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December 23, 2014

Erika Nelson **BY EMAIL**
Project Coordinator
Wisconsin Council on Families and Children
Race to Equity Project
555 West Washington Ave. Suite 200
Madison, WI 53703

Re: Measurement Issues Regarding the Wisconsin Council on Families and Children's Race to Equity Project

Dear Ms. Nelson:

On occasion I write to institutions or organizations whose activities involve the interpretation of data on demographic differences in the law or the social and medical sciences alerting them to ways in which their activities are undermined by the failure to recognize patterns by which standard measures of differences between favorable or adverse outcome rates of advantaged and disadvantaged groups tend to be systematically affected by the overall prevalence of an outcome. Other recipients of letters involving issues discussed in this letter include Robert Wood Johnson Foundation (Apr. 8, 2009),[1] National Quality Forum (Oct. 22, 2009), Institute of Medicine (June 1, 2010), The Commonwealth Fund (June 1, 2010), United States Department of Education (Apr. 18, 2012), United States Department of Justice (Apr. 23, 2012), Board of Governors or the Federal Reserve System (March 4, 2013), Harvard University (Oct. 9, 2012), Harvard Medical School and Massachusetts General Hospital (Oct. 26, 2012), Senate Committee on Health, Education, Labor and Pensions (Apr. 1, 2013), Mailman School of Public Health of Columbia University (May 24, 2013), Investigations and Oversight Subcommittee of House Finance Committee (Dec. 4, 2013), Education Trust (April 30, 2014), Annie E. Casey Foundation (May 13, 2014), Institute of Medicine II (May 28, 2014), IDEA Data Center (Aug. 11, 2014), Education Law Center (Aug. 14, 2014), and Financial Markets and Community Investment Program, Government Accountability Office (Sept. 9, 2014). An amicus curiae brief I filed on November 17, 2014, in *Texas Department of Housing and Community*

[1] To facilitate consideration of issues raised in letters such as this I include links to referenced materials in electronic copies of the letters. All such letters may be found by means of the Institutional Correspondence subpage of the Measuring Health Disparities page of jpscanlan.com.

Development, et al. v. The Inclusive Communities Project, Inc., No. 13-1731, might be deemed a similar communication to the United States Supreme Court.

This letter is principally prompted by a review of materials created in connection with the Wisconsin Council on Families and Children's Race to Equity Project aimed at reducing and eliminating racial disparities in Dane County, Wisconsin. Reviewed materials include a presentation titled "Race to Equity – a Project to Reduce Racial Disparities in Dane County" and a report titled "*Race to Equity: a Baseline Report on the State of Racial Disparities in Dane County.*" Those materials measure racial disparities in terms of either (a) relative differences between adverse outcomes of African Americans and whites or (b) differences between the proportion African Americans comprise of a population potentially experiencing an adverse outcome and the proportion they comprise of persons actually experiencing the outcome.

These are not sound measures of differences between the circumstances of African Americans and whites, among other reasons, because the measures tend to be systematically affected by the prevalence of an outcome.

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In numerous places since 1987, I have explained the patterns by which standard measures of differences between outcome rates tend to be systematically affected by the prevalence (frequency) of an outcome. The most notable of these patterns – and that most pertinent to measures currently employed in the Race to Equity Project – is that whereby the rarer an outcome, the greater tends to be the relative difference between rates at which advantaged and disadvantaged groups experience the outcome it and the smaller tends to be the relative difference between rates at which such groups avoid the outcome. For example, lowering test cutoffs (or improving test performance) tends to increase relative differences between failure rates of higher- and lower-scoring groups, while reducing relative differences between such groups' pass rates; reducing poverty tends to increase relative differences between poverty rates of higher- and lower-income groups, while reducing relative differences between such groups' rates of avoiding poverty. Thus, as outcomes change in prevalence, one will commonly reach opposite conclusions about whether demographic differences are increasing or decreasing depending on whether one examines relative differences in adverse outcomes or relative differences in the corresponding favorable outcomes.

The above two examples are illustrated in Tables 1 and 2 of my recent article "Race and Mortality Revisited," *Society* (July/Aug. 2014), which addresses at length the failings of mainstream research into demographic differences. That article also contains a number of other examples of the ways the two relative differences, as well as other standard measures of differences between outcome rates, tend to be systematically affected by the prevalence of an outcome. Many other graphical and tabular illustrations may be found in methods workshops given to the statistics, epidemiology, sociology, demography, or law arms of various universities.

See the Conference Presentations subpage of the Publications page of jpscanlan.com.[2] More succinct treatments of the above-described pattern by which the two relative differences tend to be affected by the prevalence of an outcome may be found in the following three recent items, each of which explains that, contrary to beliefs of the United States Departments of Education and Justice, relaxing discipline standards will tend to increase, not decrease, relative racial differences in public school discipline rates: "Things government doesn't know about racial disparities," The Hill (Jan. 28, 2014); "The Paradox of Lowering Standards," *Baltimore Sun* (Aug. 5, 2013); and "Misunderstanding of Statistics Leads to Misguided Law Enforcement Policies, " *Amstat News* (Dec. 2012).[3]

One corollary to the pattern by which the rarer an outcome the greater tends to be the relative difference in experiencing it and the smaller tends to be the relative difference in avoiding it is a pattern whereby the rarer an outcome the greater tend to be both (a) the proportion the group more susceptible to the outcome comprises of persons experiencing the outcome and (b) the proportion the group comprises of persons failing to experience the outcome. That is, for example, lowering a test cutoff will tend to cause the lower-scoring group to comprise both a larger proportion of those who fail the test and a larger proportion of those who pass the test than it previously did; reducing poverty will tend to cause groups with higher poverty rates to comprise both a larger proportion of the poor and a larger proportion of the non-poor than they previously did. These patterns can be inferred from the tables in "Race and Mortality Revisited" referenced above. But they are also explicitly illustrated in Table 1 of my article "Divining Difference," *Chance* (Fall 1994) and Table 1 of my guest editorial "Can We Actually Measure Health Disparities," *Chance* (Spring 2006). Thus, as outcomes change in prevalence, one will commonly reach opposite conclusions about whether demographic differences are increasing or decreasing depending on whether one compares the difference between the proportion a group comprises of persons potentially experiencing an adverse outcome or the corresponding favorable outcome with the proportion the group comprises of persons experiencing the adverse outcome or the proportion it comprises of persons experiencing the favorable outcome.

Inasmuch as the Race to Equity Project appears to be examining disparities in terms of relative differences or measures that are functions of relative differences, it is not necessary to

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[2] Particularly useful collections of illustrations may be found in "The Mismeasure of Association: The Unsoundness of the Rate Ratio and Other Measures That Are Affected by the Prevalence of an Outcome," Methods Workshop, Minnesota Population Center and Division of Epidemiology and Community Health of the School of Public Health of the University of Minnesota (Sept. 5, 2014), and "The Mismeasure of Group Differences in the Law and the Social and Medical Sciences," Applied Statistics Workshop, Institute for Quantitative Social Science at Harvard University (Oct. 17, 2012).

[3] Various subpages of the Discipline Disparities page of jpscanlan.com discuss that recent reductions in discipline rates have been accompanied by increased relative racial/ethnic differences in discipline rates in Maryland, Los Angeles, Denver, Minneapolis, St. Paul, Beaverton (OR), Montgomery County (MD), and Henrico County (VA). The DOE Equity Report subpages discusses a Department of Education report that shows relative racial differences in expulsions to be smaller in districts with zero tolerance policies than in districts without such policies.

give substantial attention to the patterns by which absolute differences and odds ratios tend to be affected by the prevalence of an outcome. But since I will make a point below about absolute differences with respect to proficiency disparities, I note the following. As an outcome goes from being rare to being common absolute differences between rates tend to increase; as common outcomes become more common absolute differences tend to decrease. As the prevalence of an outcome changes, the absolute difference tends to change in the same direction as the smaller relative difference. As the prevalence of an outcome changes, the difference measured by the odds ratio tends to change in the opposite direction of the absolute difference.

The key point of the referenced materials is not simply that one will tend to reach opposite conclusions about such things as the directions of changes in disparities depending on whether one examines relative differences in the favorable outcome or relative differences in the adverse outcome (or measures that are functions of those differences). Rather, the key point is that measures that tend to change as the prevalence of an outcome changes cannot effectively quantify the difference between the circumstances of advantaged and disadvantaged group reflected by their outcome rates (or, as it might otherwise be put, the strength of the forces causing the outcome rates to differ).[4] Further, even when findings as to such things as whether a disparity has increased or decreased that are based on such measures might be deemed broadly correct because consistent with those one would reach with a sound measure, the findings are misleading by implying that the employed measures effectively quantify the differences in circumstances signified by the outcome rates being examined.

These points hold notwithstanding that the described patterns of correlations between measures and the prevalence of an outcome will not be observed in every case. For actual patterns are functions of both (a) the strength of the forces causing the outcome rates to differ in the settings being examined and (b) the prevalence-related forces described here. Society's interest is in the understanding of (a). But only with a mastery of (b) can one understand (a).

"Race and Mortality Revisited" provides an approach to measuring the strength of the forces causing outcome rates to differ that is not affected by the prevalence of an outcome. That method involves deriving from a pair of outcome rates the difference between the means of the underlying distributions in terms of percentage of a standard deviation. I will refer to that measure below as the EES, for estimated effect size.

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[4] Apart from the fact that differences between the proportion a group comprises of persons potentially experiencing an outcome and the proportion it comprises of persons experiencing the outcome tend to be affected by the prevalence of an outcome, there are other reasons why such differences cannot effectively quantify the strength of the forces causing the proportions to differ. These reasons are addressed somewhat in Argument Section I.B. of the above-referenced Supreme Court brief (at 23-27) and are addressed more fully on the IDEA Data Center Disproportionality Guide subpage of the Discipline Disparities page of jpscanlan.com. But it is not necessary to address the reasons here.

Many illustrations of the approach may be found in "Race and Mortality Revisited" and the workshop presentations listed in note 2. Useful illustrations may also be found in my papers "Measuring Health and Healthcare Disparities" from the Federal Committee on Statistical Methodology 2013 Research Conference and my paper "The Mismeasure of Discrimination" from a September 2013 faculty workshop at the University of Kansas School of Law. I provide some additional illustrations below based on data from materials created as part of the Race to Equity Project.

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Table 1 of "Race and Mortality Revisited" illustrated the pattern whereby the rarer an outcome the greater tends to be the relative difference in experiencing it and the smaller tends to be the relative difference in avoiding it by showing how lowering a test cutoff reduces the relative difference between the pass rates of higher- and lower-scoring groups, while increasing the relative difference in failure rates. The table similarly showed (that is, if the before and after situation is reversed) that increasing a cutoff increases the relative difference in pass rates while reducing the relative difference in failure rates. The illustration was based on a situation where the underlying mean scores of the advantaged and disadvantaged groups differ by half a standard deviation. The point of the illustration was that, given that there occurred no change in the strength of the forces causing the outcome rates of the two groups to differ, conclusions respecting increases or decreases in those forces based on either of the two relative differences (or the other measures shown in the table) would be mistaken.

One could base a similar illustration on the data in page 16 of the Race to Equity Project presentation titled "Race to Equity – a Project to Reduce Racial Disparities in Dane County." The page presents rates at which black and white third graders in Dane County schools were not proficient in reading according to the standard in effect in 2011 and the rates at which they were not proficient according to the standard implemented in 2012. The page discusses the situation existing in 2011 when 48.1% of Dane County's black third graders failed to meet proficiency standards in reading, compared with 10.9% of white third graders, noting that black students were 4.4 times as likely not to be proficient as white students.[5] The page goes on to explain that under the standard implemented in 2012, the black and white rates of failing to achieve reading proficiency in the third grade would be 86.2% and 47.6%. The page does not quantify the disparity in the latter situation.

Table 1 below presents the black and white non-proficiency rates under the two standards, along with (a) the ratios of the black non-proficiency rates to the white non-proficiency rates and (b) the ratios of the white proficiency rates to the black proficiency rates. The table also includes EES figures derived from each pair of rates (which are the same as the figures that would be derived from the corresponding proficiency rates), but I defer discussion of the EES for several paragraphs.

[5] The presentation actually says "more likely." See the Times Higher subpage of the Vignettes page of jpscanlan.com regarding reasons why that usage should be avoided.

Table 1. Dane County black and white third grades rates of failing to achieve proficiency in reading under standards in effect in 2011 and 2012, with measures of difference

Yr	Black NP Rate	White NP Rate	B/W NP Ratio	W/B Prof Ratio	EES
2011	48.1%	10.90%	4.41	1.72	1.19
2012	86.2%	47.60%	1.81	3.80	1.15

Focusing on the rate ratios for non-proficiency and proficiency, we observe the pattern that will almost invariably exist when a standard is substantially increased. That is, the relative difference in failing to meet the standard decreases substantially while the relative difference in meeting the standard increases substantially. The interpretation of the data according to the approach of the Race to Equity Project (that is, a decrease in disparity based on the rate ratio for non-proficiency) might be usefully contrasted with the approach in the study discussed on the Harvard CRP NCLB Study subpage of Educational Disparities page of jpscanlan.com. The study discussed there examined the effects of higher standards on racial disparities in proficiency rates. But it measured disparities in terms of relative differences in proficiency rates (rather than non-proficiency rates) and found higher standards to be associated with larger disparities.

I emphasize again, however, that the point is not simply that one tends to reach different conclusions depending on whether one examines relative differences in the favorable or the adverse outcome – and certainly not that one approach is superior to the other or that one must choose between them. Rather, the fact that measures tend to change because the frequency of the outcome changes renders both relative differences unsound measures of the strength of the forces causing the outcome rates to differ. That the two measures tend to yield diametrically opposed conclusions as to the comparative size of disparities in settings with substantially different prevalence levels for an outcome merely highlights the inadequacies of the measures.[6]

The Educational Disparities page and all of its subpages would be useful reading for persons examining racial differences in proficiency, which tend most commonly to be measured in terms of absolute differences between rates. See especially the Disparities by Subject subpage (which discusses that when disparities are measured in terms of absolute differences between proficiency rates, improvements in proficiency rates tend to increase disparities for subjects with generally low proficiency rates and but reduce disparities for subjects with generally high proficiency rates) and the Education Trust GC Study subpage (which discusses that when disparities are measured in terms of absolute differences improvements in education tend to reduce disparities in rates of falling below the basic level but increase disparities in rates of

[6] See the "Illogical Premises and Unfounded Inferences" section of "Race and Mortality Revisited" regarding reasons that the rate ratio and its associated relative difference are illogical measures of association as well as unsound measures of association. See also my "Goodbye to the Rate Ratio," *BMJ* (Feb. 25, 2013).

reaching the advanced level). But none of the standard approaches to measuring non-proficiency/proficiency disparities is sound.

The EES figures in Table 1 are quite similar under the two standards, which is what one would expect them to be in circumstances where the only thing that has happened is the modification of a standard. That the EES changes at all in circumstances where a standard is increased reflects a weakness of the EES, presumably here arising from a small irregularity in the underlying distributions. See discussion on the ninth page of "Race and Mortality Revisited" regarding the EES figures in the article's Table 2. The EES would nevertheless remain a superior measure to any of the standard measures of differences between outcomes.

As discussed on the main Educational Disparities page, efforts to measure demographic differences in academic performance would in any case be better focused on the actual differences between the mean scores on the examinations by which proficiency rates are determined than on the proficiency or non-proficiency rates themselves. I nevertheless present two more illustrations of the pertinent measurement issues based on proficiency rate data. These data are drawn from the Race to Equity Project report titled "Race to Equity: A Baseline Report on the State of Racial Disparities in Dane County."

Table 2 provides information similar to that in Table 1, but with respect to proficiency in the eighth grade in the years 2005 and 2011 in both Dane County and Wisconsin, ordered in a way to facilitate comparisons of the size of the racial disparity in the two areas. The data are drawn from page 23 of the Appendix to the report.

Table 2. Dane County and Wisconsin black and white eighth grade rates of failing to achieve proficiency in math in 2005 and 2011, with measures of difference

Yr	Area	Black NP Rate	White NP Rate	B/W NP Ratio	W/B Prof Ratio	EES
2005	Dane County	55.0%	13.0%	4.23	1.93	1.25
2005	Wisconsin	63.0%	19.0%	3.32	2.19	1.22
2011	Dane County	46.0%	10.0%	4.60	1.67	1.18
2011	Wisconsin	49.0%	15.0%	3.27	1.67	1.02

The first two rows of the table show that in 2005, the relative difference in non-proficiency rates was larger in Dane County than in Wisconsin, while the relative difference in proficiency rates was larger in Wisconsin than in Dane County. The EES indicate that the strength of the forces causing black and white outcome rates to differ was slightly greater in Dane County. In 2011, while the relative difference in non-proficiency was larger in Dane County, the relative difference in proficiency was the same in the two areas. The EES indicates that the strength of the forces causing black and white outcome rates to differ was now substantially larger in Dane County than in Wisconsin (being large enough to cause the relative difference in proficiency not to be larger in Wisconsin than in Dane County).

Table 3 presents that same information as in Table 2, but ordered in a way to facilitate appraisals of the changes in disparity in each of the two areas. In appraising these figures the reader should keep in mind that in contrast to Table 1, which showed the effects of modifying a standard, Table 3 shows changes over time that may include both changes in the prevalence of the outcome and changes in the strength of the forces causing the rates of blacks and whites to differ.

Table 3. Dane County and Wisconsin black and white eighth grade rates of failing to achieve proficiency in math in 2005 and 2011 (reordered), with measures of difference

Area	Yr	Black NP Rate	White NP Rate	B/W NP Ratio	W/B Prof Ratio	EES
Dane County	2005	55.0%	13.0%	4.23	1.93	1.25
Dane County	2011	46.0%	10.0%	4.60	1.67	1.18
Wisconsin	2005	63.0%	19.0%	3.32	2.19	1.22
Wisconsin	2011	49.0%	15.0%	3.27	1.67	1.02

Table 3 shows that during a period of general improvements in proficiency in Dane County, relative differences in non-proficiency increased while relative difference in proficiency rates decreased. The EES shows a modest decline in disparity. In Wisconsin, both relative measures show a decrease in disparity, as does the EES (as it necessarily would when both relative measures indicate a decrease in disparity). The decrease in the strength of the forces causing black and white rates to differ was large enough to cause the relative difference in non-proficiency to decrease notwithstanding the general decline in that outcome.

Tables 4 and 5 present the same type of information as Tables 2 and 3, but with respect to black and white male unemployment rates, and include national figures (from page 6 of the Appendix to the Race to Equity Project report).

Table 4. Dane County, Wisconsin, and national black and white male unemployment rates in 2007 and 2011, with measures of difference

Yr	Area	Black M Unemp Rate	White M Unemp NP Rate	B/W Unemp Ratio	W/B Empl Ratio	EES
2007	Dane County	16.0%	3.0%	5.33	1.15	0.89
2007	Wisconsin	20.0%	5.0%	4.00	1.19	0.80
2007	National	13.0%	5.0%	2.60	1.09	0.52
2011	Dane County	24.0%	5.0%	4.80	1.25	0.93
2011	Wisconsin	28.0%	8.0%	3.50	1.28	0.83
2011	National	19.0%	9.0%	2.11	1.12	0.46

I will not belabor the patterns of the two relative differences shown in Table 4. But I note that the EES indicates that in both years the strength of the forces causing rates of unemployment and avoiding unemployment of black and white men to differ are somewhat larger in Dane County than Wisconsin and substantially larger in Dane County and Wisconsin than nationally. Further, the strength of those forces is sufficiently smaller nationally than in Dane County and

Wisconsin to cause relative differences in both the adverse outcome and the favorable outcome to be smaller nationally than in Dane County and Wisconsin.

Table 5. Dane County, Wisconsin, and national black and white male unemployment rates in 2007 and 2011 (reordered), with measures of difference

Area	Yr	Black M Unemp Rate	White M Unemp NP Rate	B/W Unemp Ratio	W/B Empl Ratio	EES
Dane County	2007	16.0%	3.0%	5.33	1.15	0.89
Dane County	2011	24.0%	5.0%	4.80	1.25	0.93
Wisconsin	2007	20.0%	5.0%	4.00	1.19	0.80
Wisconsin	2011	28.0%	8.0%	3.50	1.28	0.83
National	2007	13.0%	5.0%	2.60	1.09	0.52
National	2011	19.0%	9.0%	2.11	1.12	0.46

Table 5 shows the standard patterns of changes in the two relative differences (i.e., decreasing for the increasing outcome and increasing for the decreasing outcome) that will be found almost invariably when there occurs as substantial a change in an outcome as occurred with respect to unemployment between 2007 and 2011. The EES figures, however, indicate that, while the strength of the forces causing unemployment rates of black and white men to differ nationally decreased somewhat, the strength of those forces in Dane County and Wisconsin increased slightly.

Tables 6 and 7 provide information similar to that in tables 4 and 5, but with respect to black and white poverty rates (from page 7 of the Appendix to the Race to Equity Project report).

Table 6. Dane County, Wisconsin, and National black and white poverty rates in 2007 and 2011, with measures of difference

Yr	Area	Black Poverty Rate	White Poverty Rate	B/W Poverty Ratio	W/B Non-Pov Ratio	EES
2006	Dane County	33.0%	9.0%	3.67	1.36	0.90
2006	Wisconsin	35.0%	8.0%	4.38	1.42	1.02
2006	National	25.0%	9.0%	2.78	1.21	0.67
2011	Dane County	54.0%	9.0%	6.00	1.98	1.44
2011	Wisconsin	39.0%	10.0%	3.90	1.48	1.00
2011	National	28.0%	11.0%	2.55	1.24	0.65

As with Table 4, I will give little attention to the two relative differences in Table 6. The EES figures, however, indicate that while in 2006 the strength of the forces causing black and white poverty rate to differ was somewhat greater in Wisconsin than in Dane County, that situation had changed considerably by 2011, when the strength of those forces was substantially greater in Dane County than Wisconsin. The EES figures also indicate that strength of the pertinent forces was much greater in Dane County and Wisconsin than nationally. And, as with male unemployment, the degree to which the pertinent forces were greater in Dane County and

Wisconsin than nationally was sufficient to cause relative differences in both the adverse and the favorable outcomes to be smaller nationally than in Dane County and Wisconsin.

Table 7. Dane County, Wisconsin, and national black and white poverty rates in 2007 and 2011 (reordered), with measures of difference

Area	Yr	Black Poverty Rate	White Poverty Rate	B/W Poverty Ratio	W/B Non-Pov Ratio	EES
Dane County	2006	33.0%	9.0%	3.67	1.36	0.90
Dane County	2011	54.0%	9.0%	6.00	1.98	1.44
Wisconsin	2006	35.0%	8.0%	4.38	1.42	1.02
Wisconsin	2011	39.0%	10.0%	3.90	1.48	1.00
National	2006	25.0%	9.0%	2.78	1.21	0.67
National	2011	28.0%	11.0%	2.55	1.24	0.65

For Wisconsin and the nation, Table 7 (like Table 5) shows the standard patterns of changes in the two relative differences (i.e., decreasing for the increasing outcome and increasing for the decreasing outcome) that will be found almost invariably when there occurs a substantial overall change in an outcome. The EES figures, however, indicate that the strength of the forces causing poverty rates of blacks and white to differ was essentially unchanged in the two areas. In the case of Dane County, however, there occurred the unusual situation of a substantial increase in poverty for blacks at the same time that there was no change at all for whites. Thus, both relative differences increased. The EES indicates a very substantial increase in the strength of the forces causing the poverty rates of blacks and whites to differ.

The above discussion indicates that at least with respect to male unemployment and poverty, the strength of the forces causing outcome rates to differ is indeed comparatively large in Dane County. It also indicates that, at least with respect to poverty, patterns of recent changes in the strength of these forces are very different in Dane County from those in Wisconsin and nationally. These considerations provide strong reason not only for monitoring of disparities in Dane County, but for ensuring that sound measures are employed in that monitoring. Similar consideration may well exist with respect to other indicators discussed in the Race to Equity Project report. In any case, however, the disparity measures currently employed in the Race to Equity Project are not sound measures.

Thus, I hope the Race to Equity project will give careful consideration to the points raised in this letter and its references as it pursues its disparities reductions goals.

Sincerely,

/s/ James P. Scanlan

James P. Scanlan

cc (by email):

Helene Nelson, President, Wisconsin Council on Children and Families

Staff of the Wisconsin Council on Children and Families

Staff of the Race to Equity Project