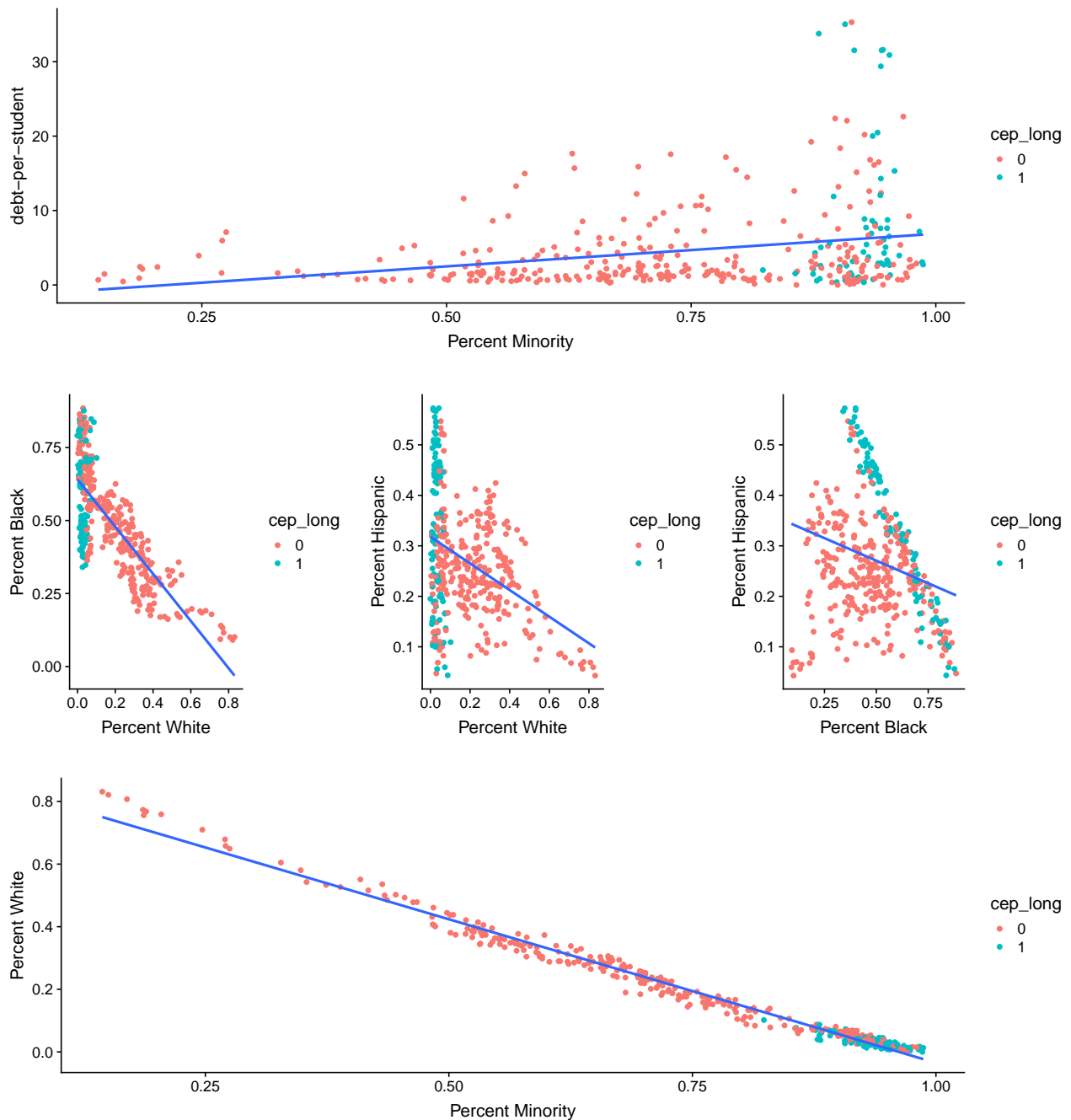
There is a weak positive correlation between the percentage of students who have free and reduced price lunch and the debt-per-student at each school. It looks like schools with CEP status generally have a higher percentage of students on free/reduced lunch. As for demographics, there is also a weak positive correlation between the percentage of black students and debt-per-student. Conversely, there is a weak negative correlation between the percent of white students and debt-per-student. There doesn't appear to be a much of a relationship between the percentage of hispanic students and debt-per-student. That being said, if we look at the total percentage of minority students — the percentage of black *and* hispanic students — there is a positive correlation with debt-per-student. Schools that CEP status are also starkly segregated, with very few white students and primarily black and hispanic students.

Debt over time

Schools with CEP status generally had a large amount of debt until the 2014-15 school year, when they gained CEP status. That being said, other schools with similar amounts of debt did not gain CEP status.

Demographics and need
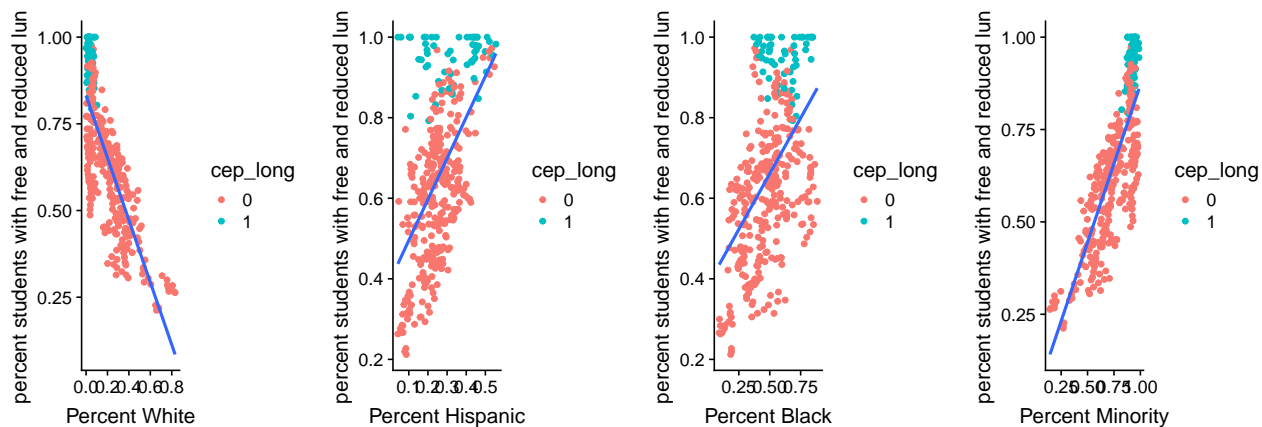
We can also see that race is a proxy for need. The percentage of black and hispanic schools have a strong, positive correlation with the percentage of students on free and reduced price lunch. For white students, this relationship is strong and negative.

Locale and debt, race
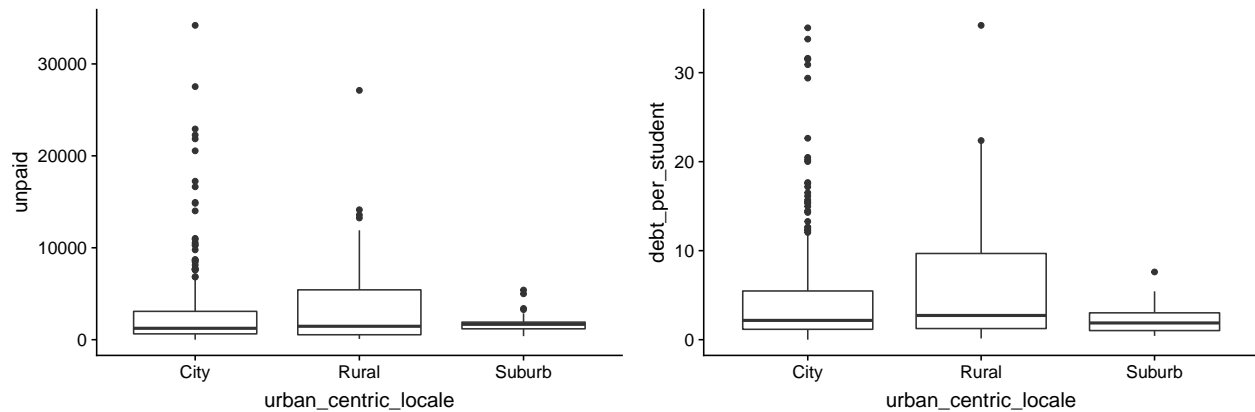
There don't seem to be major differences in debt by location.
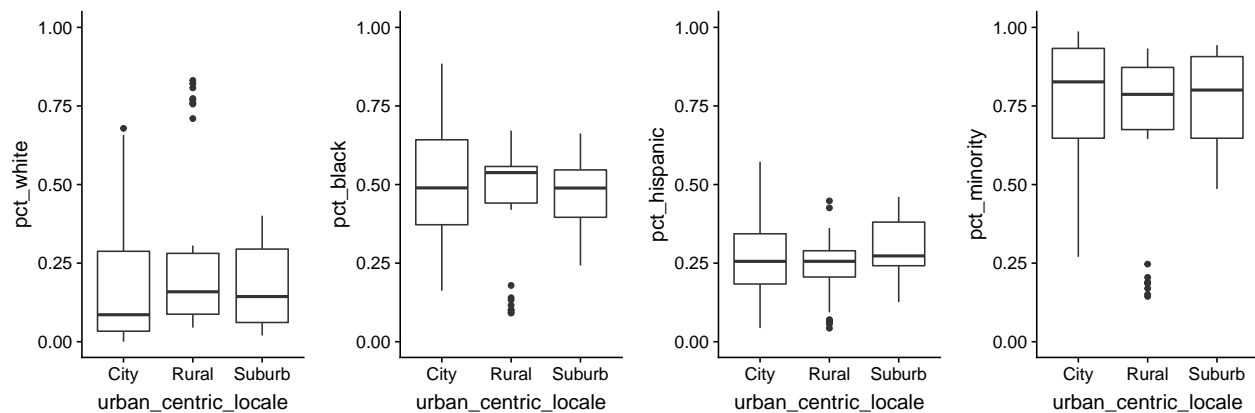
On average, we also don't see any major differences in race by locale. However, there is a subset of rural schools that seem to primarily be white.

Debt and grade

```
## # A tibble: 3 x 3
##   grade_clean mean_debt mean_dps
##   <fct>           <dbl>    <dbl>
## 1 Elementary      2181.     4.10
## 2 High            4016.     4.94
## 3 Middle          3541.     5.70
```

Debt per Student by Grade Level
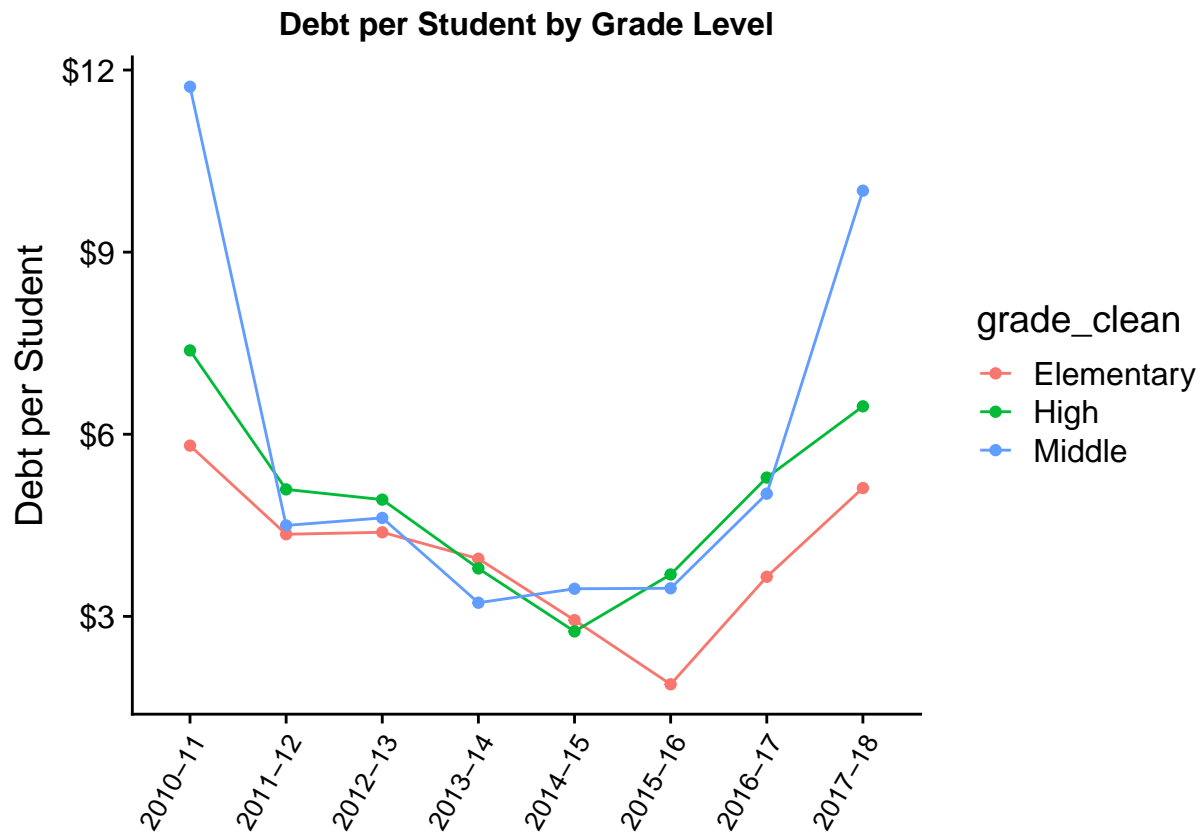
On average, high schools have the most total debt. However, middle schools, on average, have the most debt per student.
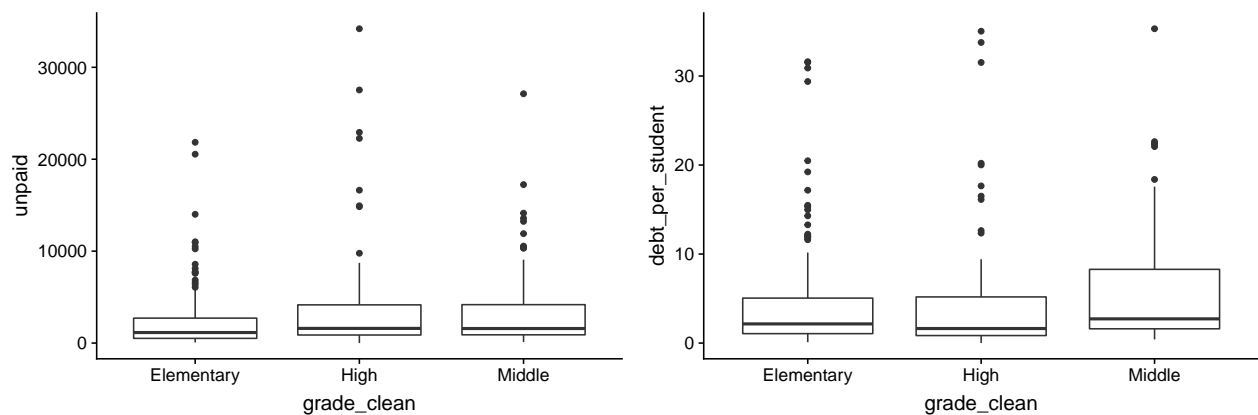
CEP Schools

In this section, I explore the differences between schools that gained CEP status and schools that did not.

Eligibility

```
##   eligible participating
## 1      105            35
```

Eligible but non-participating CEP schools

```
## # A tibble: 3 x 7
## # Groups:   eligible [?]
##   eligible participating     n  unpaid mean_dps avg_free_reduced
##      <int>         <int> <int>   <dbl>    <dbl>            <dbl>
## 1        0             0    26 1.29e+5     5.28             0.51
## 2        1             0    12 7.97e+4    10.3              0.75
## 3        1             1    13 8.00e-1     0                1
## # ... with 1 more variable: avg_pct_minority <dbl>
```

```
## [1] 0.3811623
```

Last year, debt was concentrated in schools that were not eligible to participate in the CEP program. However, eligible but non-participating CEP schools accounted for nearly 40 percent of all debt in Durham county.

CEP Status and Grade Level

```
## # A tibble: 8 x 6
## # Groups:   grade_clean, eligible [6]
##   grade_clean eligible participating     n  unpaid mean_dps
##   <fct>          <int>         <int> <int>   <dbl>    <dbl>
## 1 Middle             1             0     6 54097.     14.6
## 2 High               0             0     7 86544.      7.48
## 3 Elementary         1             0     4 17983.      7.35
## 4 Elementary         0             0    14 30607.      4.48
## 5 Middle             0             0     5 12199.      4.45
## 6 High               1             0     2  7591.      2.9
## 7 Elementary         1             1    12     0.8     0
## 8 High               1             1     1     0       0
```

```
## # A tibble: 8 x 6
## # Groups:   grade_clean, eligible [6]
##   grade_clean eligible participating     n  unpaid mean_dps
##   <fct>          <int>         <int> <int>   <dbl>    <dbl>
## 1 High               0             0     7 86544.      7.48
## 2 Middle             1             0     6 54097.     14.6
## 3 Elementary         0             0    14 30607.      4.48
## 4 Elementary         1             0     4 17983.      7.35
## 5 Middle             0             0     5 12199.      4.45
## 6 High               1             0     2  7591.      2.9
## 7 Elementary         1             1    12     0.8     0
## 8 High               1             1     1     0       0
```

Last year, all but one of the CEP schools were elementary schools. We also see that no middle schools participated in the CEP program, but the six that were eligible & non-participating had the most debt per student–nearly twice that of eligible but non-participating elementary schools. Eligible and non-participating high-schools, however, had relatively low debt per student at just $2.90 of unpaid meals per student. The overall debt for those schools was also fairly low.

debt per student among schools that were cep eligible in 2017−18
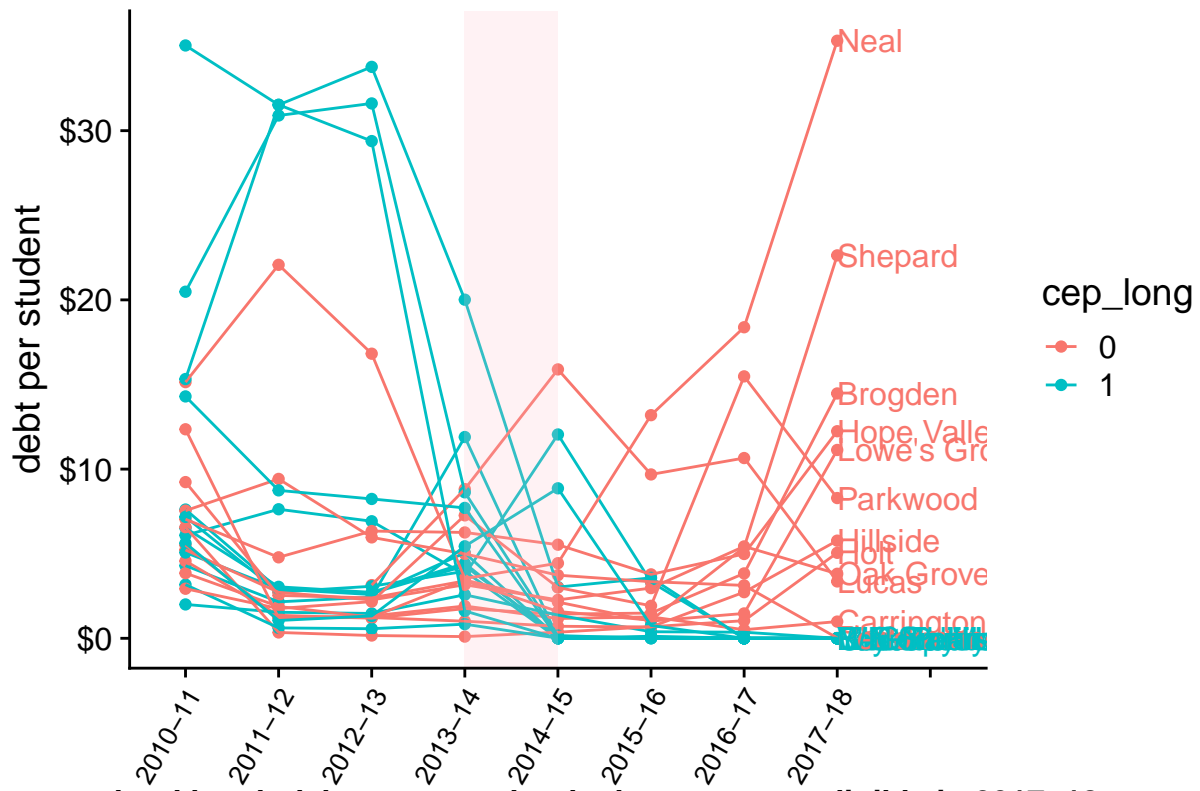
school lunch debt among schools that were cep eligible in 2017−18
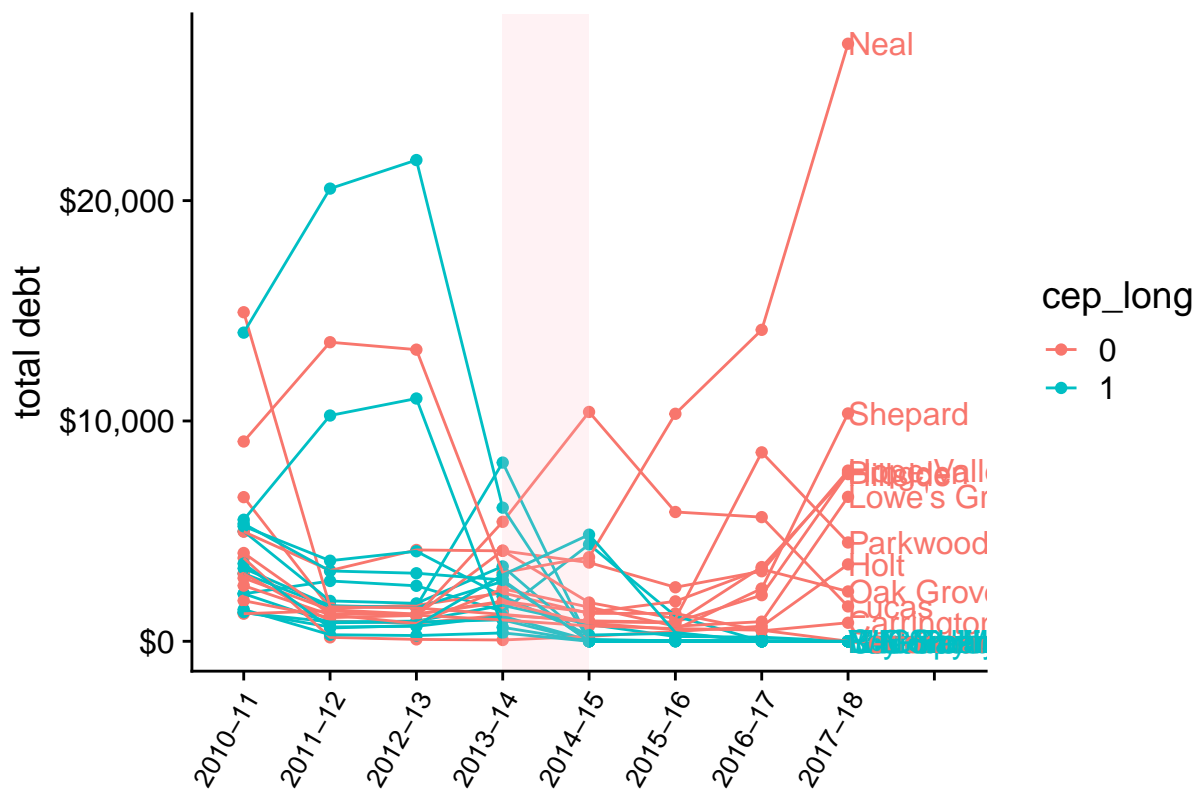
school lunch debt among schools that have participated in CEP

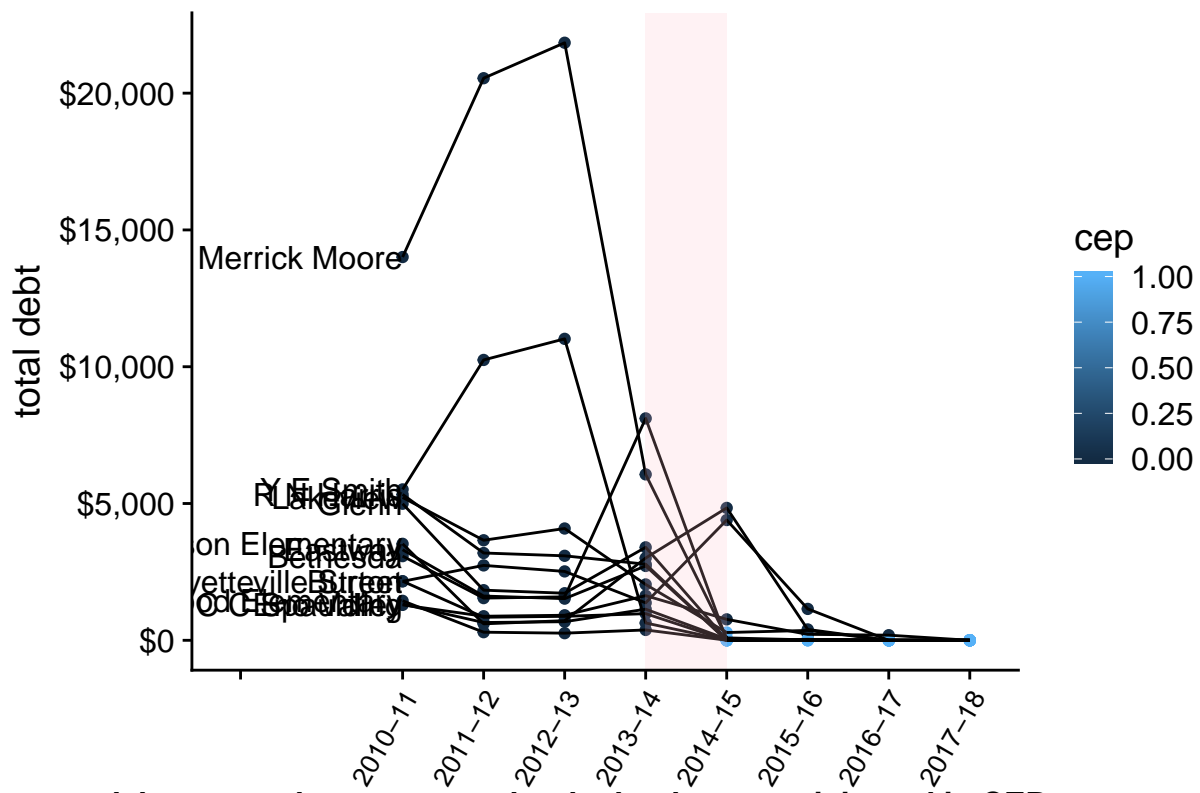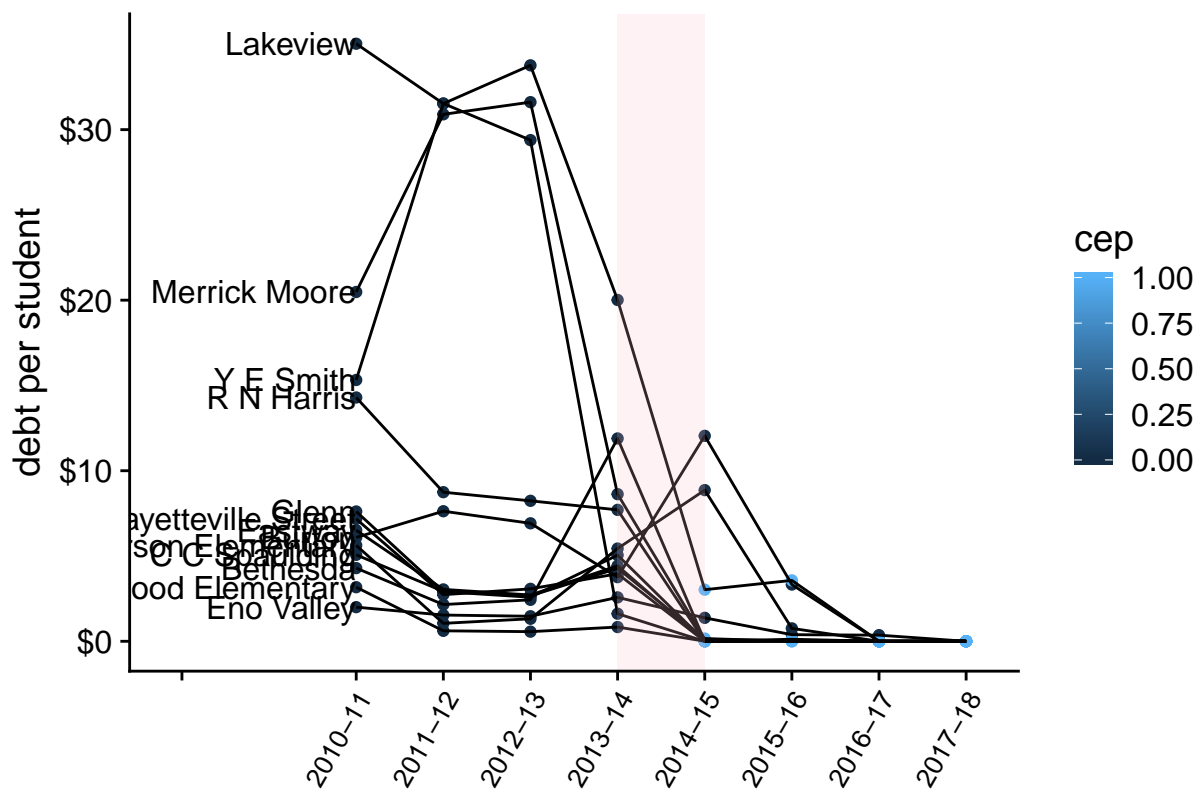debt per student among schools that have participated in CEP

Percent Minority

```
## # A tibble: 2 x 2
##   cep_long mean_minority
##   <fct>            <dbl>
## 1 0                0.712
## 2 1                0.931
```

CEP schools also have a higher concentration of minority students, on average.

Debt before CEP status

```
## # A tibble: 2 x 3
##   cep_long mean_dps mean_debt
##   <fct>       <dbl>     <dbl>
## 1 0            3.45     2297.
## 2 1            7.58     3039.
```

CEP schools also had, on average, higher debt and more debt per student than non-CEP schools prior to CEP assignments.

Individual school analysis

Neal Middle

```
##      year    unpaid debt_per_student
## 1 2010-11  9068.58        15.139533
## 2 2011-12 13574.29        22.072016
## 3 2012-13 13236.97        16.819530
## 4 2013-14  3114.71         3.531417
## 5 2014-15  3817.10         4.438488
## 6 2015-16 10325.43        13.187011
## 7 2016-17 14135.73        18.381964
## 8 2017-18 27121.24        35.314115
```

CEP vs. ISP comparison

Comparing Percentages

```
## # A tibble: 19 x 3
## # Groups:   school_name [19]
##    school_name               school_no     diff
##    <fct>                         <int>    <dbl>
## 1 Sandy Ridge                     369  15.3
## 2 Hillside                        325   7.93
## 3 Brogden                         306   6.92
## 4 Performance Learning Center     322   4.27
## 5 Lucas                           343   4.20
## 6 Lowe's Grove                    346   3.29
## 7 Burton                          308   2.68
## 8 W G Pearson Elementary          388   2.24
## 9 Eno Valley                      315   2.02
```

```
## 10 Neal                            355    1.35
## 11 Githens                         366    0.000883
## 12 Southern                        368   -0.0757
## 13 Hope Valley                     327   -0.761
## 14 Hillandale                      324   -0.814
## 15 Carrington                      316   -0.849
## 16 Shepard                         338   -0.902
## 17 Parkwood                        362   -1.44
## 18 Holt                            328  -12.8
## 19 Oak Grove                       360  -14.5

##                    school_name pct_free_reduced    isp      isp_diff
## 1                      Brogden         0.7674858 0.5289  0.078754178
## 2                   Carrington         0.6913146 0.4063 -0.041234554
## 3   Performance Learning Center      0.7676056 0.4817  0.003114366
## 4                     Hillside         0.6007605 0.4148  0.062919544
## 5                   Hope Valley       0.6777251 0.4220 -0.002525118
## 6                         Holt         0.9073806 0.4844 -0.132340608
## 7                      Shepard         0.7724289 0.4801 -0.004268884
## 8                        Lucas         0.6390658 0.4216  0.035494183
## 9                   Lowe's Grove       0.8404075 0.5276  0.003752530
## 10                        Neal         0.7617188 0.4541 -0.035158750
## 11                    Oak Grove        0.8600337 0.4347 -0.164513727
## 12                     Parkwood        0.7338262 0.4483 -0.016546248
```

Banding

```
## [1] 1.0000 0.8508 0.7432 0.6223

## [1] 1.00 0.85 0.74 0.62

## # A tibble: 4 x 2
##   orig_band      n
##   <fct>      <int>
## 1 (0,0.62]       8
## 2 (0.62,0.74]    8
## 3 (0.74,0.85]    5
## 4 (0.85,1]      10

## # A tibble: 4 x 2
##   orig_band      n
##   <fct>      <int>
## 1 (0,0.62]       8
## 2 (0.62,0.74]    8
## 3 (0.74,0.85]    5
## 4 (0.85,1]      10

##                   school_name pct_low_income pct_w_cep   orig_band
## 1 George L Carrington Middle            0.69   0.84416 (0.62,0.74]
## 2               Lucas Middle            0.57   0.66368    (0,0.62]
## 3         Parkwood Elementary           0.72   0.76816 (0.62,0.74]
## 4     James E Shepard Middle            0.72   0.77504 (0.62,0.74]
## 5         Lowe's Grove Middle           0.85   0.71728 (0.74,0.85]
## 6                Neal Middle            0.81   0.65008 (0.74,0.85]
##      isp_band alloc_band_diff
## 1 (0.74,0.85]        69641.59
```

```
## 2 (0.62,0.74]       23468.88
## 3 (0.74,0.85]       16842.67
## 4 (0.74,0.85]       15782.35
## 5 (0.62,0.74]      -42860.59
## 6 (0.62,0.74]      -64554.06

##                         school_name pct_low_income pct_w_cep    orig_band
## 1                      Lucas Middle           0.57   0.66368    (0,0.62]
## 2             Sherwood Githens Middle          0.62   0.62000    (0,0.62]
## 3              Forest View Elementary          0.61   0.61000    (0,0.62]
## 4             Spring Valley Elementary         0.61   0.61000    (0,0.62]
## 5                 Creekside Elementary         0.41   0.41000    (0,0.62]
## 6                 Southwest Elementary         0.53   0.53000    (0,0.62]
## 7           Club Boulevard Elementary          0.58   0.58000    (0,0.62]
## 8                Hillandale Elementary          0.65   0.65000 (0.62,0.74]
## 9               Sandy Ridge Elementary          0.64   0.64000 (0.62,0.74]
## 10                E K Powe Elementary           0.50   0.50000    (0,0.62]
## 11               R N Harris Elementary          0.74   0.74000 (0.62,0.74]
## 12               Hope Valley Elementary         0.69   0.67456 (0.62,0.74]
## 13                      Holt Elementary         0.83   0.84624 (0.74,0.85]
## 14            Merrick-Moore Elementary         0.85   0.85000 (0.74,0.85]
## 15                   Burton Elementary          0.89   0.89000    (0.85,1]
## 16 Fayetteville Street Elementary               0.99   0.99000    (0.85,1]
## 17              W G Pearson Elementary          0.88   0.88000    (0.85,1]
## 18                    Brogden Middle            0.79   0.77072 (0.74,0.85]
## 19          C C Spaulding Elementary            1.00   1.00000    (0.85,1]
## 20                 Lakewood Elementary          0.91   0.91000    (0.85,1]
## 21               Y E Smith Elementary           1.00   1.00000    (0.85,1]
## 22               Bethesda Elementary            0.87   0.87000    (0.85,1]
## 23               Eno Valley Elementary          0.92   0.92000    (0.85,1]
## 24                 Eastway Elementary           1.00   1.00000    (0.85,1]
## 25                   Glenn Elementary           0.93   0.93000    (0.85,1]
## 26               Oak Grove Elementary           0.74   0.66368 (0.62,0.74]
## 27                       Neal Middle             0.81   0.65008 (0.74,0.85]
##      rank_band alloc_rank_diff
## 1  (0.74,0.85]      26600.9853
## 2     (0.85,1]      17100.0000
## 3     (0.85,1]      14070.0000
## 4     (0.85,1]      11250.0000
## 5     (0.85,1]      10980.0000
## 6     (0.85,1]      10290.0000
## 7     (0.85,1]       8670.0000
## 8     (0.85,1]       8480.0000
## 9     (0.85,1]       7460.0000
## 10    (0.85,1]       7350.0000
## 11 (0.74,0.85]       2560.0000
## 12 (0.74,0.85]       -329.6870
## 13 (0.62,0.74]       -477.4901
## 14 (0.62,0.74]      -5360.0000
## 15 (0.62,0.74]      -6760.0000
## 16    (0,0.62]      -8790.0000
## 17 (0.62,0.74]      -8840.0000
## 18 (0.62,0.74]      -9232.2633
## 19    (0,0.62]      -9780.0000
```

```
## 20    (0,0.62]    -11580.0000
## 21    (0,0.62]    -12060.0000
## 22 (0.62,0.74]    -12220.0000
## 23    (0,0.62]    -13740.0000
## 24    (0,0.62]    -17400.0000
## 25    (0,0.62]    -18570.0000
## 26 (0.74,0.85]    -19317.8789
## 27    (0.85,1]    -54473.8054
```

Dr. Danner, director of federal programs for Durham Public Schools, said Title I banding changes every year, but the banding has been the same for the past two school years (2017-18 and 2018-19), which is where data is available.

2020 Eligibility

```
##   eligible
## 1       31
```