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# Improving Equitable Representation in Program Eligibility Data

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## Abstract

*Persistent poverty is used as an indicator across federal agencies for designating areas as eligible for programs serving regions of embedded poverty. This article tests various methods for incorporating margins of error (MOEs) in the designation of persistent poverty areas and evaluates the outcomes of including MOEs in eligibility metrics for the U.S. Department of Housing and Urban Development's Distressed Cities and Persistent Poverty Technical Assistance program. The study finds that when MOEs are used in persistent poverty metrics to exclude census tracts with low MOE reliability, there is no substantial change in counties and incorporated census places that serve persistent poverty census tracts. However, when MOEs are used as an inclusive metric for measuring persistent poverty, there is an increase in low-population areas included in program eligibility. Furthermore, the study finds that using MOEs to include areas in program eligibility increases the representation of underserved populations as defined by race, ethnicity, and poverty status.*

## Introduction

Executive Orders 13985 and 14091 (“Advancing” and “Further Advancing” racial equity and support for underserved communities through the federal government) provide guidance for federal agencies to implement and support comprehensive mission and service delivery strategies to yield equitable outcomes for all Americans, including underserved communities and others that have been adversely affected by structural inequality. This guidance involves monitoring activities and promoting accountability to ensure that agencies undertake measurable steps to deliver equitable outcomes through their policies and programs.

A data-based component of this effort defines equity spatially, often relying upon areawide poverty indicators and related demographic, socioeconomic, and geographic characteristics, such as racial and ethnic diversity, employment and disability status, educational attainment, and rurality (Farrigan and Crowe, 2023). These and other aspects of equity can be explored using U.S. Census Bureau survey data (U.S. Census Bureau, 2023). A spatial equity metric that is commonly derived from these data is persistent poverty area status, which has increasingly been relied upon to implement and monitor federal grants and programs (for example, U.S. Congress, 2020).

This article describes how margins of error (MOEs) for Census survey data can be incorporated into persistent poverty area estimation to boost eligibility inclusivity for federal programs. The Department of Housing and Urban Development (HUD) Distressed Cities and Persistent Poverty Technical Assistance (DCTA) program serves as the test case, but the methodology can be applied broadly to other programs that rely on survey data (for example, U.S. Department of Agriculture’s Rural Development Programs; U.S. Economic Development Administration’s Public Works Program; U.S. Department of the Treasury’s Community Development Financial Institutions and Regulatory Improvement Fund, the Comprehensive Environmental Response, Compensation, and Liability Act, and National Infrastructure and Investments; and Thriving Communities programs as defined in U.S. Congress, 2022).

## The Use of Persistent Poverty Area Measures in Federal Program Eligibility

Persistent poverty refers to longstanding geographic concentrations of people living in poverty. It is typically defined by consistent high poverty area status over 3 to 4 decades and most often at the county level of analysis. The majority of persistent poverty counties are in Appalachia, the Black Belt, the Mississippi Delta, the Ozarks, and the Southwest (U.S. Department of Agriculture, Economic Research Service, 2023). The spatial clustering of persistent poverty has led practitioners and policymakers to implement place-based policies with the aim of improving local amenities and infrastructure, building human capital, stimulating local economies, and alleviating multi-generational poverty (Parker, Tach, and Robertson, 2022).

Census tracts can supply a more geographically precise view of persistent poverty than counties (Benson, Bishaw, and Glassman, 2023). Census tract geography is increasingly being integrated into federal policies and programming, often in combination with counties. The HUD DCTA

program uses persistent poverty at the census tract level to classify counties and incorporated census places for program eligibility.

## The Distressed Cities and Persistent Poverty Technical Assistance Program

The DCTA program was established in 2018 to build capacity of relatively small local governments that may not otherwise have direct access to HUD programs and technical assistance resources (HUD, 2023). Local governments (for example, counties, cities, or Tribal governments) serving communities with populations under 50,000 that meet either economic distress or persistent poverty criteria are eligible to receive assistance under the program (exhibit 1).

### Exhibit 1

DCTA Program Eligibility for the 50 States and Puerto Rico\*

Geography	Economic Distress		Persistent Poverty		Both	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
County	967	43.8	668	30.2	477	21.6
Place	9,804	52.4	1,944	10.4	1,506	8.0

\*By number and share of counties and places (or equivalents) for the data period ending in 2021.

Note: Percents represent the proportion of all counties and places with a population below 50,000.

Sources: Economic distress eligibility—2007–2011 and 2017–2021 American Community Survey (ACS) 5-year estimates; persistent poverty eligibility—2000 Census and 2007–2011 and 2017–2021 ACS 5-year estimates

Economic distress criteria include an unemployment rate of 8.95 percent or more, a poverty rate of 19.95 percent or more among individuals not enrolled in higher education, or a population loss of 4.95 percent or more over 10 years. In addition, a local government is eligible for DCTA if it serves one or more persistent poverty census tracts. This article examines only the persistent poverty area measure included in the DCTA program; it does not evaluate incorporating MOEs in designating program eligibility using unemployment, non-college poverty rate, or population loss.

Within the DCTA program, a census tract is considered to be in persistent poverty when the poverty rate is 19.95 percent or higher over a 30-year period. For this study, census tract level persistent poverty is calculated using poverty rate estimates from the 2000 Decennial Census and the 2007–2011 and 2017–2021 American Community Survey (ACS) 5-year estimates. Census tracts with a poverty rate of 19.95 or greater in 2000 and the 5-year periods ending in 2011 and 2021 are considered to be persistently poor in the DCTA program. Counties and places that intersect with, contain, or are contained by persistent poverty census tracts are eligible for the program.

## Integrating Margins of Error into Persistent Poverty Area Estimation

The Census Bureau supplies calculated MOEs for all ACS estimates and Census geographies. The MOE is a statistical measure that captures the amount of random sampling errors in a survey's

results. It can be used to evaluate the extent to which the Census Bureau is confident that the reported estimates are the “true” value for the whole population. For example, the degree of confidence represented by the MOE can be expressed as a confidence interval, which is a range of values bounded by  $\pm$  the MOE (lower bound = estimate – MOE; upper bound = estimate + MOE). The larger the MOE, the greater the degree of uncertainty of the estimate. MOEs tend to be larger for smaller geographies and populations, such as those applicable to the DCTA program.

The Census Bureau encourages the use of MOEs in decisionmaking (U.S. Census Bureau, 2022); however, there is no standard practice on how to incorporate this information in program eligibility calculations. When developing poverty area measures, one choice is to use the confidence interval to determine if the MOE impacts the high poverty status of a given area. For example, the true value of a census tract with a poverty rate estimated at 17.90 and an MOE of  $\pm$  6.20 is understood to lie somewhere between 11.70 and 24.10 percent. If the estimate is taken at face value, then that census tract would not be counted as having high poverty according to the DCTA 19.95 percent cutoff. This estimate could contribute to the exclusion of a poor community from program eligibility because the true value is potentially well above 19.95 percent. In such cases where the MOE pushes the poverty rate above or below the program cutoff, decisionmakers are faced with erring on the side of inclusivity or exclusivity.

When MOEs are incorporated in persistent poverty area designation, they are often used as an exclusionary measure to reduce the uncertainty of data by choosing not to include cases considered unreliable. The rest of this article describes an additional methodology in which MOEs are used for the purpose of inclusion with respect to DCTA program eligibility. Summary geographic and demographic results are provided, including an assessment of racial equity impacts.

## Methodology

This study evaluates an inclusive MOE decision process that can be used to expand eligibility measures for low-population places, potentially increasing the areas that meet program eligibility criteria beyond a measure that does not include MOEs. The inclusive MOE criterion uses the upper bound of the confidence interval for the 2017–21 poverty rate estimate in the determination of persistent poverty. That is, a census tract is defined as persistently poor if the poverty rate estimates for 2000 and 2007–11 and the poverty rate estimate for 2017–21 plus its margin of error are all equal to or greater than 19.95 percent. For comparison, the eligibility impact of an exclusive MOE approach is also evaluated.

The exclusive MOE is defined by two criteria (Farrigan and Sanders, forthcoming). The first is based on a measure of reliability created from the coefficient of variation (CV), which is generated from the MOE of the estimate. The poverty rate estimate is calculated as the total number of people with a household income below the official poverty level divided by the total population for whom poverty status was determined multiplied by 100. The margins of error of the poverty rates for each census tract are derived using Equation 1. The coefficients of variation at the 90-percent significance level are generated from the derived margins of error using Equation 2. Poverty rate estimates for 2017–21 are defined as having low reliability if the CV is greater than 40 percent.

**Equation 1. Derived Margin of Error**

$$MOE(\hat{Q}) = 100 \times \left[ \frac{1}{\hat{Y}} \sqrt{[MOE(\hat{X})]^2 - (\hat{P}^2 \times [MOE(\hat{Y})]^2)} \right]$$

**Equation 2. Coefficient of Variation**

$$CV = \frac{\left[ \frac{MOE(\hat{Q})}{1.645} \right]}{\hat{Q}} \times 100$$

Notes:  $\hat{Q}$  is the derived poverty rate estimate.  $\hat{X}$  is the American Community Survey (ACS) estimate of the number of people with a household income below the official poverty level.  $\hat{Y}$  is the ACS estimate of the number of people in the poverty universe for an area.  $\hat{P}$  is the ratio of the number of people with household income below the poverty level to the number of people in the poverty universe in that area.

The second criterion for defining the exclusive MOE takes the confidence interval (CI) into consideration by adjusting the poverty rate estimates by the bounds of the CI. If a census tract is determined to have a low reliability poverty rate estimate based on the CV, and the poverty rate estimate plus or minus its margin of error (upper and lower bound poverty rate values) would change the tract’s high poverty status for 2017–21, the census tract is excluded from persistent poverty area determination.

All analyses were performed using R Statistical Software (v4.3.2; R Core Team, 2023) and SPSS (IBM Corporation, 2020). The population weighted interpolation function in R’s tidycensus package was used to transform census tracts in consistent geographies for comparison of poverty rates across time (Walker and Herman, 2023). Counties and places that intersect with, contain, or are contained by persistent poverty census tracts were identified using spatial join functions in R’s sf package (Pebesma, 2018). Data are aggregated by HUD regions (exhibit 2) and states to convey spatial variation in counties and places eligible for DCTA using each of the MOE criteria.

**Exhibit 2**

HUD Regions		
HUD Region Name	HUD Region Number	States
Great Plains	VII	Kansas, Iowa, Missouri, Nebraska
Mid-Atlantic	III	Pennsylvania, Virginia, West Virginia, Maryland, Delaware, District of Columbia
Midwest	V	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
New England	I	Connecticut, Vermont, Massachusetts, Maine, New Hampshire, Rhode Island
New York/New Jersey	II	New York, New Jersey
Northwest/Alaska	X	Washington, Alaska, Idaho, Oregon
Pacific/Hawaii	IX	California, Arizona, Hawaii, Nevada
Rocky Mountain	VIII	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
Southeast/Caribbean	IV	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico, U.S. Virgin Islands
Southwest	VI	Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Source: Regions as defined by the U.S. Department of Housing and Urban Development <https://www.hud.gov/localoffices/regions>

## Inclusive and Exclusive MOE Results

The census tract level analysis shows a predictable change, with the inclusive MOE criterion increasing the number of persistent poverty census tracts and the exclusive MOE criterion decreasing the number of tracts (exhibit 3). Under each, approximately 1 percent of all census tracts are excluded due to missing poverty data in 2000, 2007–11, or 2017–21. Furthermore, 5 percent of census tracts are excluded due to low-reliability margins of error when applying the exclusive MOE criterion.

### Exhibit 3

Change in Persistent Poverty Census Tract Designation

MOE Group	Persistently Poor		Not Persistently Poor		No Data		Low Reliability MOE	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
No MOE	10,282	12.0	73,917	86.6	1,196	1.4		
Inclusive MOE	12,267	14.4	71,932	84.3	1,196	1.4		
Exclusive MOE	10,048	11.8	69,686	81.6	1,196	1.4	4,465	5.2

MOE = margin of error.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

When examining counties and Census-designated places (or equivalents) that intersect with, contain, or are contained by persistent poverty census tracts, the largest differences are observed using the inclusive MOE criterion (exhibit 4). The observed trends are nearly identical when no MOE is used and when the exclusive MOE criterion is used. At the regional level, using an inclusive MOE criterion adds eligible counties and places primarily in HUD's Southeast/Caribbean and Southwest regions (exhibit 5).

### Exhibit 4

Counties and Incorporated Places that Serve Persistent Poverty Census Tracts

Geography	Without MOE				Inclusive MOE				Exclusive MOE			
	All		Population Below 50,000		All		Population Below 50,000		All		Population Below 50,000	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
County	1,342	41.8	670	30.2	1,461	45.5	760	34.4	1,341	41.8	669	30.3
Place	2,417	12.4	1,944	10.4	2,833	14.5	2,333	12.5	2,404	12.3	1,932	10.3

MOE = margin of error.

Note: A county or place is considered to serve a persistent poverty census tract if it contains, overlaps with, or is contained by the census tract.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

**Exhibit 5**

Counties and Incorporated Places that Serve Persistent Poverty Census Tracts by HUD Region

HUD Region Name	County			Place		
	Without MOE (%)	Inclusive MOE (%)	Exclusive MOE (%)	Without MOE (%)	Inclusive MOE (%)	Exclusive MOE (%)
Great Plains	1.5	1.7 (+0.2)	1.5	0.4	0.5 (+0.1)	0.4
Mid-Atlantic	1.7	2.0 (+0.3)	1.7	0.9	1.0 (+0.1)	0.9
Midwest	1.4	1.8 (+0.4)	1.4	0.9	1.1 (+0.2)	0.9
New England	0.1	0.1	0.1	0.1	0.1	0.1
New York/New Jersey	0.1	0.1	0.1	0.3	0.3	0.3
Northwest/Alaska	0.6	1.0 (+0.4)	0.6	0.6	0.7 (+0.1)	0.6
Pacific/Hawaii	0.3	0.3	0.3	0.4	0.5 (+0.1)	0.4
Rocky Mountain	12.0	12.0	12.0	12.0	12.0	12.0
Southeast/Caribbean	12.0	12.0	12.0	12.0	12.0	12.0
Southwest	12.0	12.0	12.0	12.0	12.0	12.0

MOE = margin of error.

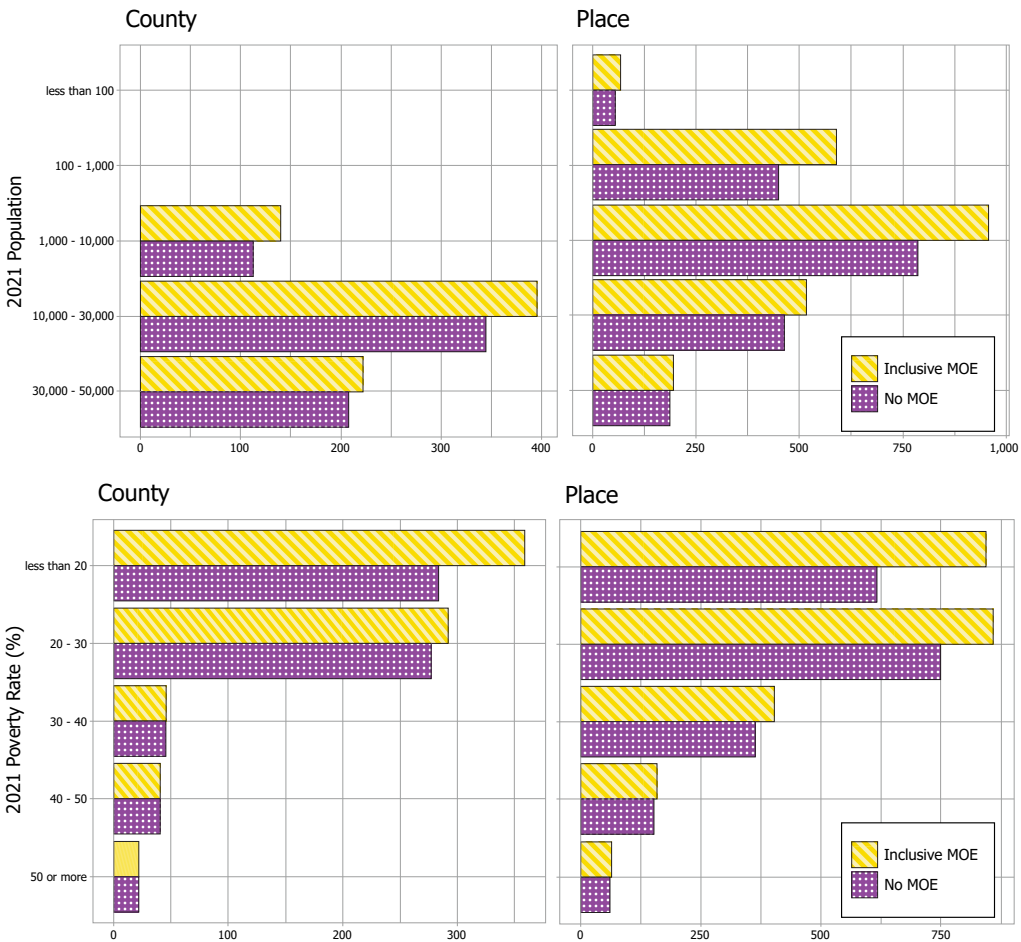
Notes: A county or place is considered to serve a persistent poverty census tract if it contains, overlaps with, or is contained by the census tract. Percents represent the proportion of all counties and places with a population below 50,000. When there is a change from not using MOEs and the inclusive or exclusive MOE criteria, it is represented in parentheses.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

The study finds that, at the census place and county levels, the use of an inclusive MOE criterion increases the representation of lower population areas as eligible for DCTA (exhibit 6). Although a greater inclusion of high (20 percent or more) and extreme (40 percent or more) poverty counties and places was expected when using the inclusive MOE criterion, results show that it primarily increases the inclusion of counties and places with a poverty rate under 30 percent (exhibit 5). This outcome is likely due to the use of census tract level poverty estimates in persistent poverty calculations; when a place or county with an overall poverty rate below 20 percent serves a persistent poverty census tract, this tract can represent distinct concentrations of communities living in poverty within counties and places.

**Exhibit 6**

Distribution of Population and Poverty Rate for Counties and Incorporated Places by MOE Criterion



MOE = margin of error.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

## Racial and Ethnic Equity Impact Assessment

A racial and ethnic equity impact assessment is an examination of how different racial and ethnic groups may be affected by a proposed action or decision (Keleher, 2009). This study considers the equity impacts that could result from incorporating the inclusive MOE criterion into the DCTA persistent poverty eligibility determination process. The first step is to determine what are perceived as desirable outcomes in the context of racial and ethnic equity. Generally, this includes greater representation of historically marginalized populations and racially/ethnically diverse communities in the pool of eligible areas. The next step is to generate and interpret related outcome indicators. Indicators were selected that focus on poverty concentration, geography, and population.



This article examines representative changes in high poverty areas, where high poverty status is characterized by individual or diverse racial/ethnic populations. High poverty areas are defined here as counties or places with a poverty rate of 19.95 percent or more using data from the 2017–2021 ACS 5-year estimates. Of the areas with a population below 50,000, about 25 percent are high poverty. The high poverty areas are classified by the extent to which their poverty reflects the low income of select racial and ethnic groups. This classification is based on two conditions (Beale, 2004): (1) over one-half of the people living in poverty in the area represent one race or ethnicity, and (2) over one-half of the people living in poverty identify as non-Hispanic White, but the high poverty rate of a different racial or ethnic group pushes the area’s poverty rate over 19.95 percent.

The study finds that at the census place and county levels, the use of an inclusive MOE criterion for persistent poverty determination increases the representation of historically marginalized populations among those eligible for DCTA (exhibits 7 and 8). This is particularly true at the place level of analysis, in which the percent change is greatest for high poverty places characterized by the poverty of the resident Black or African American and Hispanic populations.

**Exhibit 7**

Counties by Racial and Ethnic High Poverty Area Type that are Eligible for DCTA when an Inclusive MOE is Applied to Persistent Poverty Determination

High Poverty Concentration by Race and Ethnicity	Total Counties		Persistent Poverty Eligible Counties					
			Without MOE		Inclusive MOE		Change	
	Count	Percent (%)	Number Eligible	Percent of Total (%)	Number Eligible	Percent of Total (%)	Number Eligible	Percent of Total (%)
Not high poverty in the current period (2017–2021)	1,692	76.2	243	14.4	317	18.7	74	4.4
Black or African American	143	6.4	123	86.0	128	89.5	5	3.5
American Indian or Alaska Native	34	1.5	26	76.5	26	76.5	0	0.0
Asian	0	0.0	0	0.0	0	0.0	0	0.0
Native Hawaiian or other Pacific Islander	1	0.0	0	0.0	0	0.0	0	0.0
Hispanic, any race	108	4.9	97	89.8	100	92.6	3	2.8
White Non-Hispanic	147	6.6	102	69.4	109	74.1	7	4.8
High poverty not defined by a single race or ethnicity	96	4.3	77	80.2	78	81.3	1	1.0

MOE = margin of error.

Notes: Only counties with a population below 50, 000 are included in the analysis. High poverty is defined as a poverty rate above 19.95 percent. Persons in each racial category include those who reported belonging to a single racial group (alone) in the 2017–2021 American Community Survey (ACS).

Source: Authors’ analysis of 2000 Census and 2007–2011 and 2017–2021 ACS 5-year data

**Exhibit 8**

Places by Racial and Ethnic High Poverty Area Type That are Eligible for DCTA When an Inclusive MOE is Applied to Persistent Poverty Determination

High Poverty Concentration by Race and Ethnicity	Total Places		Persistent Poverty Eligible Places					
			Without MOE		Inclusive MOE		Change	
	Count	Percent (%)	Number Eligible	Percent of Total (%)	Number Eligible	Percent of Total (%)	Number Eligible	Percent of Total (%)
Not high poverty in the current period (2017–2021)	13,727	73.3	538	3.9	741	5.4	203	1.5
Black or African American	985	5.3	524	53.2	594	60.3	70	7.1
American Indian or Alaska Native	135	0.7	84	62.2	87	64.4	3	2.2
Asian	20	0.1	0	0.0	0	0.0	0	0.0
Native Hawaiian or other Pacific Islander	2	0.0	0	0.0	0	0.0	0	0.0
Hispanic, any race	530	2.8	168	31.7	198	37.4	30	5.7
White Non-Hispanic	2,646	14.1	426	16.1	489	18.5	63	2.4
High poverty not defined by a single race or ethnicity	680	3.6	204	30.0	224	32.9	20	2.9

MOE = margin of error.

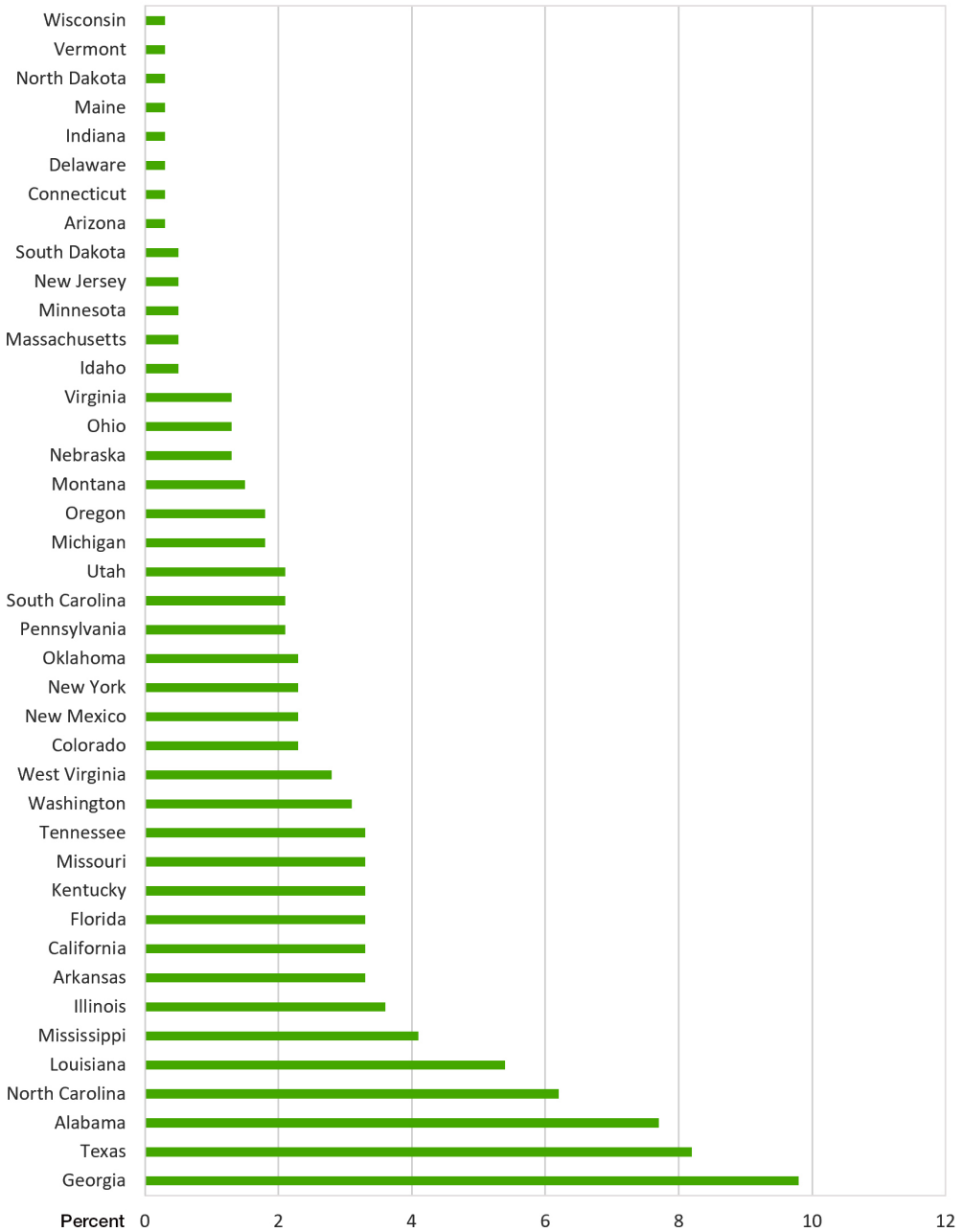
Notes: Only incorporated places with a population below 50,000 are included in the analysis. High poverty is defined as a poverty rate above 19.95 percent. Persons in each racial category include those who reported belonging to a single racial group (alone) in the 2017–2021 American Community Survey (ACS).

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 ACS 5-year data

The high poverty places included in DCTA eligibility when an inclusive MOE criterion is used reflect historic geographic concentrations of Black or African American and Hispanic households in areas of chronic poverty (exhibit 9). The greatest representation is in the Black Belt region that primarily runs from southern North Carolina through Georgia, Alabama, Mississippi, and Louisiana to Texas. Also, among the most represented places are established (for example, Texas) and newer areas (for example, Georgia and Florida) of Hispanic population concentrations and distinct areas of concentrated White, Non-Hispanic poverty in the extended Southern Highlands region (for example, Arkansas, Kentucky, Missouri, and West Virginia).

**Exhibit 9**

**Geography of Newly Eligible Places When the Inclusive MOE Criterion is Used for Persistent Poverty Determination**



MOE = margin of error.

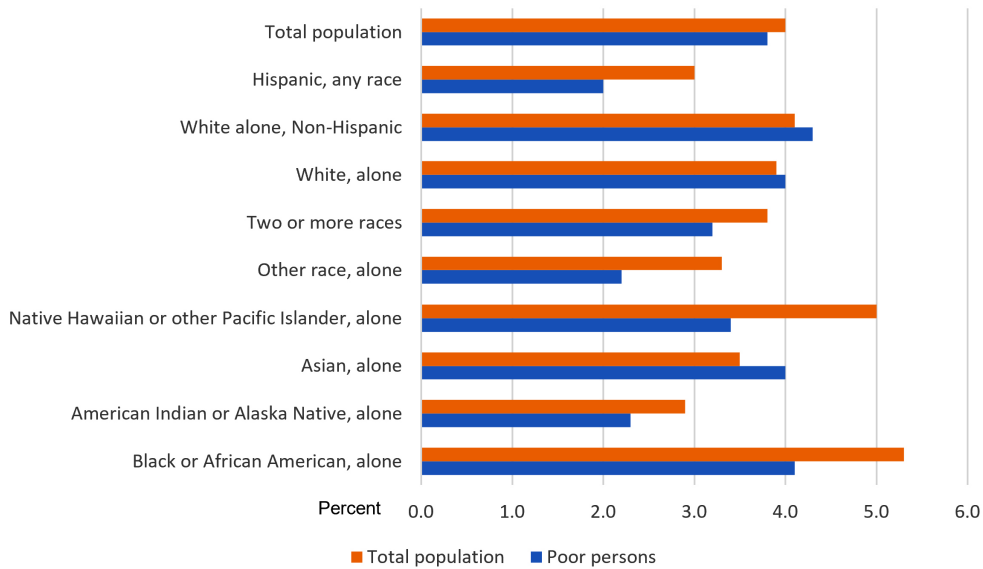
Note: Percent distribution by state.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

Considering representative change in the total population and the population living in poverty by race and ethnicity for the 2017–21 data period shows a statistically significant increase for all groups when the inclusive MOE criterion is applied to persistent poverty determination (exhibits 10 and 11). The largest increases at the county level of analysis are for total population identifying as Black or African American and as Native Hawaiian or other Pacific Islander. At the place level of analysis, the change in the total population identifying as Native Hawaiian or other Pacific Islander stands out, as do increases in both the total population and the population living in poverty for individuals identifying as Hispanic (any race) and other race (alone). These findings suggest that in total, the inclusive MOE contributes to greater racial and ethnic diversity across the persistent poverty eligible areas for the DCTA program.

**Exhibit 10**

Percent Change in Racial and Ethnic Group Representation Within DCTA Persistent Poverty Eligible Counties due to Inclusive MOE



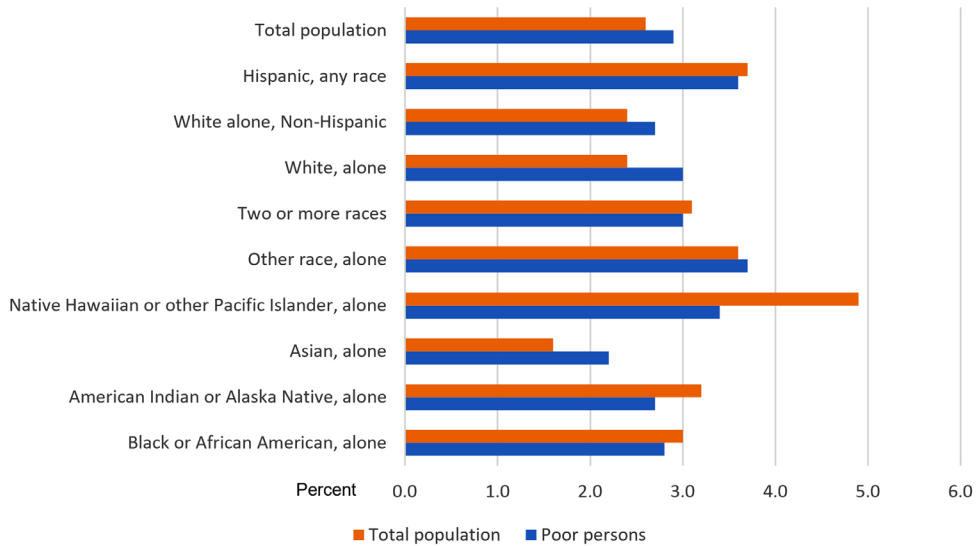
MOE = margin of error.

Note: Data are displayed for the total population and the population living in poverty.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

**Exhibit 11**

Percent Change in Racial and Ethnic Group Representation Within DCTA Persistent Poverty Eligible Places Due to Inclusive MOE



MOE = margin of error.

Note: Data are displayed for the total population and the population living in poverty.

Source: Authors' analysis of 2000 Census and 2007–2011 and 2017–2021 American Community Survey 5-year data

**Conclusions**

This study found that applying an inclusive MOE criterion to the persistent poverty determination process increases the number of places and counties that are eligible for the DCTA program. This results in greater representation of underserved communities, including smaller population areas and those characterized by poverty among historically marginalized populations. In contrast, the use of MOEs to exclude census tracts due to low reliability data did not substantively change the eligibility outcomes in comparison to the program standard of not using MOEs. When using persistent poverty area designations to determine federal program eligibility, the use of MOEs to expand program eligibility can help contribute to better representation of marginalized areas and populations.

However, limitations to using MOEs to expand program eligibility are particularly associated with technical expertise and the time and resources necessary for program implementation. Notably, the incorporation of an inclusive MOE approach is most useful with sub-county geography. That is, at a geographic scale where MOEs tend to be larger, there is a greater likelihood that an inclusive MOE will significantly impact the eligibility outcome. In cases where the eligibility outcome of using MOEs is insignificant, incorporating MOEs into the eligibility determination process may not be worth the added methodological complexity and program resources (for example, staff time). In addition, using MOEs for inclusivity presents potential for false positives—a particular consideration for competitive grant programs where expanding program eligibility to areas with a

wide confidence interval around poverty estimates may lead to awards being made in regions with low-reliability poverty measures. In the case of competitive grant programs, an exclusive MOE approach may be more appropriate. Furthermore, beyond refining the calculation of eligibility metrics, it is important to consider the broader context of eligible areas when implementing technical assistance programs, particularly areas with very low populations that may lack the staff and capacity to participate in technical assistance programs fully.

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