

# Patterns of Uncertainty, Inaccuracy and Statistical Erasure:

Where does the ACS-ED fail the next generation of Native American scholars most?

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December 2, 2022

# Introduction

- ▶ Use of an asterisk so prevalent that American Indians and Alaska Natives (AIs/ANs) are often referred to as the Asterisk Nation.
- ▶ Though widely accepted there has been no work to formally document the lack of data quality for AI/sANs
- ▶ Initial motivation derived from Johnson-O'Malley Modernization Act 2019

## Current Study

- ▶ Use the Common Core of Data (CCD) to evaluate the quality of American Community Survey - Education Tabulation (ACS-ED), Relevant Children Enrolled Public
- ▶ Focus on the K - 12 student population from 2015 - 2019, non-Hispanic, single-race White and American Indian and Alaska Native students.
- ▶ Uses two techniques to start an assessment of the current state of data quality: Coefficient of Variation (CV) and Mean Absolute Percent Error (MAPE)
- ▶ Examine different geographies (US, inside and outside AI/AN Homeland areas, majority AI/AN and second majority AI/AN areas)
- ▶ Find areas where ACS-ED estimates zero AIs/ANs

## American Community Survey - Education Tabulation (ACS-ED)

- ▶ Part of Education Demographic and Geographic Estimates Program
- ▶ Uses American Community Survey Data to create estimates at the school district level
- ▶ Published as 5 year samples
- ▶ Accuracy largely dependent upon sample size

## Common Core of Data (CCD)

- ▶ Administrative data reported by individual schools
- ▶ Reporting required by law for all public school districts
- ▶ Accuracy dependent upon those collecting and reporting data
- ▶ Published annually

Table 1. Student Enrollment by Race, Geographic Area, and Dataset

|  | CCD        |            | ACS-ED     |            |         |
|--|------------|------------|------------|------------|---------|
|  | Count      | Percentage | Estimate   | Percentage | 90% MOE |
| <b>All School Districts</b>                      |            |            |            |            |         |
| AIAN   | 456,219    | 1.0%       | 398,662    | 0.8%       | 4,601   |
| White  | 22,756,560 | 48.9%      | 23,605,508 | 48.5%      | 30,679  |
| Total Population                                 | 46,541,612 |            | 48,688,832 |            | 42,845  |
| # of School Districts                            |            |            |            |            | 11,544  |
| <b>AI/AN Homeland Areas</b>                      |            |            |            |            |         |
| AIAN   | 296,605    | 5.3%       | 278,229    | 4.8%       | 3,074   |
| White  | 2,190,330  | 39.2%      | 2,324,774  | 40.4%      | 9,100   |
| Total Population                                 | 5,593,708  |            | 5,760,965  |            | 13,239  |
| # of School Districts                            |            |            |            |            | 1,328   |
| <b>Outside AI/AN Homeland Areas</b>              |            |            |            |            |         |
| AIAN   | 159,614    | 0.4%       | 120,433    | 0.3%       | 3,424   |
| White  | 20,566,232 | 50.2%      | 21,280,734 | 49.6%      | 29,298  |
| Total Population                                 | 40,947,904 |            | 42,927,864 |            | 40,748  |
| # of School Districts                            |            |            |            |            | 10,216  |
| <b>Majority AI/AN Population Areas</b>           |            |            |            |            |         |
| AIAN   | 125,528    | 68.4%      | 137,725    | 64.3%      | 1,780   |
| White  | 27,181     | 14.8%      | 31,791     | 14.8%      | 1,021   |
| Total Population                                 | 183,610    |            | 214,290    |            | 2,179   |
| # of School Districts                            |            |            |            |            | 225     |
| <b>AI/AN Secondary Majority Population Areas</b> |            |            |            |            |         |
| AIAN   | 86,927     | 17.2%      | 61,479     | 12.2%      | 1,442   |
| White  | 307,145    | 60.9%      | 309,589    | 61.6%      | 2,940   |
| Total Population                                 | 504,632    |            | 502,735    |            | 3,575   |
| # of School Districts                            |            |            |            |            | 504     |

# Mean and Median Absolute Percent Error by Geographic Area and Year

$$CV = \frac{MOE/1.645}{\text{Estimate}} \quad (1)$$

- ▶ Provides a measurement of Census' level of uncertainty concerning the estimate
- ▶ Is undefined when estimate is zero
- ▶ ESRI uses ranges to denote expected estimate quality - <12% - High Reliability, Medium Quality - between 12% and 40%, Low quality - greater than 40%.

## Mean Absolute Percent Error (MAPE)

$$\text{MAPE}_R = \sum_{n=1}^n \frac{|\text{Estimate} - \text{Actual}|}{\text{Actual}} \quad (2)$$

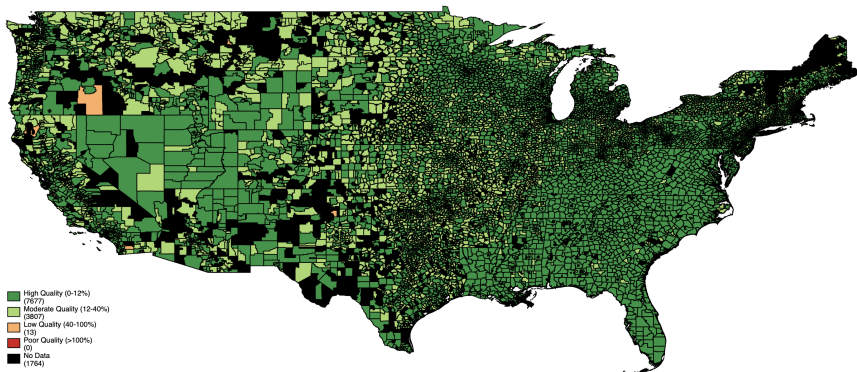
- ▶ Compares an estimate to the established or actual value being estimated
- ▶ The absolute percentage error for individual districts is then divided by the number of districts for different geographies
- ▶ Provides an estimate of accuracy of estimate relative to actual value



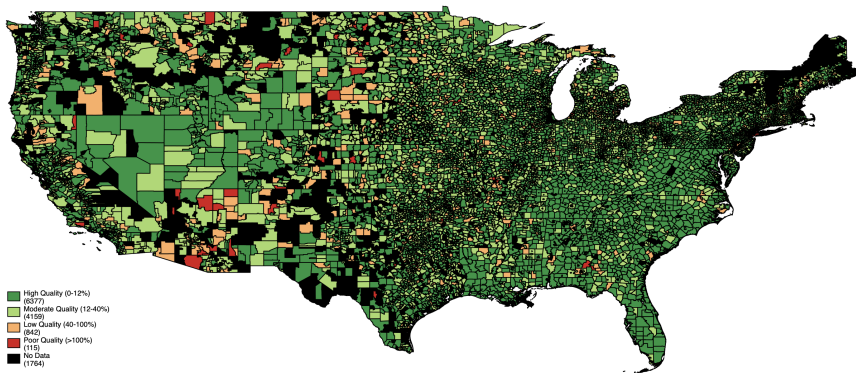
# Methodology

- ▶ Aggregate individual school totals from CCD to obtain district totals
- ▶ Pool CCD estimates and take average for 5 year periods
- ▶ Compare CCD with ACS-ED at school district level (many school districts split and merge)

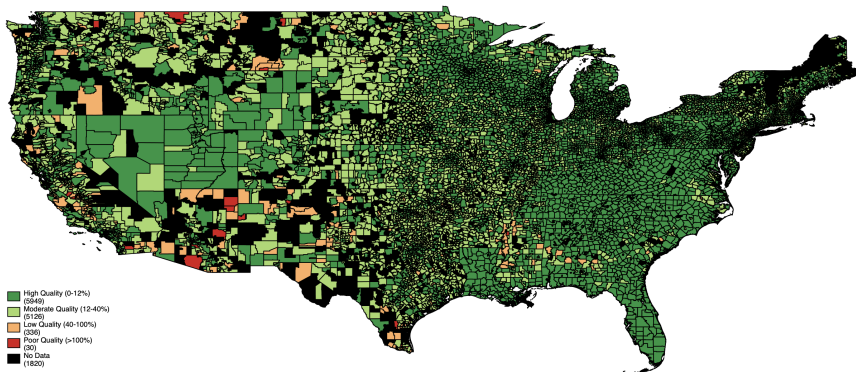
## Coefficient of Variation for All K-12 Students from 2015 - 2019



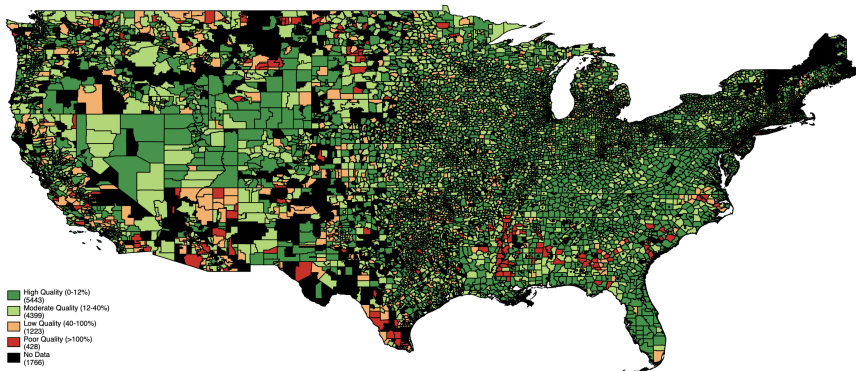
## Absolute Percent Error for All K-12 Students from 2015 - 2019



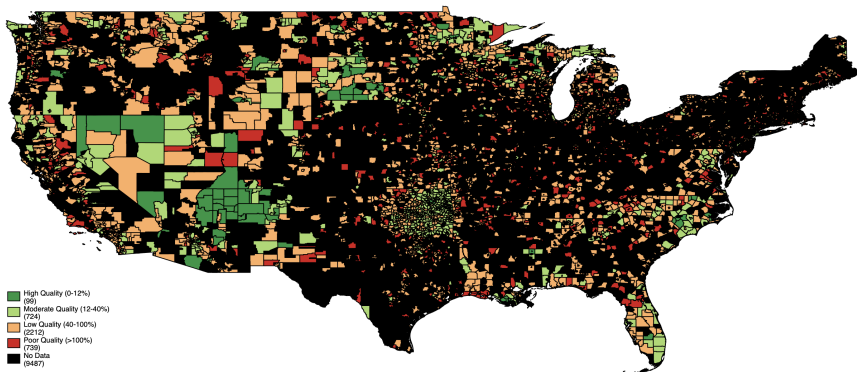
# Coefficient of Variation for White K-12 Students from 2015 - 2019



# Absolute Percent Error for White K-12 Students from 2015 - 2019



## Coefficient of Variation for AI/AN K-12 Students from 2015 - 2019



# Absolute Percent Error for AI/AN K-12 Students from 2015 - 2019

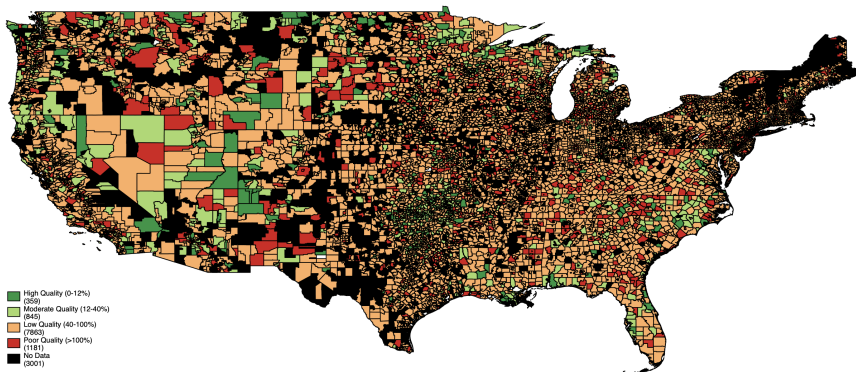


Table 1. Uncertainty, Accuracy and False Zeros by Race (2015 – 2019)

|   | All School Districts     |                                |                          |                                |                          |                                |
|---|--------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|
|   | AI/AN                    |                                | White                    |                                | Total Population         |                                |
|   | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error |
| # High Quality (0-12%)                        | 118                      | 384                            | 5,961                    | 5,458                          | 7,705                    | 6,403                          |
| # Moderate Quality (12% - 40%)                | 745                      | 863                            | 5,146                    | 4,413                          | 3,826                    | 4,176                          |
| # Low Quality (40%-100%)                      | 2,217                    | 7,879                          | 345                      | 1,239                          | 13                       | 850                            |
| # Poor Quality (>100%)                        | 740                      | 1,181                          | 31                       | 432                            | -                        | 115                            |
| # of School Districts with False Zeros        | 6,566                    |                                | 60                       |                                |                          |                                |
| Percentage of Districts with False Zeros      | 62.9%                    |                                | 0.5%                     |                                |                          |                                |
| Average Student Group Total in District (CCD) | 44                       |                                | 1,972                    |                                | 4,032                    |                                |
| # of AI/AN Students in False Zero Districts   | 45,493                   |                                |                          |                                |                          |                                |



Table 2. Uncertainty, Accuracy and False Zeros by Race and Homeland Area (2015 – 2019)

|   | Inside AIANNH Homeland Areas |                                |                          |                                |                          |                                |
|---|------------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|
|   | AI/AN                        |                                | White                    |                                | Total Population         |                                |
|   | Coefficient of Variation     | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error |
| # High Quality (0-12%)                        | 114                          | 182                            | 507                      | 497                            | 797                      | 608                            |
| # Moderate Quality (12% - 40%)                | 547                          | 377                            | 702                      | 516                            | 528                      | 537                            |
| # Low Quality (40%-100%)                      | 423                          | 647                            | 72                       | 218                            | 3                        | 152                            |
| # Poor Quality (>100%)                        | 61                           | 109                            | 17                       | 96                             | 0                        | 31                             |
| # of School Districts with False Zeros        | 171                          |                                | 30                       |                                |                          |                                |
| Percentage of Districts with False Zeros      | 12.9%                        |                                | 2.2%                     |                                |                          |                                |
| Average Student Group Total in District (CCD) | 226                          |                                | 1,651                    |                                | 4,212                    |                                |
| # of AI/AN Students in False Zero Districts   | 3,242                        |                                |                          |                                |                          |                                |

|   | Outside AIANNH Homeland Areas |                                |                          |                                |                          |                                |
|---|-------------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|
|   | AI/AN                         |                                | White                    |                                | Total Population         |                                |
|   | Coefficient of Variation      | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error |
| # High Quality (0-12%)                        | 4                             | 202                            | 5,454                    | 4,961                          | 6,908                    | 5,795                          |
| # Moderate Quality (12% - 40%)                | 198                           | 486                            | 4,444                    | 3,897                          | 3,298                    | 3,639                          |
| # Low Quality (40%-100%)                      | 1,794                         | 7,232                          | 273                      | 1,021                          | 10                       | 698                            |
| # Poor Quality (>100%)                        | 679                           | 1,072                          | 14                       | 336                            | 0                        | 84                             |
| # of School Districts with False Zeros        | 6,395                         |                                | 30                       |                                |                          |                                |
| Percentage of Districts with False Zeros      | 70.3%                         |                                | 0.3%                     |                                |                          |                                |
| Average Student Group Total in District (CCD) | 18                            |                                | 2,013                    |                                | 4,008                    |                                |
| # of AI/AN Students in False Zero Districts   | 42,252                        |                                |                          |                                |                          |                                |

Table 3. Distribution of Uncertainty, Accuracy and False Zeros by Race and Geographic Area (2015 – 2019)

|   | Majority AI/AN Districts |                                |                          |                                |                          |                                |
|---|--------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|
|   | AI/AN                    |                                | White                    |                                | Total Population         |                                |
|   | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error |
| # High Quality (0-12%)                        | 73                       | 48                             | 7                        | 34                             | 109                      | 71                             |
| # Moderate Quality (12% - 40%)                | 144                      | 88                             | 120                      | 50                             | 115                      | 89                             |
| # Low Quality (40%-100%)                      | 8                        | 74                             | 54                       | 78                             | 1                        | 49                             |
| # Poor Quality (>100%)                        | 0                        | 15                             | 15                       | 62                             | 0                        | 16                             |
| # of School Districts with False Zeros        | 0                        |                                | 29                       |                                |                          |                                |
| Percentage of Districts with False Zeros      | 0.0%                     |                                | 12.5%                    |                                |                          |                                |
| Average Student Group Total in District (CCD) | 558                      |                                | 121                      |                                | 816                      |                                |
| # of AI/AN Students in False Zero Districts   | 0                        |                                |                          |                                |                          |                                |

|   | Secondary Majority AI/AN Districts |                                |                          |                                |                          |                                |
|---|------------------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|
|   | AI/AN                              |                                | White                    |                                | Total Population         |                                |
|   | Coefficient of Variation           | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error | Coefficient of Variation | Mean Absolute Percentage Error |
| # High Quality (0-12%)                        | 16                                 | 56                             | 146                      | 195                            | 232                      | 206                            |
| # Moderate Quality (12% - 40%)                | 245                                | 149                            | 351                      | 215                            | 272                      | 225                            |
| # Low Quality (40%-100%)                      | 162                                | 272                            | 6                        | 74                             | 0                        | 60                             |
| # Poor Quality (>100%)                        | 15                                 | 27                             | 1                        | 20                             | 0                        | 13                             |
| # of School Districts with False Zeros        | 66                                 |                                | -                        |                                |                          |                                |
| Percentage of Districts with False Zeros      | 13.1%                              |                                | 0%                       |                                |                          |                                |
| Average Student Group Total in District (CCD) | 172                                |                                | 609                      |                                | 1,001                    |                                |
| # of AI/AN Students in False Zero Districts   | 2,051                              |                                |                          |                                |                          |                                |

Table 4. Worst Errors More than 60 AIs/ANs and 5% AI/AN

| School District                                 | State | Homeland Area                  | Second Majority<br>AIAN Area | Total<br>AIs/ANs | District<br>Population | Percentage<br>of AI/AN |
|---|-------|--------------------------------|------------------------------|------------------|------------------------|------------------------|
| LaFayette Central School District               | NY    | Onondaga Nation Reservation    | Yes                          | 283              | 868                    | 33%                    |
| Ruidoso Municipal Schools                       | NM    | Mescalero Reservation          | No                           | 316              | 2,026                  | 16%                    |
| Fountain Hills Unified District <sup>1</sup>    | AZ    | Not in AIANNH Homeland Area    | Yes                          | 199              | 1,429                  | 14%                    |
| Southampton Union Free School District          | NY    | Shinnecock (state) Reservation | No                           | 120              | 1,614                  | 7%                     |
| Archuleta County School District 50-JT          | CO    | Southern Ute Reservation       | No                           | 109              | 1,610                  | 7%                     |
| Wahpeton Public School District 37 <sup>2</sup> | ND    | Not in AIANNH Homeland Area    | No                           | 82               | 1,221                  | 7%                     |
| Cicero School District 99                       | IL    | Not in AIANNH Homeland Area    | Yes                          | 717              | 11,650                 | 6%                     |
| International Falls School District             | MN    | Bois Forte Reservation         | Yes                          | 63               | 1,051                  | 6%                     |
| Balsz Elementary District <sup>3</sup>          | AZ    | Not in AIANNH Homeland Area    | No                           | 124              | 2,378                  | 5%                     |
| Kingfisher Public Schools                       | OK    | Cheyenne and Arapaho OTSA      | No                           | 76               | 1,489                  | 5%                     |
| Total   |       |                                |                              | 2,090            | 25,336                 | 8%                     |

<sup>1</sup>The Salt River Reservation is less than 10 miles east of Fountain Hills, AZ.

<sup>2</sup>The Lake Traverse Reservation is approximately 25 miles south of Wahpeton, ND.

<sup>3</sup>Balsz Elementary is less than 10 miles away from Salt River Reservation is less than 10 miles. > << >> << >> << >> << >> << >>

# Conclusions

- ▶ There majority of school district level estimates for AIs/ANs falls into the low or poor quality categories
- ▶ More than half of the districts containing AIs/ANs falsely estimate the AI/AN student population to be zero
- ▶ More than 3,000 students live in AIANNH Homeland areas where the ACS-ED reports an AI/AN student population of zero

# Thank You and Do You Have Any Questions?

