The item below was posted on journalreview.org on May 1, 2007, attached to the article by Vaccarino et al., but discussing article by Jha et al and Trivedi et al. that appeared with the Vaccarino article in the August 28, 2005 issue of the New England Journal of Medicine. In light of the closing of the journalreview.org site, it is reproduced here. A correction regarding the statements concerning the measurement methods in the National Healthcare Disparities Report, which was posted on journalreview.org on November 6, 2007, may be found [here](). A follow-up of October 18, 2009, discussed a method for measuring differences in outcome rates that is not affected by the overall prevalence of an outcome. It may be found [here](). More on that method may be found on the [Solutions]() sub-page of the [Measuring Health Disparities]() page.

Effects of choice measure on determination of whether health care disparities are increasing or decreasing.

The special articles on healthcare disparities by Vaccarino et al.[1], Jha et al.[2], and Trivedi et al.[3] in the August 18, 2005 New England Journal of Medicine together illustrate how the choice of a measure of health disparities in a particular setting tends to dictate the nature of the findings regarding whether the disparities are increasing or decreasing. The three articles, like virtually all health disparities research, suffer from the failure to recognize the ways measures of differences between rates at which groups experience some outcome tend to vary depending on the overall prevalence of the outcome.

The most notable of these tendencies is that whereby, when two groups differ in their susceptibility to an outcome, the rarer an outcome, the greater tends to be the relative difference between rates of experiencing it and the smaller tends to be the relative difference between rates of avoiding it.[4-7] The tendency can be illustrated with virtually any data set that allows one to examine the rates at which two groups fall above or below various points on a continuum of factors associated with some outcome. For example, published income data in the United States illustrate the way that reductions in poverty tend to increase relative demographic differences in poverty rates but reduce relative differences in rates of avoiding poverty.[4,6,7]. Hypothetical test score data illustrate the way lowering a cutoff (or improving test performance such as to allow everyone just below the cutoff to pass at the existing cutoff) will generally increase relative differences in failure rates but reduce relative differences in pass rates.[5-7]. The same pattern can be expected to occur wherever two groups differ in their distributions of risks of experiencing or avoiding some outcome, even when, as in the case of mortality and most other health outcomes, the risk distributions cannot be directly observed.

The failure to recognize this tendency is responsible for the near universal perception that racial and socioeconomic disparities in adverse health outcomes have been increasing, a view based on the fact that during periods of declining mortality and other adverse outcomes, relative disparities in experiencing those outcomes have been increasing. But as these outcomes become rarer, it is to be expected that, solely due to factors inherent in the shapes of the risk distributions, relative differences in rates of experiencing the outcomes will increase while relative differences in rates of avoiding the outcomes will

decline. Yet increasing relative differences in adverse health outcomes have been regarded as indicating a meaningful worsening of health disparities without consideration of whether the increases are other than what would be expected solely due to declines in the prevalence of the outcomes or whether relative differences in avoiding those outcomes have decreased.

On the other hand, disparities in healthcare have typically been measured in terms of relative differences between rates of receiving a procedure, as in the yearly National Healthcare Disparities Reports of the Agency for Healthcare Research and Quality (AHRQ).[8,9] And, as various health procedures have become more widely available, decreasing disparities in receipt of the procedures have been deemed to indicate meaningful reductions in healthcare disparities without consideration of whether the decreases are other than what would be expected solely because of the increased availability of the procedures or whether the disparities in failure to receive those procedures have increased. Recently, researchers at the National Center for Health Statistics (NCHS), recognizing that one may get different results as to the direction of a change in the size of a disparity depending on whether on examines the favorable or the adverse outcome, have recommended that all disparities, including disparities in procedures like mammography, be measured in terms of the relative differences in the adverse outcome (i.e., rates of failing to receive mammography).[10-12] But the NCHS has failed to recognize that as the overall prevalence of an outcome changes, the relative difference between rates of experiencing the outcome and the relative differences between rates of avoiding the outcome tend to move systematically in opposite directions. So it has merely offered an approach whereby many healthcare disparities that previously were regarded as declining now will instead be regarded as increasing, and without providing any guidance for distinguishing changes in relative differences that are solely the consequence of changes in prevalence from those that reflect something more consequential. As yet AHRQ has not adopted the NCHS recommendation, which means that, with respect to the size of healthcare disparities, the two agencies will tend to reach opposite conclusions about the direction of changes.

Only one of the three special articles, however, relies on relative differences (Vaccarino et al.[1]). The two others rely on absolute differences between rates in determining whether disparities are increasing or decreasing.[2,3] Both AHRQ and NCHS approve of presenting disparities in absolute, as well as relative terms, but give priority to the latter. The use of absolute differences avoids the above-described problem that relative differences between favorable outcomes and between adverse outcomes tend to change systematically in opposite directions as the prevalence of an outcome changes, since the absolute difference is the same regardless of whether one examines the adverse or the favorable outcome. But reliance on absolute difference to measure health disparities is nevertheless problematic because, like relative differences, absolute differences between rates of experiencing (or avoiding) an outcome tend to change solely as a consequence of changes in prevalence of the outcome.

In terms of favorable outcomes like receipt of beneficial healthcare procedures, the absolute difference will be small at the point where few people from either group

experience the outcome, will grow larger as the favorable outcome becomes more common, and then will grow small again as the favorable outcome become almost universal. In situations where the distributions are perfectly normal, the maximum value for the absolute difference will coincide with the point where (1) the ratio of the advantaged group's rate of experiencing the outcome to the disadvantaged group's rate of experiencing the outcome equals (2) the ratio of the disadvantaged group's rate of avoiding the outcome to the advantaged group's rate of avoiding the outcome. The pattern will be similar with near normal distributions, as in the case of black and white income distributions. One will observe such pattern in table 1 and figures 1,2, and 4 of reference 4 (though, because there the black rates are used as the numerator in both ratios, the maximum value for the absolute difference will occur at the point where the relative differences in the favorable and the adverse outcomes are the reciprocals of one another).

Thus, typically, as a favorable outcomes increase, absolute differences will increase in prevalence ranges where ratio (1) is greater than ratio (2), but decline in areas where ratio (2) is greater than ratio (1). The point of intersection of ratios (1) and (2) will vary depending on the difference between the risk distributions of the two groups, but should always occur at a place where more than 50 percent of the advantaged group experiences the favorable outcome. As an example, in circumstances where two groups differ in test scores by one half of a standard deviation, serially lowering a cutoff (and, hence, increasing the prevalence of the favorable outcome) from the point where no one passes will cause the absolute difference between rates of the higher- and lower-scoring groups to reach a high at the point where approximately 60 percent of the higher-scoring group passes the test (and where the decreasing relative difference in pass rates approximates the increasing relative difference in failure rates).[5] In the case of black and whites differences in rates of falling above (or below) various percentages of the poverty line, the absolute difference will reach a high at the point where approximately 63 percent of whites fall above a ratio of the poverty line (250 percent of the poverty line).[4]

So, keeping in mind that actual distributions will depart somewhat from models based on perfectly normal and near normal distributions and that, moreover, we cannot directly observe the distributions, we can generally expect that an increase in prevalence that does not bring the advantaged group's rate above 50 percent will tend to result in an increase in the absolute difference between the rates of the advantaged and disadvantaged groups, while an increase in prevalence where the advantaged group's rate is above 75 percent will tend to result in a decrease in that difference. Between those levels, identification of the expected direction of the change in absolute difference may be more difficult (particularly since the period being examined may involve situations where a threshold is crossed and an initial increase in the absolute difference may change to a decline in the absolute difference), though comparisons between the size of the relative differences in experiencing the outcome and relative differences in avoiding the outcome may be helpful. In the case of health outcomes like mortality the matter is usually not complicated, because the favorable outcome rates tend to be in ranges where further increases generally lead to declining absolute differences. But the issue can be more

complicated in the case of healthcare disparities. Against that background, let us first examine the two studies that relied on absolute differences.

Jha et al. relied on such differences in examining trends in racial disparities in the use of major procedures among the elderly between 1991 and 2001. The study found that nationally for 9 procedures the differences were usually increasing. Focusing primarily on men, the authors found significant increases in absolute differences for 5 procedures, a significant decrease for one procedure, and no significant change for 3 procedures, noting that results were similar for women. Examining rates of total hip replacement, carotid endarterectomy, and coronary-artery bypass grafting in 158 hospital referral regions, the study found that absolute differences widened significantly in 42 regions and narrowed significantly in 22 regions, while not changing significantly in the others.

The predominance of increasing absolute differences in both the national and regional analyses, however, were pretty much what one would expect given the setting. Table 2 of the study showed 10 significant changes in absolute differences for procedures by gender, including 8 increases in the absolute difference and 2 declines. All 8 increases involved procedures that were increasing in frequency. But, while the authors reasonably characterized the procedures as "common," the rates were in a range where an increase in prevalence tends to be accompanied by an increase in the absolute difference – white final rates ranging from 0.6% (appendectomy for men) to 6.6% (total knee replacement for women) – with the relative difference between rates of receiving the procedures being much higher than the relative difference between rates of failing to receive the procedures. Given that one would expect increases in the absolute differences in these circumstances, there is no reason to regard the observed increases as reflecting some meaningful worsening of the disparity. However, that the relative disparity between rates of receipt increased for 4 of the 8 procedures, being contrary to the norm in such circumstances, might be cautiously regarded as a meaningful worsening of the disparity.

(Of the two significant declines in absolute differences, one (repair of abdominal aortic aneurism for men), involved a situation where the overall prevalence was declining in circumstances (white rate 2.1%) where a decline in prevalence would ordinarily lead to a decline in the absolute difference (though the decline in relative rates of failure to receive the procedure suggests a meaningful reduction in disparity). The other involved a situation where a narrow margin favoring white women changed to a narrow margin favoring black women.)

As to the changes in absolute differences between rates of three procedures in hospital regions, suffice it to say that the procedures being examined (total hip replacement, carotid endarterectomy and coronary artery bypass grafting) all involved rate ranges where the increases in prevalence would typically be accompanied by increasing absolute differences. The study did not provide figures that would allow more in-depth analysis.

Thus, both as to the national and the regional analyses, whether or not close examination of the data might allow one to draw some useful inferences about changes in disparities,

in the main the study's findings were simply what one would expect in circumstances where procedures of relatively limited prevalence were increasing.

The article by Trivedi et al. provides an interesting contrast to that by Jha et al. The Trivedi study also relied on absolute differences in appraising changes between 1997 and 2003 in racial disparities in outcomes that were generally increasing, specifically, receipt of 9 types of adequate care among Medicare beneficiaries. The study found absolute differences between rates to be decreasing in 7 of the 9 measures of adequate care. The frequency rates involved, however, were much higher than those in the Jha study – white final rates ranging from 73% (control of LDL cholesterol as part of cardiovascular care) to 94% (receipt of beta blocker) – and hence in the range where increasing prevalence typically is associated with a decline in the absolute difference. In accordance with the usual pattern where an outcome is increasing in these ranges, the relative difference in receiving adequate care decreased in 8 of 9 cases and the relative difference in rates of failing to receive adequate care increased in 6 of 9 cases. In a letter to the editor, the NCHS statisticians who authored the NCHS policy on measuring disparities in terms of relative differences in adverse outcomes cited the last pattern as a reason why the disparities should be regarded as increasing [13] (to which Trivedi et al. replied by pointing out that the disparities would usually be regarded as declining if one examined the relative differences between rates of receiving adequate care[14]). But while one might draw some inferences about meaningful changes on the on the basis of certain departures from expected patterns, the change in absolute differences relied on by the authors, as well as the other measures the authors might have chosen, were largely what one would expect simply because rates of adequate care in these 9 areas were increasing.

Since increasing attention to quality of care is likely to both increase rates of adequate and result in adequate care rates in ranges where further increases typically lead to declining absolute differences, the findings in the Trivedi study might be expected to be the norm in analyses of absolute differences between rates of adequate care. Sehgal had previously relied on absolute differences in examining changes in racial and gender disparities in rates of receiving adequate hemodialysis dose during a period (1993-2000) when rates of adequate dose were rising dramatically (from 46% to 87% for whites and from 36% to 84% for blacks; from 54% to 91% for women and from 31% to 82% for men)).[15] Like Trivedi et al., Seghal found that disparities generally declined over the period. The rates in the latter years, of course, were in the range where overall increases would be expected to reduce absolute disparities. As would be expected as well, the relative difference in rates of receiving adequate doses declined, while the relative difference in rates of inadequate doses increased.

As noted above, only Vaccarino et al.[1] relied on relative differences, examining such differences in rates of receipt of a therapy, the standard approach to measuring disparities in healthcare. The study examined gender and racial difference in the management of acute myocardial infarction from 1994 through 2002, and found that, apart from receipt of aspirin and beta-blockers, disparities persisted over time with no evidence that the difference narrowed. The patterns in the Vaccarino study are not easy to summarize and it would take some space to sort out the way the changes patterns comport with, or vary

from, the expected patterns in the circumstances. The main thing to be said about the study, however, is that the prevalence rates of the procedures examined were simply not changing very much. And when prevalence does not change much, measures of disparity tend also not to change much. Notably, in lamenting the lack of progress in the reduction of disparities in recent years, the authors contrasted their findings with the declines in disparities between blacks and whites in the use of coronary angiography and revascularization procedures between 1987 and 1997 that had been observed in a study by Escarce and McGuire.[16] In large part, however, that study found declining relative differences with respect to rates of receiving procedures that were substantially increasing. For that reason alone, it is understandable that Vaccarino et al. would not observe a similar pattern of narrowing relative differences.

With respect to all of the points above, it must be remembered that what I term the expected patterns are merely tendencies. Departures from the patterns do not disprove the tendencies, but merely mean that there may be irregularities in a particular distribution (in which case the tendencies may not be operating at all) or that there may in fact be meaningful changes in the relative situations of two groups (which means that the tendencies may be operating but are outweighed by other factors). At any rate the tendencies are sufficiently widespread and influential that it makes no sense to analyze changes in disparities without consideration of the role of the tendencies. At the same time, however, possible irregularities in the distributions, and several other factors, make interpreting patterns of change while taking the tendencies into account problematic as well.[4-6]. Hence, attributing meaning to departures from expected patterns must be done warily.

Finally, I note that the careful reader may be troubled by the references to prevalence of an outcome, since prevalence is a function of the rates of each group within a population and the proportion each group makes up of the total. Nevertheless, I think it is clear enough what is meant above by a change in prevalence – i.e., a change akin to that observed when a test cutoff is lowered or poverty declines – and reasonable to speak broadly of the implications of changes in overall prevalence.

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