

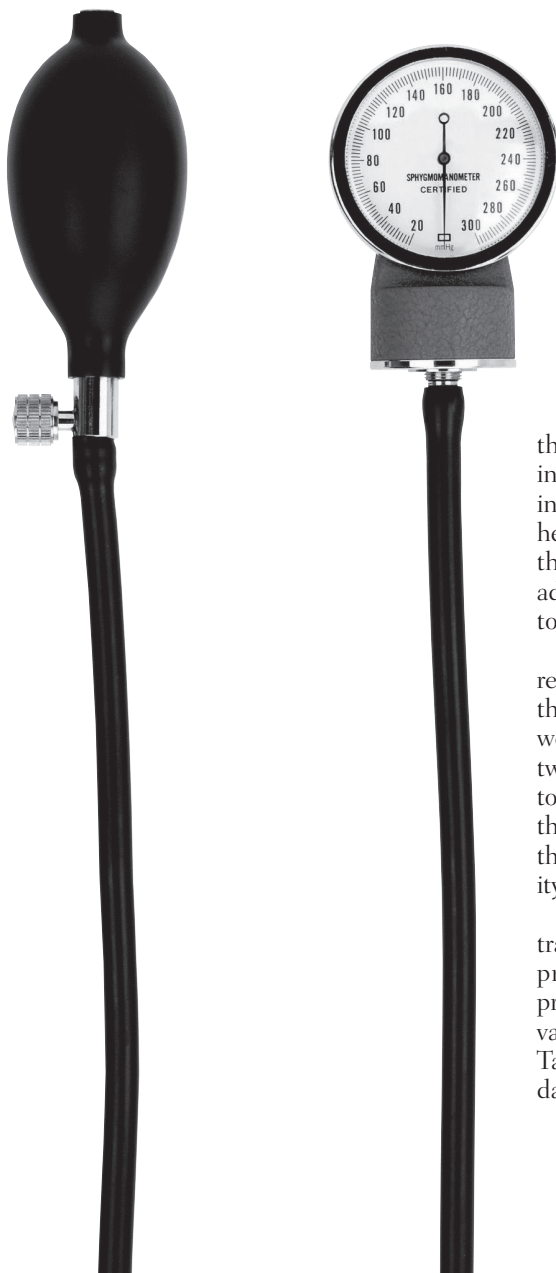


GUEST EDITORIAL

Can We Actually Measure Health Disparities?

James P. Scanlan

The sixth page this document describes subsequent treatments of the issues the editorial addresses. The most important of these are my article “Race and Mortality Revisited,” *Society* (July/Aug. 2014); commentary “The Mismeasure of Health Disparities,” *Journal of Public Health Management and Practice* (July/Aug. 2016); Federal Committee on Statistical Methodology 2013 Research Conference paper “Measuring Health and Healthcare Disparities; methods workshops at arms of American universities, the most recent of which is “The Mismeasure of Health Disparities in Massachusetts and Less Affluent Places,” University of Massachusetts Medical School (Nov. 18, 2015); and an October 8, 2015 letter to the American Statistical Association urging it to (a) form a committee to generally address problems in the measurement of differences between outcome rates and (b) explain to the government that reducing the frequency of an outcome tends to increase, not decrease, relative differences in experiencing it. Links are available on the sixth page.



For several decades, researchers around the world have studied demographic disparities in mortality. It is hard to know exactly how much money has been spent on this research. But certainly the amounts have run into the hundreds of million dollars. And, by and large, the conclusions of that research have been the same: The disparities have been increasing.

But what if all that research was simply wrong, or, at best, confused to the point of offering negligible insight into the dynamics of group differences in experiencing adverse and favorable health outcomes? I explain below why this is pretty much the case and then address whether there is a better way to do it.

The main problem with existing research lies in the failure to recognize the following statistical tendency, which we'll call heuristic rule X (HRX): When two groups differ in their susceptibility to an outcome, the rarer the outcome, the greater the disparity in experiencing the outcome and the smaller the disparity in avoiding the outcome.

Readily available income data illustrate HRX. The U.S. Census Bureau provides data on the number and proportion of each race falling below various percentages of the poverty line. Table 1 presents key elements of that data for blacks and whites in 2004,

along with a number of fields expressing statistical relationships stemming from those elements. The information in Table 1 underlies the figures that follow and many of the points in the text. It should be recognized, however, that the essential aspects of the relationships reflected in the table and described below would be found in any set of data reflecting more or less normal distributions of factors associated with whether one experiences or avoids some outcome. Figure 1, which shows the proportions of blacks and whites falling below each of the percentages of the poverty line, provides what may be the best visual illustration of crucial aspects of the data.

Consider what these data show for blacks and whites with respect to poverty. Blacks are more likely to be poor than whites, and, as is generally the case when one group is more susceptible to an outcome than another, blacks comprise a larger proportion of each segment of the combined black and white population that is increasingly susceptible to poverty. Correspondingly, the ratio of the black rate to the white rate of falling below each income level increases as the income level declines. For example, the black rate of falling below the poverty line (24.7%) is 2.3 times the white rate (10.8%). But the black rate of the rarer event of falling below 50% of the poverty line (11.7%) is 2.7 times the

Table 1—Relationships of Black and White Rates of Falling Below and Above Various Percentages of The Poverty Line with Black Representation of Those Above and Below plus Absolute Differences and Odds Ratios

Perc of Pov Line	Perc Black Below	Perc White Below	Ratio B/W Below	Perc Black Above	Perc White Above	Ratio B/W Above	Black Rep Among Below	Black Rep Among Above	Absolute Difference	Odds Ratio
600	91.9	79.5	1.16	8.1	20.5	0.40	15.3	5.8	12.4	2.91
500	86.9	71.6	1.21	13.2	28.4	0.46	15.9	6.7	15.3	2.62
400	78.6	60.5	1.30	21.4	39.5	0.54	16.8	7.8	18.1	2.39
300	66.1	45.7	1.44	33.9	54.3	0.63	18.4	8.9	20.3	2.31
250	58.0	37.3	1.56	42.0	62.7	0.67	19.5	9.5	20.7	2.32
200	48.7	28.5	1.71	51.3	71.5	0.72	21.1	10.1	20.2	2.38
175	43.6	23.9	1.83	56.4	76.1	0.74	22.2	10.4	19.7	2.46
150	37.3	19.1	1.95	62.7	80.9	0.78	23.3	10.8	18.2	2.52
125	31.0	14.9	2.08	69.0	85.1	0.81	24.5	11.2	16.1	2.56
100	24.7	10.8	2.28	75.3	89.2	0.84	26.2	11.6	13.9	2.70
75	17.8	7.2	2.49	82.2	92.8	0.88	28.0	12.1	10.7	2.82
50	11.7	4.4	2.69	88.3	95.6	0.92	29.6	12.6	7.4	2.92

white rate of falling below 50% of the poverty line (4.4%). See Figure 2.

Thus, suppose poverty is reduced to enable everyone between the poverty line and 50% of the poverty line to escape poverty. Following that decline, blacks will comprise a larger proportion of the poor than they did previously. And the disparity in the rates of experiencing poverty will increase from 2.3:1 to 2.7:1. The pattern also holds for other disadvantaged groups. For example, the same hypothetical decline in poverty would cause female-headed families to comprise a larger proportion of the poor than they did previously and would increase the ratio of their poverty rate to that of other groups. The disparity in poverty rates can increase even when

the disadvantaged group especially benefits from the decline in poverty, as, for example, where all blacks between the poverty line and 50% of the poverty line escape poverty while only 90% of similarly situated whites do.

On the other hand, the hypothetical reduction in poverty that would increase the disparity between black and white poverty rates would reduce the disparity in rates of avoiding poverty. That is, the black rate of avoiding poverty, which was 84% of the white rate before the reduction in poverty (75.3%/89.2%), would rise to 92% of the white rate (88.3%/95.6%). See Figure 3.

Progress in almost every area of human well-being is a matter of increasingly restricting adverse out-

comes to the point where only the most susceptible segments of the population experience the outcome—until, in an ideal world, the adverse outcome disappears. But, as illustrated with income data, progress in eliminating an outcome generally will lead to an increase in the disparity between the rates at which disadvantaged and advantaged groups experience the outcome (though a decline in the disparity between the rates at which they avoid the outcome). Disparities in experiencing the adverse outcome thus will be greatest at the point where society verges on the total elimination of the outcome, which is also the point where society verges on complete equality concerning the outcome.

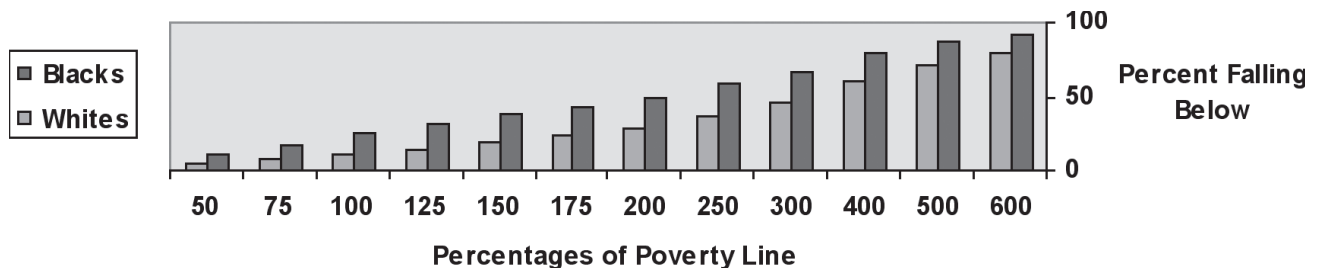


Figure 1. Proportions of black and white populations falling below various percentages of the poverty line.

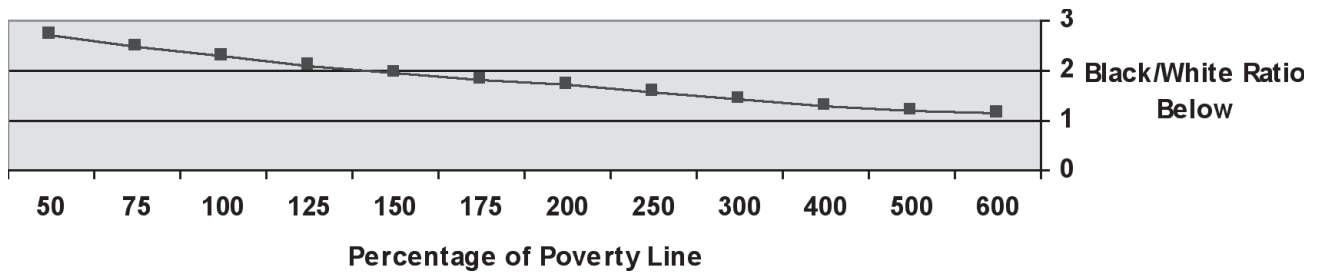


Figure 2. Black/white ratios of falling below various percentages of the poverty line.

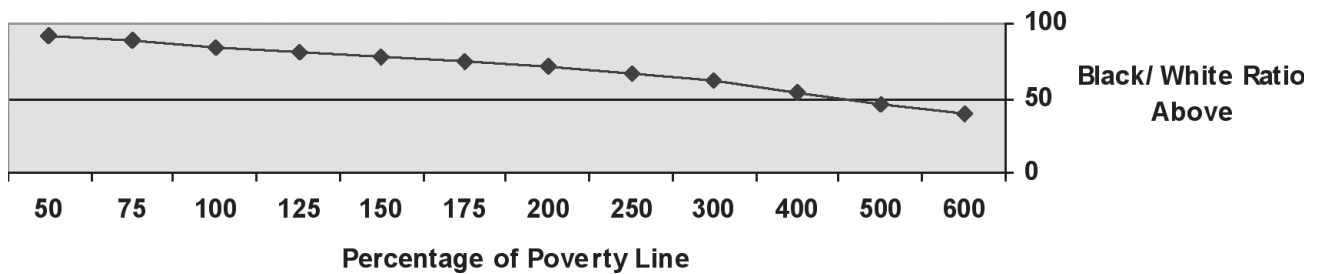


Figure 3. Black/white ratios of falling above various percentages of the poverty line.

To be sure, one will be able to find many departures from HRX, some of which might be due to true changes in the relative well-being of the groups being examined. But HRX is nevertheless pervasive enough that one cannot meaningfully interpret changes in group differences in susceptibilities to an outcome without taking HRX into account.

As it happens, disparities in certain dichotomous outcomes have been measured traditionally in terms of the favorable outcome. The lowering of test cutoffs has long been universally regarded as reducing the discriminatory effect of tests on which minorities or women do not perform as well as whites or men, because the lowering of the cutoff reduces the disparity in pass rates, even though it increases the disparity in failure rates. Disparities concerning beneficial health procedures (e.g., prenatal care, immunization, mammography) traditionally have been evaluated in terms of differences in receipt of the procedure. Thus, the increased availability of such procedures has led to a perception that the disparities are declining, even as that same increased availability, by reducing certain types

of mortality, has led to the perception that racial differences in those types of mortality are increasing.

The Centers for Disease Control and Prevention recently issued a report that, using black-white mammography rates as an example, recognized one might interpret changes in the size of disparities over time differently depending on whether one examines disparities in favorable or adverse outcomes. However, the report merely recommended the comparison always be made in terms of the adverse outcome, hence tending to ordain that disparities that otherwise would be deemed to be decreasing now will be thought to be increasing. The report neither acknowledged nor attempted to address the implications of the fact that disparities in favorable and adverse outcomes tend to move systematically in opposite directions.

Analyzing Health Disparities

The failure to understand HRX has led to the misinterpretation of data on group differences in a range of contexts in the law and the social and medical sciences. In terms of resources expended

on misfocused research and commentary, however, the area where the misunderstanding probably has its greatest consequences involves the interpretation of data on demographic differences in health outcomes. Interest in such disparities has grown substantially over the last few decades both here and abroad. The scope of that interest is reflected by the more than 10 million Google hits for the phrases “health disparities” or “health inequalities,” the preferred phrase abroad.

Yet, with negligible exception, the research in this area has been carried out without recognition of the role of HRX. For the most part, health disparities have been measured in terms of the ratio of the mortality rate of the disadvantaged group to that of the advantaged group. And it is common to read that “despite declining mortality,” disparities in mortality rates have increased. Virtually absent from the discussion of such issues is the recognition that disparities in mortality rates tend to increase because of declining mortality, or that increasing disparities in mortality rates have been accompanied by declining disparities in survival rates.

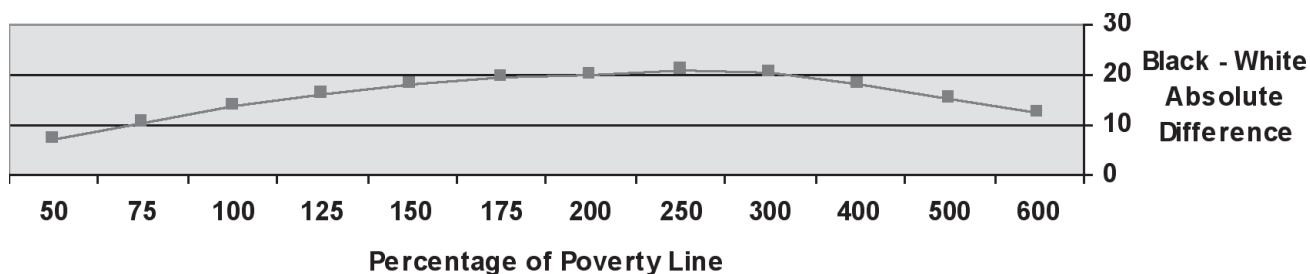


Figure 4. Absolute differences between black and white rates of falling below (or above) various percentages of the poverty line.

In 1997, *The Lancet* published a landmark study ranking western European countries in terms of the size of socioeconomic differences in mortality. The study surprised many by finding that relatively egalitarian Nordic countries had particularly large disparities. Due in significant part to these findings, these countries have devoted substantial resources to the study of inequalities in health. But the extent to which the size of the disparities in mortality rates was a function of the fact that mortality was relatively low in these countries has gone largely unnoticed. Similarly, in the United States, large racial disparities among relatively advantaged groups (e.g., infant mortality where parents are college-educated, low birth weights where mothers are at low risk) have come as surprises to most observers, and such disparities have even been interpreted as suggesting genetic differences. That large racial disparities in adverse outcomes among advantaged groups occur because the adverse outcomes are rarer among those groups has gone unnoticed, as have the small disparities among such groups in rates of avoiding the outcome.

Other Approaches

Is there a satisfactory way to measure changes in the size of health disparities? I'm not sure there is. The key would be to find a measure between the situation of two groups that does not change when there occurs an across-the-board change in the prevalence of an outcome—"across the board" meaning something akin to a change that enabled everyone between the poverty line and 50% of the poverty line to escape poverty.

Let us consider a few possibilities. Some observers rely on absolute differences between rates at which advantaged and disadvantaged groups experience some outcome to appraise changes in the relative well-being of the two groups. In fact, the recent CDC report suggests health disparities be measured in both absolute and relative terms. Absolute differences have the advantage of being the same whether one examines the adverse outcome or the favorable outcome. Further, absolute differences provide the most useful indicator of how large a proportion of the disadvantaged group is affected by its greater susceptibility to an adverse outcome.

But for the purpose of determining whether there has been a meaningful change in the difference between the health statuses of two groups that is not simply a consequence of a change in the prevalence of an outcome, the absolute difference is no more useful than the relative difference. As shown in Figure 4, like relative differences, absolute differences change when there is an across-the-board change in the prevalence of an outcome. At a point where the great majority of both groups experience the adverse outcome, the absolute difference will be small. As a larger part of the upper reaches of the overall distribution starts to avoid the outcome, the absolute difference tends to increase for a time. Then, as the outcome is restricted to the lower reaches of the distribution, the absolute difference declines.

With respect to most types of mortality usually examined, declines in prevalence are associated with declines in absolute differences between rates at which advantaged and disadvantaged groups experience the outcome. This is why so often it seems that whether a disparity is increasing or decreasing

depends on whether the difference is measured in relative or absolute terms. In fact, neither approach can tell one very much if not interpreted with an understanding of the patterns that flow solely from changes in the prevalence of an outcome.

Like absolute differences, odds ratios are the same (or reciprocal) whether one examines the favorable or the adverse outcome. But odds ratios also change systematically due simply to an overall change in the prevalence of an outcome. The ratio of the odds of the disadvantaged group to that of the advantaged group tends to be high where the adverse outcome predominates, grows smaller as the adverse outcome becomes somewhat less pervasive, and then grows large again when the adverse outcome becomes rare (See Figure 5). Thus, changes in odds ratios do not provide a useful indicator of whether true changes have occurred in the relative well-being of two groups.

Longevity, not being a dichotomous measure, is more on the order of the measures I suggested might offer a useful means of appraising changes in the relative health status of two groups (in a previous *CHANCE* article). If longevity could provide a benchmark for appraising such changes, however, it still would not be useful for evaluating changes in susceptibilities to particular types of mortality (which is the subject of much health disparities study), but only for evaluating changes in overall mortality differences. But it seems longevity cannot even provide a means of appraising changes in overall mortality differences.

There are various ways to model the implications of across-the-board changes in the prevalence of an outcome with respect to changes in the relative longevity of two groups. It suffices to

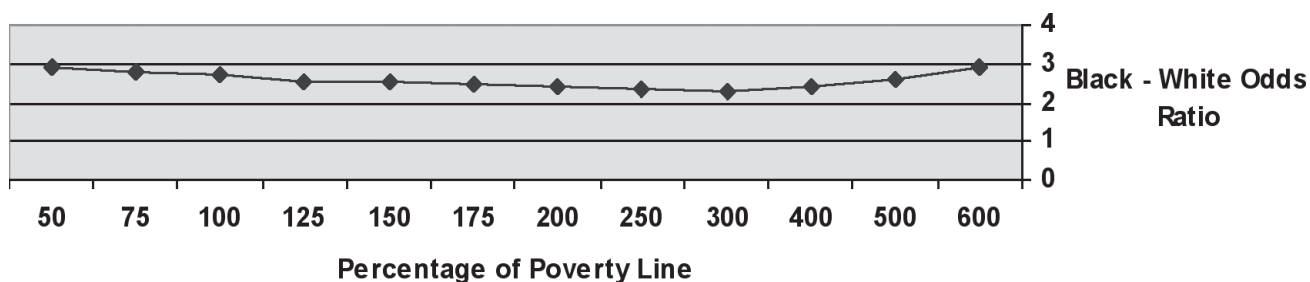


Figure 5. Odds ratios of black and white rates of falling below various percentages of the poverty line

say, however, that, as with the measures just discussed, changes in the prevalence of mortality will cause changes in the relationship of two groups' life expectancies, both in relative and absolute terms, sometimes narrowing those gaps and sometimes increasing them. Hence, we cannot rely on longevity as a means of determining whether there have been true changes in the relative well-being of two groups vis-à-vis mortality and survival.


Nor do seemingly sophisticated measures, such as Gini coefficients or concentration indexes, appear useful for appraising changes in the size of health disparities. For each can be expected to change in one manner or another when an outcome becomes more or less prevalent, and, as with relative differences, will tend generally to give a different impression depending on whether one examines the adverse or the favorable outcome.

Based simply on HRX, we might, in some circumstances, draw inferences about the true nature of changes in the relative well-being of two groups during times of change in the prevalence of an outcome. When the rate of experiencing an adverse outcome is increasing for one group and declining for the other group, it would seem to reflect a true change in the relative well-being of the two groups. But such situations are likely to be rare in any case and even rarer when the increases or decreases are substantial. In theory, one might interpret any clear departure from expected patterns of changes in relative or absolute differences in times of overall increases or decreases in prevalence of an outcome to reflect some true change in the relative well-being of two groups. Yet underlying the changes in outcome rates that we typi-

cally find reported in disparity studies are varied distributions of different demographic groups within diverse components of the overall population. And these components can differ not only in overall prevalence rates, but in the nature of changes in the prevalence of an outcome during a particular period. Thus, seeming departures from expected patterns we observe in aggregated results may not reflect departures within the components.

Moreover, with respect to various types of mortality, the rates of advantaged groups have begun to approach irreducible minimums. That fact may confound efforts to draw inferences about true changes in the relative well-being of two groups with respect to preventable mortality, which is society's actual concern.

It needs also to be recognized that, once we appreciate the seemingly large increases in health disparities that have been identified may just be a reflection of HRX, there is a good chance that any real changes we might somehow identify will be quite small. Thus, while it might be entirely sensible to devote large resources to studying changes in demographic disparities in mortality or other health outcomes when we know we are identifying substantial and meaningful changes, devoting such resources to drawing uncertain conclusions about small changes may be another matter. In any case, it is pointless to continue studying these issues without recognizing the role of HRX and other ways measures of difference change solely because of prevalence increases or decreases. Further, the considerations set out above suggest we need to generally rethink our impressions of things such

as two-to-one disparities and three-to-one disparities, recognizing that the latter often may not be larger than the former in any meaningful sense and that very often a disadvantaged group will be better off when it is suffering from a seemingly larger disparity than it did previously. 

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Subsequent Developments (as of June 28, 2016):

The most important subsequent treatments of the issues in this paper include my "[Race and Mortality Revisited](#)," *Society* (July/Aug. 2014); "The Mismeasure of Health Disparities," *Journal of Public Health Management and Practice* (July/Aug. 2016); "[Measuring Health and Healthcare Disparities](#)," Proceedings of the Federal Committee on Statistical Methodology 2013 Research Conference. (March, 2014); and methods workshops at [University of Massachusetts Medical School](#)" (2015), [University of California, Irvine](#) (2015), [George Mason University](#) (2014), [University of Maryland](#)" (2014), [University of Minnesota](#) (2014); "[Harvard University](#) (2013, [American University](#) (2013). They also include the letters to institutions and organizations collected [here](#), the most important of which it that to the [American Statistical Association](#) (Oct. 8, 2015) urging it to (a) form a committee to generally address problems in the measurement of differences between outcome rates arising from the failure to recognize patterns by which measures tend to be affected by the prevalence of an outcome and (b) explain to the United States Government that reducing the frequency of an outcome tends to increase, not decrease, relative differences in rates of experiencing it.

Important treatments regarding the statistical issues as they bear on civil rights law enforcement include my [amicus curiae](#) brief in *Texas Department of Housing and Community Development, et al. v. The Inclusive Communities Project, Inc.*, Supreme Court No. 13-1731 (Nov. 17, 2014);

"[The Perverse Enforcement of Fair Lending Laws](#)," Mortgage Banking (May 2014); and my "[The Mismeasure of Discrimination](#)," Faculty Workshop, University of Kansas School of Law (Sept. 20, 2013). More succinct treatments of the law enforcement issues especially regarding the government's mistaken belief that reducing the frequency of an outcome reduces relative differences in rates of experiencing it and the proportion groups most susceptible to the outcome make up of persons experiencing it may be found in my "[Things DoJ doesn't know about racial disparities in Ferguson](#)," *The Hill* (Feb. 22, 2016); "[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).

Other subsequent treatments of issues addressed in this article, including over 20 conference presentations and over 140 online comments to journal articles, may be found on the [Measuring Health Disparities](#) page (MHD) of [jpscanlan.com](#). [Section E.7](#) of MHD discusses the extent of scholarly agreement with the views expressed in this article. The [Solutions](#) sub-page of MHD discusses a method for measuring differences between outcomes rates that is theoretically unaffected by the overall prevalence of the outcome.

Following a reference to what is termed "heuristic rule X" in this article as "Scanlan's rule" in a 2008 paper in the United Kingdom *K* (Bauld L, Day P, Judge K. Off target: A critical review of setting goals for reducing health inequalities in the United Kingdom. *Int J Health Serv* 2008;38(3):439-454), the [Scanlan's Rule](#) page (SR) on [jpscanlan.com](#) was created to address various nuances and implications of the patterns by which various measures tend to be affected by the overall prevalence of an outcome. See also Lambert P, Subramanian S. Group inequalities and "Scanlan's Rule": Two apparent conundrums and how we might address them. Working Paper 84/2014, Madras School of Economics. Possibly the most important of these implications are addressed on the [Subgroup Effects](#) sub-page of SR. The [Illogical Premises](#) and [Illogical Premises II](#) sub-pages of SR explain why the rate ratio not only is an unsound measure of association, but is illogical as well (as now addressed also in the 2014 *Society* article). The [Collected Illustrations](#) sub-page contains links to an expanding group of illustrations of the patterns illustrated with income data in this article.

The [Mortality and Survival](#) page discusses the way that, particularly with respect to differences in cancer outcomes, researchers commonly refer to relative differences in mortality and survival interchangeable without recognizing that the two tend relative differences tend to change in the opposite direction as cancer survival generally increases.