What the New Census Bureau Demographic Analysis (DA) Experimental Young Child Coverage Estimates for States and Counties Tell Us About Methodology

By

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Overview

The undercount of young children (ages 0 to 4) has drawn increasing attention because young children had a much higher net undercount rate (5.4 percent) than any other age group in the 2020 Census and because the net undercount rate of young children has increased dramatically since 1980. This paper compares the newly released Census Bureau experimental DA young child coverage rates for states and selected counties to young child coverage estimates based on a method often used in the past. I call this traditional method the PEP (Population Estimation Program) method. The coverage rates produced by the two methods are highly correlated. Across states, the correlation coefficient is +.96 and across the counties examined here the correlation coefficient between net coverage rates is +.90. That means the patterns and trends found in previous analyses using the traditional method are largely accurate, credible, and trustworthy. Both methods show the undercount of young children is widespread. Based on the DA estimates every state had an undercount of young children and 84 percent of the countries examined had a net undercount of young children. The results of the PEP method were similar. Comparison of the result of the PEP method and the

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DA method suggest the PEP results are somewhat conservative and are likely to slightly underestimate the true young child undercount rate. Both data series show a lot of variation in coverage of young children across states and counties. For states, the range of the results based on the DA method is 15.9 percentage points, and the range based on the PEP method 17.2 percentage points.. The standard deviation for the DA method is 2.6 percentage points compared to 2.8 percentage points for the PEP method. For counties, the range and standard deviation for both methods show a lot of variation in accuracy among the counties, as well. Both methods show the largest counties account for the vast majority of undercounted young children.

Introduction

In the 2020 Census, the undercount of young children (ages 0 to 4) was 5.4 percent which is much higher than any other age group (U.S. Census Bureau 2024a). Moreover, the net undercount of young children has tripled since the 1980 Census (O'Hare 2024) while the coverage of adults improved, and the coverage of older children was stable. This makes counting young children one of the most vexing problems faced by the U.S. Census Bureau.

In light of the high net undercount of young children, the Census Bureau has recently expanded work in this area (Jensen 2022). The new experimental undercount estimates for young children are part of that expanded effort. On April 11, 2024, the U.S. Census Bureau released an experimental series of coverage estimates for the population ages 0 to 4 for states and selected counties (U.S. Census Bureau 2024a).

In this paper, results for states based on the DA method are compared to the results of the PEP method for states then results for counties based on the DA method are compared to the results of the PEP method for more than 1,900 counties for which the DA method produced data.

Methodology

The PEP methodology for developing coverage rates at the state and county levels has been used by several researchers in the past (Siegel et al. 1977; Robinson et al. 1993; Adlakha et al. 2003; Mayol-Garcia and Robinson 2011; Cohn 2011; U.S. Census Bureau 2014; O'Hare 2014; O'Hare 2017; King et al. 2019; Jensen and Johnson 2021; Hartley et al. 2021;Castellanos-Sosa, F. A., and O'Hare, W. P. 2023a;

O'Hare 2023b). So, a comparison of previous results to the new DA-based method results will be useful.

The two methodologies examined here are very similar, but Census Bureau staff (Jensen and Hayward 2024, slide 7) identify three key differences between the DA methodology and the PEP methodology.

- The DA estimates do not use projected births.
- DA includes a specific component for young children born in the United States but living in Mexico on April 1, 2020.
- DA is a bottom-up approach, so estimates are not raked.[3]

. Both methods compare the Census counts to a benchmark population to measure coverage. Calculation of the state and county coverage rates were produced based on equation (1) below.

Coverage Rate=((Census count – Benchmark estimate)/Benchmark estimate)*100 (1)

One benchmark is based on the DA method, and one is based on the PEP method. Both methods are very similar to the Demographic Analysis method which has been used by the Census Bureau since the 1950 Census for calculating the young child undercount at the national level. Both methods are based on the fundamental cohort-component method long used by demographers.

[3] Raking is a statistical procedure used by the Census Bureau to make sure substate and subnational data sum to the state or national total. County and state estimates are often changed in the raking process.

A detailed description of the methodology for producing the DA estimates are provided by the Census Bureau (2024b). A detailed description of what I call the PEP method is provided by O'Hare (2014).

O'Hare (2023a, 2023b) developed 2020 Census coverage estimates for young children at the state and county levels using the PEP method. These are the PEP estimates used in this comparative analysis.

Analysis of States

Given the similarity of the DA and PEP methodologies, it is not surprising to see the results are very similar. Table 1 shows state net young child coverage rates produced by the DA method and the PEP method, as well as the percentage point difference between the two series.. Given the likelihood of some small errors in the estimates, I round them to one decimal place rather than two as shown in some work in this arena.

For the state of Vermont, the PEP analysis shows a slight (0.5 percent) overcount while the DA method shows a slight (0.02 percent) undercount rate when rounded to two decimal places. Thus, based on the DA method all states exhibited a young child undercount.

Table 1. State Net Coverage Rates for Young Children (ages 0 to 4) n the 2020 Census Based on Two Different Methodologies			
State	Net Coverage Rate Based on DA*Method (Numeric Difference / Population Estimate)*100	Net Coverage Rate Based on PEP** Method (Numeric Difference / Population Estimate)*100	Difference in rates (PEP - DA)
Alabama	-3.8	-2.1	1.7
Alaska	-4.3	-4.0	0.3
Arizona	-6.5	-7.9	-1.4
Arkansas	-5.1	-4.0	1.2
California	-7.8	-8.1	-0.3
Colorado	-3.3	-3.5	-0.2
Connecticut	-2.7	-1.9	0.9
Delaware	-6.8	-6.1	0.7
District of Columbia	-15.9	-16.7	-0.8
Florida	-9.9	-9.3	0.5
Georgia	-5.8	-5.4	0.4
Hawaii	-9.7	-8.6	1.1
Idaho	-0.4	-0.1	0.3
Illinois	-4.4	-3.7	0.8
Indiana	-2.7	-1.9	0.8
Iowa	-2.9	-1.8	1.1
Kansas	-3.0	-2.4	0.6
Kentucky	-3.7	-2.5	1.2
Louisiana	-6.4	-5.5	0.9
Maine	-3.9	-3.3	0.6
Maryland	-5.5	-4.2	1.3
Massachusetts	-4.2	-3.7	0.4
Michigan	-3.0	-2.2	0.8
Minnesota	-2.6	-2.0	0.6
Mississippi	-7.5	-5.9	1.6
Missouri	-4.2	-3.7	0.5
Montana	-0.7	-1.6	-0.9
Nebraska	-3.1	-2.1	0.9
Nevada	-5.3	-5.9	-0.6
New Hampshire	-3.0	-2.9	0.1
New Jersey	-4.1	-2.5	1.5
New Mexico	-3.0	-3.8	-0.8
New York	-5.7	-4.8	0.9
North Carolina	-6.1	-5.5	0.6
North Dakota	-2.6	-1.9	0.7
Ohio	-3.9	-2.9	1.0
Oklahoma	-5.0	-5.2	-0.2
Oregon	-2.4	-3.2	-0.8
Pennsylvania	-4.4	-3.5	1.0
Rhode Island	-4.8	-3.8	1.0
South Carolina	-5.8	-5.1	0.7
South Dakota	-3.7	-4.8	-1.1
Tennessee	-4.3	-3.5	0.8
Texas	-7.7	-7.9	-0.2
Utah	-0.5	-1.3	-0.7
Vermont***	0.0	0.5	0.5
Virginia	-5.8	-4.7	1.2
Washington	-2.9	-3.1	-0.2
West Virginia	-4.0	-2.8	1.2
Wisconsin	-2.4	-1.6	0.7
Wyoming	-1.6	-0.2	1.4
* Source: U.S. Census Bureau, (2024a)			
** Source: O'Hare (2023a)			
*** when the rate for Vermont is shown to two decimal places in indicates a slight (0.02 percent) undercount.			

Figure 1 is a scattergram showing the relationship between the state-level results of the two methods. The correlation between the two series is very high (+.96) which is highly statistically significant. This means the states that had a high net young child undercount rate in the DA series were very likely to have a high net young children undercount rate in the PEP series. The District of Columbia is the outlier in Figure 1.

Figure 1. Scattergram Showing the Relationship Between 2020 Census State Net Young Child Coverage Rates from the DA Method and the PEP method

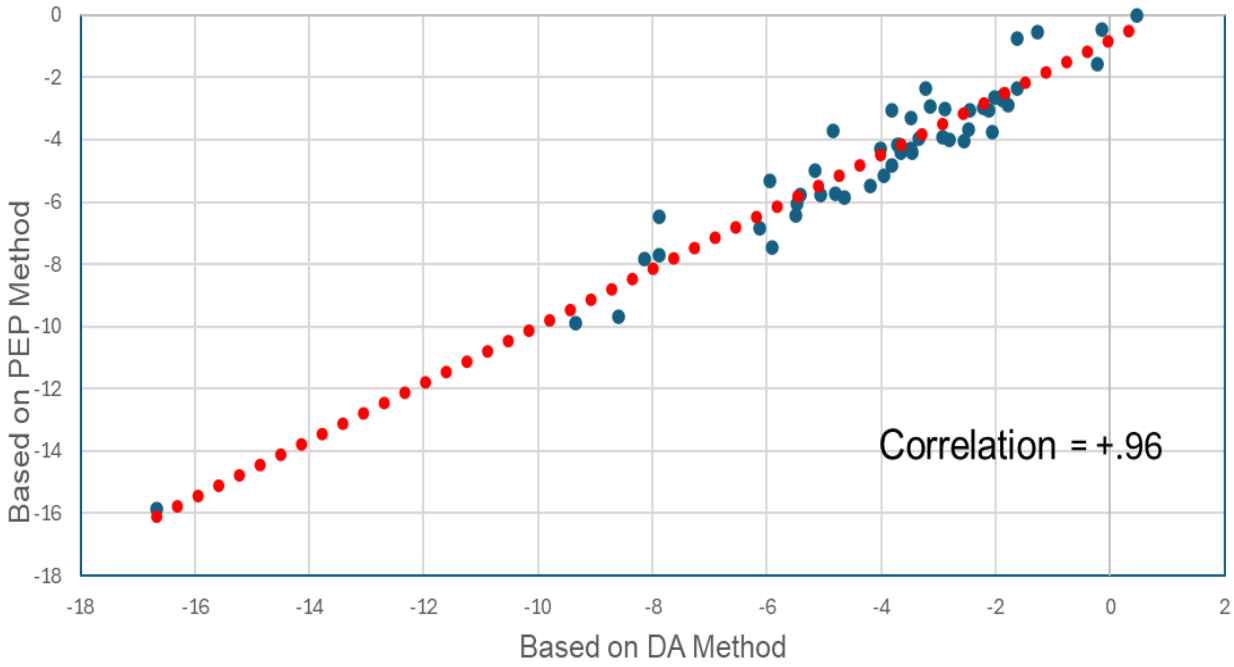

Table 2 shows summary statistics for the state distributions based on the two methods. The shapes of the distributions are very similar. The range and the standard deviations of the two distributions are very similar indicating similar variation. The range for the DA data is 15.9 percentage points while the range for the PEP method is 17.2

percentage points. The standard deviations for the distributions for the two methods are very similar: 2.6 percentage points for DA and 2.8 percentage points for PEP.

Table 2. Summary Statistics for Distributions of State* Level Coverage Rates for Ages 0 to 4 in the 2020 Census Based on Two Methods

	DA Method **	PEP Method***
State Average	-4.5	-4.0
Maximum (Percent)	0	0.5
Minimum (Percent)	-15.9	-16.7
Range (Percentage Points)	15.9	17.2
Standard Deviation	2.6	2.8
Number of States with a Net Undercount	51	50
* District of Columbia is treated as a state in this analysis		
** Source: U.S. Census Bureau (2024a)		
*** Source: O'Hare (2023a)		

Evidence in Table 2 suggests that the DA method generally produced a slightly larger (worse) net undercount rate than the PEP Method. The average state estimated coverage error using the DA methods was -4.5 percent compared to -4.0 for the PEP method. Previous research using the PEP method showed a high net undercount for young children (O'Hare 2014, 2015, 2017), but the current analysis indicates those were probably conservative estimates. The true young child undercount rates were probably a little higher than those shown with the PEP method.

Despite the high correlation, there are 16 states where the DA estimated net undercount rate for ages 0 to 4 was at least one percentage point different from the estimate from PEP estimate. Of these 16 states, 14 are situations where the DA estimates show a worse (larger) net undercount rate for ages 0 to 4 than the PEP estimates.. The biggest difference among the states is in Alabama where the PEP

method shows an undercount rate of 2.1 percent compared to the estimated undercount rate of 3.8 percent based on the DA method.

For calculations in both methods the Census count is the same, so the only differences in the coverage rates are estimates of the number of children ages 0 to 4. The total number of young children estimated from the DA method was 19,462,294 compared to 19,377,059 based on the PEP method. That amounts to a difference of 86,235 young children or 0.4 percent.

Table 3 shows the numeric difference in the size of the population ages 0 to 4 for each state based on the two different methodologies. Generally, the number of estimated young children are pretty similar between the two methods. The correlation between the estimated number of young children using the two methods rounds to +1.0. But there are ten states where the difference is more than 5,000 young children and 19 states where the difference is more than 1 percentage point.

Table 3 States Ranked by Numeric Difference in Estimated Young Children Population in 2020 Census Based on Two Different Methodologies

Rank *	State	Number of children ages 0 to 4 from Census Bureau DA estimates **	Number of children ages 0 to 4 from Census Bureau Vintage 2020 Population estimates***	Difference between Number estimated with DA method and number estimated with PEP method (DA - PEP)	Percent Difference (Difference/PEP)*100
1	New York	1,125,285	1,114,159	11,126	1.0
2	New Jersey	523,264	515,150	8,114	1.6
3	Ohio	693,573	686,542	7,031	1.0
4	Pennsylvania	698,586	691,701	6,885	1.0
5	Florida	1,143,120	1,136,528	6,592	0.6
6	Virginia	511,295	504,902	6,393	1.3
7	Illinois	738,282	732,395	5,887	0.8
8	Alabama	297,751	292,574	5,177	1.8
9	Maryland	365,000	360,121	4,879	1.4
10	Michigan	565,801	561,267	4,534	0.8
11	North Carolina	611,557	607,724	3,833	0.6
12	Indiana	420,162	416,635	3,527	0.8
13	Tennessee	411,470	407,944	3,526	0.9
14	Kentucky	274,385	270,964	3,421	1.3
15	Mississippi	185,510	182,411	3,099	1.7
16	Louisiana	300,610	297,590	3,020	1.0
17	Wisconsin	330,091	327,595	2,496	0.8
18	Georgia	651,900	649,412	2,488	0.4
19	Arkansas	189,309	186,976	2,333	1.2
20	South Carolina	294,142	291,887	2,255	0.8
21	Iowa	195,743	193,506	2,237	1.2
22	Minnesota	349,568	347,406	2,162	0.6
23	Missouri	370,450	368,547	1,903	0.5
24	Massachusetts	354,754	353,112	1,642	0.5
25	Connecticut	181,819	180,221	1,598	0.9
26	Nebraska	130,620	129,357	1,263	1.0
27	West Virginia	92,944	91,777	1,167	1.3
28	Kansas	185,068	183,952	1,116	0.6
29	Hawaii	85,659	84,616	1,043	1.2
30	Rhode Island	54,534	53,966	568	1.1
31	Wyoming	34,505	34,033	472	1.4
32	Delaware	54,992	54,573	419	0.8
33	Maine	64,000	63,605	395	0.6
34	North Dakota	53,751	53,363	388	0.7
35	Idaho	114,638	114,285	353	0.3
36	Alaska	50,255	50,115	140	0.3
37	Vermont	28,561	28,424	137	0.5
38	New Hampshire	63,389	63,309	80	0.1
39	District of Columbia	44,083	44,479	-396	-0.9
40	Oklahoma	253,946	254,354	-408	-0.2
41	Montana	59,669	60,208	-539	-0.9
42	Colorado	325,309	325,912	-603	-0.2
43	South Dakota	59,967	60,684	-717	-1.2
44	New Mexico	118,403	119,355	-952	-0.8
45	Washington	450,442	451,433	-991	-0.2
46	Nevada	183,803	185,025	-1,222	-0.7
47	Utah	241,052	242,865	-1,813	-0.7
48	Oregon	220,488	222,411	-1,923	-0.9
49	Texas	1,971,128	1,975,115	-3,987	-0.2
50	Arizona	419,488	425,967	-6,479	-1.5
51	California	2,319,173	2,326,607	-7,434	-0.3
	Total	19,463,294	19,377,059	86,235	0.4

* Ranking based on unrounded data

** Source: U.S. Census Bureau (2024a)

***Source: O'Hare (2023a)

Table 4 shows states ranked by percent difference in the number of estimated children ages 0 to 4. Differences range from -1.5 percentage points in Arizona to 1.8 percentage points in Alabama. A negative sign means the PEP estimate is larger (better) than the DA estimate. Only 13 states had a negative difference. For most of the states, there is less than one percentage point difference.

Table 4 States Ranked by Percent Difference in Numeric Estimates of Young Children in the 2020 Census Based on Two Different Methodologies

Rank *	State	Number of children ages 0 to 4 from Census Bureau DA estimates **	Number of children ages 0 to 4 from PEP Method Vintage 2020 Population estimates***	Difference between number estimated with DA method and number estimated with PEP method (DA - PEP)	Percent Difference (Difference/PEP)*100
1	Arizona	419,488	425,967	-6,479	-1.5
2	South Dakota	59,967	60,684	-717	-1.2
3	Montana	59,669	60,208	-539	-0.9
4	District of Columbia	44,083	44,479	-396	-0.9
5	Oregon	220,488	222,411	-1,923	-0.9
6	New Mexico	118,403	119,355	-952	-0.8
7	Utah	241,052	242,865	-1,813	-0.7
8	Nevada	183,803	185,025	-1,222	-0.7
9	California	2,319,173	2,326,607	-7,434	-0.3
10	Washington	450,442	451,433	-991	-0.2
11	Texas	1,971,128	1,975,115	-3,987	-0.2
12	Colorado	325,309	325,912	-603	-0.2
13	Oklahoma	253,946	254,354	-408	-0.2
14	New Hampshire	63,389	63,309	80	0.1
15	Alaska	50,255	50,115	140	0.3
16	Idaho	114,638	114,285	353	0.3
17	Georgia	651,900	649,412	2,488	0.4
18	Massachusetts	354,754	353,112	1,642	0.5
19	Vermont	28,561	28,424	137	0.5
20	Missouri	370,450	368,547	1,903	0.5
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38	Louisiana	300,610	297,590	3,020	1.0
39	Ohio	693,573	686,542	7,031	1.0
40	Rhode Island	54,534	53,966	568	1.1
41	Iowa	195,743	193,506	2,237	1.2
42	Hawaii	85,659	84,616	1,043	1.2
43	Arkansas	189,309	186,976	2,333	1.2
44	Kentucky	274,385	270,964	3,421	1.3
45	Virginia	511,295	504,902	6,393	1.3
46	West Virginia	92,944	91,777	1,167	1.3
47	Maryland	365,000	360,121	4,879	1.4
48	Wyoming	34,505	34,033	472	1.4
49	New Jersey	523,264	515,150	8,114	1.6
50	Mississippi	185,510	182,411	3,099	1.7
51	Alabama	297,751	292,574	5,177	1.8

*Ranks based on unrounded data

**Source: U.S. Census Bureau, (2024a)

*** Source: O'Hare (2023a)

Analysis of Counties

The Census Bureau only produced net young child undercount estimates for a subset of counties, namely, those counties that had at least 1,000 persons ages 0 to 4 based on the DA method. Estimates for smaller counties were likely to be less reliable. There were 1,927 counties where estimates were produced. That is 61 percent of all counties, but it should be noted that these 1,927 counties account for 97 percent of all young children based on DA estimates.

For this analysis, I compare the county data from the DA Method to corresponding counties where estimates were produced by O'Hare (2023b) using the PEP method.[4]

The characteristics of the two county-level distributions of young child county coverage rates are provided in Table 5.

[4] There were three counties where the Census Bureau produced a young child coverage estimate based on DA for which there was no corresponding estimate from the PEP method because the PEP data used here was based on 2010 Census geography. So, only 1,924 counties were analyzed here.

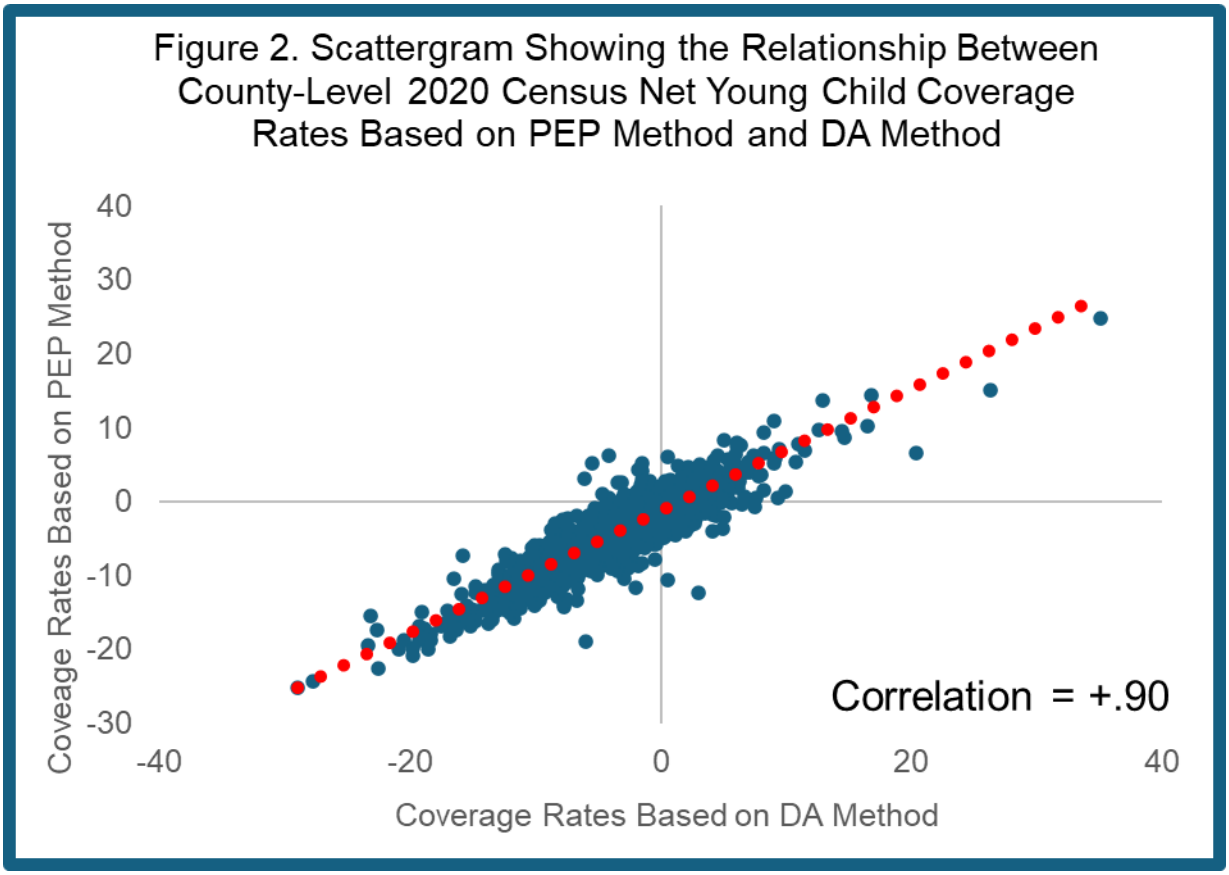
Table 5. Summary Statistics of Distributions of County* Level 2020 Census Coverage Rates for Ages 0 to 4 from Two Different Methods (for selected Counties)		
	DA method**	PEP method***
County Average	-4.0	-3.4
Maximum (Percent)	25	35
Minimum (Percent)	-25	-29
Range (Percentage Points)	50	64
Standard Deviation	4.6	5.0
Number Counties with a Net Undercount for Young Children (out of 1,924)	1,624	1,512
* The District of Columbia is treated as a county in this analysis.		
** U.S. Census Bureau (2024a)		
** *Source O'Hare 2023b		

Like the state estimates, the county net young child undercount rates produced by the DA method show slightly higher (worse) net undercount rates than the estimates produced by the PEP method. The county average error from the DA method was -4.0 compared to -3.4 for the PEP method.

For both methods, the vast majority of the counties show a net undercount of young children (79 percent for the PEP method and 84 percent for the DA method).

The range and the standard deviation show the distribution based on the PEP method have a somewhat larger variance than the distribution for the DA method. The range for the DA methods was 50 percentage points compared to 64 percentage points for the PEP method.

Figure 2 is a scattergram showing the relationship between the results of the two methods for counties. The correlation between the two series is +.90 which is highly statistically significant.



Evaluation of Young Child Coverage by County Population Size

O'Hare (2023b and 2017) found big differentials in the coverage of young children by the population size of the county. Table 6 shows the percent of the national undercount of young children that is accounted by counties in several population size categories.

The results are pretty similar for both the DA and PEP methods. The largest counties account for a very high share of the overall national undercount of young children. The 46 counties with a million people or more account for 45 percent of the national undercount based on the DA method and 46 percent based on the PEP

method. Counties with more than half a million people account for two-thirds (66 percent) of the national undercount of young children.

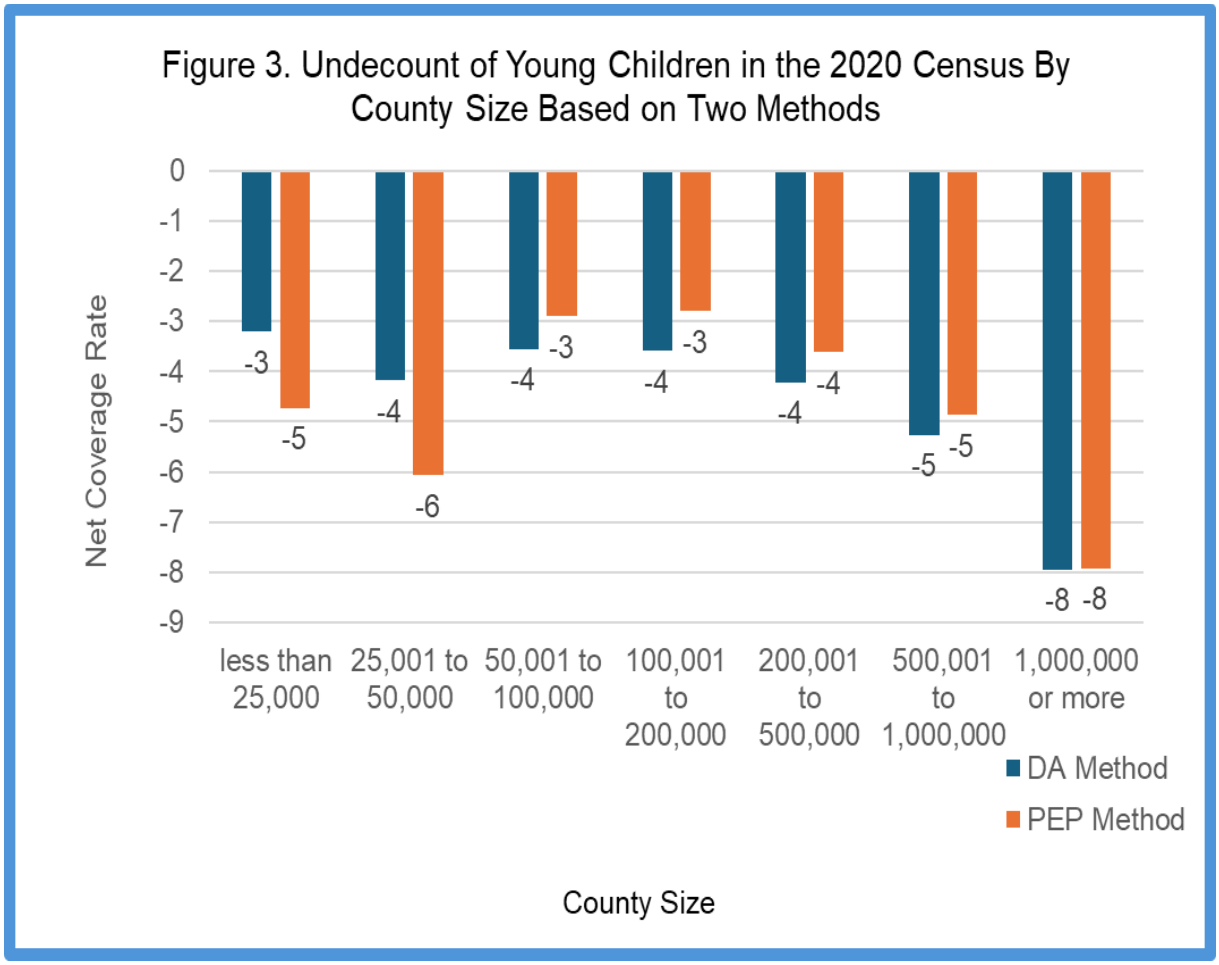
Table 6. Net Coverage of Young Children in the 2020 Census Based by County Populaion Size Base on Two Different Estimation Methods

		Percent of Total National Undercount of Young Children in This Group of Counties	
Total Population Size of County	Number of Counties	DA	PEP
less than 25,000	323	1	2
25,001 to 50,000	611	5	8
50,001 to 100,000	389	5	5
100,001 to 200,000	263	8	6
200,001 to 500,000	198	15	13
500,001 to 1,000,000	94	21	20
1,000,000 or more	46	45	46
Total	1924	100	100

* Analysis of 1,924 counties with DA Expeimental Estimates from 2020 Census

While part of the reason the largest counties account for a large share of undercounted young children is because a lot of young children live in those counties, another significant reason why they account for such a large share is that those counties also have higher young children undercount rates than smaller counties.

Figure 3 shows the aggregate young child net undercount rate by county size for the two estimation methods. Both methods show the largest counties have higher net undercount rates at 8 percent, compared to 3 to 6 percent for counties with under 500,000 people..



Summary

Analysis shows the two methods for producing young child coverage estimates evaluated here (the DA method and the PEP method) produce very similar results. Both methods examined here indicate the net undercount of young children is widespread. Based on the DA method all states had a net undercount of young children and 84 percent of the counties examined here had a net undercount of young children.

Results were similar for data based on the PEP method. Both methods indicate the undercount of young children is concentrated in the largest counties.

This analysis underscores the accuracy of earlier studies using the PEP method and the patterns revealed by those analysis (O'Hare 2014; O'Hare 2017; O'Hare 2023a; O'Hare 2023b; O'Hare 2024). Moreover, the traditional method of estimating subnational young child net coverage rates appears to be conservative. True net undercounts were probably slightly higher than the PEP method showed.

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