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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Rochester Institute of Technology

Research Summit
Center for Indian Country Development
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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.
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

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

\[ CV = \frac{\text{MOE}}{\text{1.645}} \]

▶ 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)

\[
\text{MAPE}_R = \sum_{n=1}^{n} \frac{|\text{Estimate} - \text{Actual}|}{\text{Actual}}
\]

- 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
Patterns of Uncertainty, Inaccuracy and Statistical Erasure

J.D. Burnette
Coefficient of Variation for AI/AN K-12 Students from 2015 - 2019

Map of Uncertainty and Error by School District
Uncertainty and Error by Region
10 Worst False Zero Areas
Absolute Percent Error for AI/AN K-12 Students from 2015 - 2019
Table 1. Uncertainty, Accuracy and False Zeros by Race (2015 – 2019)

<table>
<thead>
<tr>
<th></th>
<th>All School Districts</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AI/AN</td>
<td>White</td>
<td>Total Population</td>
<td></td>
</tr>
<tr>
<td># High Quality (0-12%)</td>
<td>118</td>
<td>5,961</td>
<td>7,705</td>
<td>6,403</td>
</tr>
<tr>
<td># Moderate Quality (12% - 40%)</td>
<td>745</td>
<td>5,146</td>
<td>4,413</td>
<td>3,826</td>
</tr>
<tr>
<td># Low Quality (40%-100%)</td>
<td>2,217</td>
<td>345</td>
<td>1,239</td>
<td>13</td>
</tr>
<tr>
<td># Poor Quality (&gt;100%)</td>
<td>740</td>
<td>31</td>
<td>432</td>
<td>-</td>
</tr>
<tr>
<td># of School Districts with False Zeros</td>
<td>6,566</td>
<td>60</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Percentage of Districts with False Zeros</td>
<td>62.9%</td>
<td>0.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Student Group Total in District (CCD)</td>
<td>44</td>
<td>1,972</td>
<td></td>
<td>4,032</td>
</tr>
<tr>
<td># of AI/AN Students in False Zero Districts</td>
<td>45,493</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 2. Uncertainty, Accuracy and False Zeros by Race and Homeland Area (2015 – 2019)

#### Inside AIANNH Homeland Areas

<table>
<thead>
<tr>
<th></th>
<th>AI/AN</th>
<th>White</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient of Variation</td>
<td>Mean Absolute Percentage Error</td>
<td>Coefficient of Variation</td>
</tr>
<tr>
<td># High Quality (0-12%)</td>
<td>114</td>
<td>182</td>
<td>507</td>
</tr>
<tr>
<td># Moderate Quality (12% - 40%)</td>
<td>547</td>
<td>377</td>
<td>702</td>
</tr>
<tr>
<td># Low Quality (40%-100%)</td>
<td>423</td>
<td>647</td>
<td>72</td>
</tr>
<tr>
<td># Poor Quality (&gt;100%)</td>
<td>61</td>
<td>109</td>
<td>17</td>
</tr>
<tr>
<td># of School Districts with False Zeros</td>
<td>171</td>
<td>30</td>
<td>12.9%</td>
</tr>
<tr>
<td>Percentage of Districts with False Zeros</td>
<td>4,212</td>
<td>1,651</td>
<td>1,148</td>
</tr>
<tr>
<td>Average Student Group Total in District (CCD)</td>
<td>226</td>
<td>1,651</td>
<td>4,212</td>
</tr>
<tr>
<td># of AI/AN Students in False Zero Districts</td>
<td>3,242</td>
<td>3,242</td>
<td>3,242</td>
</tr>
</tbody>
</table>

#### Outside AIANNH Homeland Areas

<table>
<thead>
<tr>
<th></th>
<th>AI/AN</th>
<th>White</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient of Variation</td>
<td>Mean Absolute Percentage Error</td>
<td>Coefficient of Variation</td>
</tr>
<tr>
<td># High Quality (0-12%)</td>
<td>4</td>
<td>202</td>
<td>5,454</td>
</tr>
<tr>
<td># Moderate Quality (12% - 40%)</td>
<td>198</td>
<td>486</td>
<td>4,444</td>
</tr>
<tr>
<td># Low Quality (40%-100%)</td>
<td>1,794</td>
<td>7,232</td>
<td>273</td>
</tr>
<tr>
<td># Poor Quality (&gt;100%)</td>
<td>679</td>
<td>1,072</td>
<td>14</td>
</tr>
<tr>
<td># of School Districts with False Zeros</td>
<td>6,395</td>
<td>30</td>
<td>70.3%</td>
</tr>
<tr>
<td>Percentage of Districts with False Zeros</td>
<td>4,008</td>
<td>2,013</td>
<td>4,008</td>
</tr>
<tr>
<td>Average Student Group Total in District (CCD)</td>
<td>18</td>
<td>2,013</td>
<td>4,008</td>
</tr>
<tr>
<td># of AI/AN Students in False Zero Districts</td>
<td>42,252</td>
<td>42,252</td>
<td>42,252</td>
</tr>
</tbody>
</table>
Table 3. Distribution of Uncertainty, Accuracy and False Zeros by Race and Geographic Area (2015 – 2019)

### Majority AI/AN Districts

<table>
<thead>
<tr>
<th>Quality Type</th>
<th>AI/AN</th>
<th>White</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td># High Quality (0-12%)</td>
<td># Moderate Quality (12% - 40%)</td>
<td># Low Quality (40%-100%)</td>
<td># Poor Quality (&gt;100%)</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>Mean Absolute Error</td>
<td>Coefficient of Variation</td>
<td>Mean Absolute Error</td>
</tr>
<tr>
<td># High Quality (0-12%)</td>
<td>73</td>
<td>48</td>
<td>7</td>
</tr>
<tr>
<td># Moderate Quality (12% - 40%)</td>
<td>144</td>
<td>88</td>
<td>120</td>
</tr>
<tr>
<td># Low Quality (40%-100%)</td>
<td>8</td>
<td>74</td>
<td>54</td>
</tr>
<tr>
<td># Poor Quality (&gt;100%)</td>
<td>0</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td># of School Districts with False Zeros</td>
<td>0</td>
<td>29</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percentage of Districts with False Zeros</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Student Group Total in District (CCD)</td>
<td>558</td>
<td>121</td>
<td>816</td>
</tr>
<tr>
<td># of AI/AN Students in False Zero Districts</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Secondary Majority AI/AN Districts

<table>
<thead>
<tr>
<th>Quality Type</th>
<th>AI/AN</th>
<th>White</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td># High Quality (0-12%)</td>
<td># Moderate Quality (12% - 40%)</td>
<td># Low Quality (40%-100%)</td>
<td># Poor Quality (&gt;100%)</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>Mean Absolute Error</td>
<td>Coefficient of Variation</td>
<td>Mean Absolute Error</td>
</tr>
<tr>
<td># High Quality (0-12%)</td>
<td>16</td>
<td>56</td>
<td>146</td>
</tr>
<tr>
<td># Moderate Quality (12% - 40%)</td>
<td>245</td>
<td>149</td>
<td>351</td>
</tr>
<tr>
<td># Low Quality (40%-100%)</td>
<td>162</td>
<td>272</td>
<td>6</td>
</tr>
<tr>
<td># Poor Quality (&gt;100%)</td>
<td>15</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td># of School Districts with False Zeros</td>
<td>66</td>
<td>-</td>
<td>13.1%</td>
</tr>
<tr>
<td>Percentage of Districts with False Zeros</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Student Group Total in District (CCD)</td>
<td>172</td>
<td>609</td>
<td>1,001</td>
</tr>
<tr>
<td># of AI/AN Students in False Zero Districts</td>
<td>2,051</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Worst Errors More than 60 AIs/ANs and 5% AI/AN

<table>
<thead>
<tr>
<th>School District</th>
<th>State</th>
<th>Homeland Area</th>
<th>Second Majority AIAN Area</th>
<th>Total AIs/ANs</th>
<th>District Population</th>
<th>Percentage of AI/AN</th>
</tr>
</thead>
<tbody>
<tr>
<td>LaFayette Central School District</td>
<td>NY</td>
<td>Onondaga Nation Reservation</td>
<td>Yes</td>
<td>283</td>
<td>868</td>
<td>33%</td>
</tr>
<tr>
<td>Ruidoso Municipal Schools</td>
<td>NM</td>
<td>Mescalero Reservation</td>
<td>No</td>
<td>316</td>
<td>2,026</td>
<td>16%</td>
</tr>
<tr>
<td>Fountain Hills Unified District¹</td>
<td>AZ</td>
<td>Not in AIANNH Homeland Area</td>
<td>Yes</td>
<td>199</td>
<td>1,429</td>
<td>14%</td>
</tr>
<tr>
<td>Southampton Union Free School District</td>
<td>NY</td>
<td>Shinnecock (state) Reservation</td>
<td>No</td>
<td>120</td>
<td>1,614</td>
<td>7%</td>
</tr>
<tr>
<td>Archuleta County School District 50-JT</td>
<td>CO</td>
<td>Southern Ute Reservation</td>
<td>No</td>
<td>109</td>
<td>1,610</td>
<td>7%</td>
</tr>
<tr>
<td>Wahpeton Public School District 37²</td>
<td>ND</td>
<td>Not in AIANNH Homeland Area</td>
<td>No</td>
<td>82</td>
<td>1,221</td>
<td>7%</td>
</tr>
<tr>
<td>Cicero School District 99</td>
<td>IL</td>
<td>Not in AIANNH Homeland Area</td>
<td>Yes</td>
<td>717</td>
<td>11,650</td>
<td>6%</td>
</tr>
<tr>
<td>International Falls School District</td>
<td>MN</td>
<td>Bois Forte Reservation</td>
<td>Yes</td>
<td>63</td>
<td>1,051</td>
<td>6%</td>
</tr>
<tr>
<td>Balsz Elementary District³</td>
<td>AZ</td>
<td>Not in AIANNH Homeland Area</td>
<td>No</td>
<td>124</td>
<td>2,378</td>
<td>5%</td>
</tr>
<tr>
<td>Kingfisher Public Schools</td>
<td>OK</td>
<td>Cheyenne and Arapaho OTSA</td>
<td>No</td>
<td>76</td>
<td>1,489</td>
<td>5%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>2,090</td>
<td>25,336</td>
<td>8%</td>
</tr>
</tbody>
</table>

¹ The Salt River Reservation is less than 10 miles east of Fountain Hills, AZ.
² The Lake Traverse Reservation is approximately 25 miles south of Wahpeton, ND.
³ Balsz Elementary is less than 10 miles away from Salt River Reservation is less than 10 miles.
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?