Measurement Problems in the National Healthcare Disparities Report

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Prefatory notes (as modified May 26, 2011):

1. The material under the Oral Presentation heading below approximates the planned oral presentation for the 2007 APHA conference on November 7, 2007 (with additional annotations). The actual oral presentation and PowerPoint presentation will be available through APHA's E-ssential Learning Recorded Presentations site. The PowerPoint presentation can also be found at http://www.jpscanlan.com/images/APHA_2007_Presentation.ppt.

2. An addendum addressing several additional points, including that AHRQ measures health and healthcare disparities in terms of the larger or the relative difference in the favorable outcome and the relative difference in the adverse outcomes, was added in March 2008. It can be found at: http://www.jpscanlan.com/images/Addendum.pdf.

3. The points made regarding patterns by which absolute differences and differences measured by odds ratios tend to change as the prevalence of an outcome have been qualified by the introductory material to the Scanlan's Rule page of jpscanlan.com.

4. Section A.6 of the Scanlan's Rule page criticizes the varying measurement approaches of AHRQ, NCHS, and CDC. The Immunization Disparities subpage of the Scanlan's Rule page also discusses related issues.

5. In March 2009 a NHDR Technical Issues subpage was added to the Measuring Health Disparities to address certain technical problems in the National Healthcare Disparities Report apart from the general problem of measuring disparities without consideration of the implications of overall prevalence.

Oral Presentation

My subject is the National Healthcare Disparities Report and the measurement problems in that report that preclude it from providing useful information about changes in healthcare disparities over time.

[SLIDE 2]

The first slide [following the title] provides some of the background to the National Healthcare Disparities Reports (NHDR). It is a yearly report mandated by Congress. Three have been issued so far and a 2007 report will issue shortly.

The report covers both healthcare processes and health outcomes. In my abstract,[1] I incorrectly stated that process outcomes are usually measured in terms of relative differences in favorable outcomes (e.g., receipt of prenatal care in the first trimester). In fact, however, all or almost all disparities are measured in terms of relative differences in adverse outcomes.[2] In the case of processes, that means rates of the failure to receive certain types of care. Also, whereas my abstract discusses a requirement that relative and absolute differences must move in the same direction to be counted as a change over time, that aspect of the 2005 report was abandoned in the 2006 report.

But these differences with the abstract have little bearing on my central point here, which involves the problems with using any dichotomous variable to measure changes in disparities over time.

[SLIDE 3]

The crucial failing of the NHDR methodology for appraising the size of a disparity is that it fails to recognize that all measures of differences between two groups' rates of experiencing or avoiding some outcome tend to change in certain ways solely as a result of changes in the prevalence of the outcome.

Without recognizing and attempting to account for these tendencies, it is impossible to draw meaningful conclusions about changes in health or healthcare disparities over time. Further, under the approach whereby all disparities are measured in terms of relative differences in adverse outcomes, as healthcare improves, and favorable outcomes become more common, healthcare disparities will be perceived to be increasing.

[SLIDE 4]

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[1] http://apha.confex.com/apha/135am/techprogram/paper_153201.htm

[2] I also make this error in three on-line responses to journal articles. These, and the correction thereto, are discussed infra. See also Addendum of March 11, 2008, regarding situations where certain disparities may be measured in terms of relative differences in favorable outcomes because such differences are larger than the relative differences in the adverse outcomes.

The next slide describes the way four measures of differences between rates change as the prevalence of an outcome changes from being very rare to being almost universal:

- Relative differences in experiencing the outcome tend to decrease.

- Relative differences in failing to experience the outcome tend to increase.

- Absolute differences initially increase then decline.

- Differences measured in odds ratios initially decline then increase.

I am going to attempt to graphically illustrate these tendencies. This is not an easy thing to do in a short presentation. So in the next slide I list a group of references that should clarify any aspects of the presentation that leave you puzzled or unpersuaded.

[SLIDE 5]

The health disparities measurement page on my web site (jpscanlan.com)[3] contains more than 60 discussions of these tendencies and their bearing on the interpretation of group differences in the law and the social and medical sciences. Section D of that page includes more than 40 recent on-line responses to various journal articles explaining the problem with the effort in each article to compare the size of health or healthcare disparities in different settings. Items D23, 40, and 41 specifically discuss the NHDR.[4]

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[3] **http://www.jpscanlan.com/homepage/measuringhlthdisp.html**

[4] These references, which include misstatements regarding the methodology used in the NHDR (referenced in note 1 supra), are listed below. The misstatements have already been corrected with respect to item D23 (in item D23a, also listed below) and the others will be shortly corrected:

D23. Effects of choice measure on determination of whether health care disparities are increasing or decreasing. *Journal Review* May 1, 2007, responding to Vaccarino V, Rathore SS, Wenger NK, et al. Sex and racial differences in the management of acute myocardial infarction, 1994 through 2002. N Engl J Med 2005;353:671-682 (and two other articles in the same issue):http://www.journalreview.org/view_pubmed_article.php?pmid=16107620&weben v=00P_2r_lHBKZPkExnEkCR_j5-u8waNcJ-87aLnoSJWxvN_ljFKstOR3CAx%402B600907661FF950_0034SID&qkey=1&rescnt=2 &retstart=0&q=%22vaccarino+v%22+%22rathore+ss%22

D23a. Correction to statements concerning the measurement of healthcare disparities in the National Healthcare Disparities Reports in earlier comment on Vaccarino et al. *Journal Review* Nov. 6, 2007:

I'll shortly add another comment relating to a 2005 Health Affairs article on the NHDR and expand on the points I make here.[5]

But the points made in these comments could be made with respect to thousands of other articles – in fact, with respect to virtually to every effort to compare the size of health disparities at different points in time, in different places, or among different populations. Thus, the points I make here about the NHDR could be made about almost every study of health disparities.

I urge anyone who is going to try and study health disparities to read a few of the papers listed here (all of which are on my web site).[6] And I suggest that it would not be very

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http://www.journalreview.org/view_pubmed_article.php?pmid=16107620&specialty_id=

D40. Understanding the ways improvements in quality affect different measures of disparities in healthcare outcomes regardless of meaningful changes in the relationships between two groups' distributions of factors associated with the outcome. *Journal Review* Aug. 30, 2007, responding to Sequist TD, Adams AS, Zhang F, Ross-Degnan D, Ayanian JZ. The effect of quality improvement on racial disparities in diabetes care. *Arch Intern Med* 2006;166:675-681:
http://www.journalreview.org/view_pubmed_article.php?pmid=16567608&specialty_id=

D41. Understanding patterns of correlations between plan quality and different measures of healthcare disparities. *Journal Review* Aug. 30, 2007, responding to Trivedi AN, Zaslavsky AM, Schneider EC, Ayanian JZ. Relationship between quality of care and racial disparities in Medicare health plans. JAMA 2006;296:1998-2004:
http://www.journalreview.org/view_pubmed_article.php?pmid=17062863&specialty_id=

[5] The comment will address Moy E, Drayton E, Clancy CM. Compiling the evidence: The National Healthcare Disparities Reports. *Health Affairs* 2005;24(2):376-387. See also Recognizing the way correlations between improvements in healthcare and reductions in healthcare disparities tend to turn on the choice of disparities measure. *Journal Review* Nov. 9, 2007, responding to: Kaytur FA, Clancy CM. Improving quality and reducing disparities. *JAMA* 2003;289:1033-34:
http://www.journalreview.org/view_pubmed_article.php?pmid=12597759&specialty_id=22.

[6] Formal citations and links are:

Scanlan JP. Can we actually measure health disparities? *Chance* 2006:19(2):47-51:
http://www.jpscanlan.com/images/Can_We_Actually_Measure_Health_Disparities.pdf

Scanlan JP. Race and mortality. *Society* 2000;37(2):19-35:
http://www.jpscanlan.com/images/Race_and_Mortality.pdf.

worthwhile simply to come away thinking they perhaps raise interesting issues. For, unless you conclude that the points they make are entirely wrong, you will have to approach health disparities research in a way materially different from the way such research has been conducted to date.

[SLIDE 6]

The tendencies I have listed can be illustrated with any data set that allows one to examine various points on two groups' distributions of factors associated with experiencing or avoiding some outcome. The next slide simply sets out the specifications for a hypothetical illustration.

Basically, two groups have normal distributions of factors associated with an outcome where the advantaged group (AG) has an average that is one half a standard deviation greater than the average for the disadvantaged group (DG).

[SLIDE 7 – FIG 1]

In Figure 1, the numbers along the bottom, which are used as benchmarks for overall prevalence of some outcome, show the proportion of the advantaged group that falls above each point – in other words the success rate or favorable outcome rate of the advantaged group.   You can think of each point as representing a cutoff on a paper and pencil test and consider moving from left to right as reflecting the lowering of the cutoff on the test such as to serially enable the population between each point to pass the test. But the patterns I will show would also obtain if, instead of lowering the cutoff, we improved test performance sufficiently to allow everyone between the two points to pass the test at the existing cutoff.

The blue line with the diamond marker represents the ratio of AG's rate of falling above each point to DG's rate of falling above the point – Ratio A I have termed it. It reflects the relative differences between rates of experiencing the favorable outcome. And notice that that as we move from left to right and the favorable outcome becomes more common, relative differences between success rates tend to decline.

Let me add that I use rate of the advantaged group as the numerator (whereas the health disparities report always uses the disadvantaged group's rate as the numerator as I used to

Scanlan JP. Measuring health disparities. *J Public Health Manag Pract* 2006;12(3):293-296, responding to Keppel KG, Pearcy JN. Measuring relative disparities in terms of adverse events. *J Public Health Manag Pract* 2005;11(6):479–483::
http://www.nursingcenter.com/library/JournalArticle.asp?Article_ID=641470

Scanlan JP. The Misinterpretation of Health Inequalities in the United Kingdom, presented at the British Society for Populations Studies Conference 2006, Southampton, England, Sept. 18-20, 2006 (BSPS 2006 paper):
http://www.jpscanlan.com/images/BSPS_2006_Complete_Paper.pdf.

do myself).[7] Choice of numerator will have small effect on the size of a disparity – e.g., whether we call a difference between 80 and 60 a difference of 25% (20/80) or a difference 33% (20/60). Such differences, however, is immaterial to the principal points made here. (But see Addendum referenced in note 2.) I use the advantage group's rate as the numerator here because of a pattern to be illustrated in the next few slides.

[SLIDE 8 – FIG 2]

Next we examine the other side of the picture, the relative difference between rates of experiencing the adverse outcome. Figure 2 adds to the first figure a red line with a box marker. It represents the ratio of DG's failure rate to AG's failure rate at each point – termed here Ratio B. And here we see that as we move from left to right and the adverse outcome becomes less common, the relative difference in experiencing that outcome increases.

Thus, we observe how relative differences in experiencing an outcome and relative differences in avoiding the outcome tend to move systematically in opposite directions as the prevalence of the outcome changes. If this seems counterintuitive to some, others will recognize that the latter change is implicit in the former.[8]

[SLIDE 8 – FIG 3]

Figure 3 adds the odds ratio – the yellow line with the triangle marker. When the favorable outcome is quite rare, the odds ratio is very large. As the favorable outcome becomes more common the odds ratio declines, reaching a low at approximately the intersection of the declining ratio of success rates (Ratio A) and increasing ratio of failure rates (Ratio B). I am not going to give a great deal of attention to odds ratios, but several of the references explore its problematic nature in health disparities research.[9]

[SLIDE 9 – FIG 4]

Figure 4 now adds a chartreuse line with an x marker, which represents the absolute difference between rates of experiencing or failing to experience an outcome. And we observe that the absolute difference behaves exactly the opposite of the odds ratio. That is, the absolute difference between rates starts out small (when the favorable outcome is rare), grows larger as that outcome becomes more common, then grows small again as the favorable outcome becomes nearly universal.

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[7] See note 1 of the BSPS 2006 paper.

[8] See BSPS 2006 paper at 4.

[9] See the BSPS 2006 paper and Scanlan JP. Interpreting patterns of differing effects of chronic conditions on self-assessed health. *Journal Review* June 30, 2007, responding to Brown AF, Ang A, Pevley AR. The association between neighborhood characteristics and self-rated health for adults with chronic conditions. *Am J Pub Health* 2007;97:926-932.
http://www.journalreview.org/view_pubmed_article.php?pmid=17395847&specialty_id=0

I have included the absolute difference indicator with the other measures, even though it does not show up very well and is really a different kind of measure on a different scale. But I've included it here to illustrate the way the absolute difference reaches a maximum at the intersection of Ratios A and B, and then declines.

[SLIDE 10- FIG 5]

Figure 5 is simply a more viewable picture of the pattern of changes in absolute differences as the prevalence of an outcome changes.

The patterns shown here are nothing peculiar to hypothetical normal data or hypothetical normal test score data. There are a variety of other types of data that can illustrate these same patterns.

INCOME: US income data, for example, show how when poverty declines, racial (relative) differences in poverty rates will tend to increase while racial (relative) differences in avoiding poverty will tend to decrease. More broadly, as one moves from the highest income levels to the lowest, relative differences in falling above each point decrease while relative differences in falling below each point increase. See 2007 *Chance* article listed in note 6.

NHANES data can show, for example, how as we improve rates of controlling blood pressure, relative differences in rates of control will tend to decrease while relative differences in rates of failing to control will tend to increase. These patterns are addressed in reference D41 and a BSPS 2007 paper.[10]

FRAMINGHAM CALCULATOR: You can easily find online pages that allow you calculate heart attack risks according to the algorithms derived from the Framingham study. Just choose an advantaged and disadvantaged group with respect to heart attack risks – women versus men; non-smokers versus smokers – and then vary the other risk

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[10] Methodological Issues in Comparing the Size of Differences between Rates of Experiencing or Avoiding an Outcome in Different Settings, presented at the British Society for Populations Studies Conference 2007, St. Andrews, Scotland, Sept. 11-13, 2007.
> PowerPoint Presentation:http://www.jpscanlan.com/images/2007_BSPS_Presentation.ppt
> Oral Presentation:
> http://www.jpscanlan.com/images/2007_BSPS_Oral_Presentation.pdf

See also:

Can We Actually Measure Health Disparities, presented at the 7th International Conference on Health Policy Statistics, Philadelphia, PA, Jan. 17-18, 2008.
> Abstract:
> http://www.amstat.org/meetings/ichps/2008/index.cfm?fuseaction=AbstractDetails&AbstractID=300283
> PowerPoint Presentation: http://www.jpscanlan.com/images/2008_ICHPS.ppt
> Oral Presentation: http://www.jpscanlan.com/images/2008_ICHPS_Oral.pdf

elements.   You will observe patterns of changes in differences between each group's likelihood of experiencing adverse and favorable outcomes that are more or less like I illustrated with figures 1 to 5.

And of course there is a great deal of published information on test scores and rates of meeting certain achievement levels that can illustrate these tendencies as well.

In these and other data sets, you will find that the patterns behave more or less – though rarely exactly – in the way suggested by the figures I showed earlier.

[SLIDE 13 - POST]

The next slide presents some figures from an article in last Sunday's Washington Post where an educational technique was regarded as being not only successful in improving overall proficiency rates, but successful in reducing racial disparities in proficiency.   It caught my attention simply because it illustrates the common pattern whereby improving overall performance reduces relative differences in favorable outcome while increasing relative differences in adverse outcomes.

[SLIDE 14 – TRIVEDI AND JHA]

The next slide references two articles that appeared together in a 2005 issue of the *New England Journal of Medicine*. Both involved cases where the favorable outcome was increasing in prevalence and both measured disparities in terms of absolute differences. But the first found disparities to be increasing while the second found them to be decreasing. And one obvious explanation for this difference is that the first study (by Jha et al.) involved relatively uncommon outcomes where Ratio A exceeded Ratio B (the left hand part of the figure) and the second (by Trivedi et al.) involved more common outcomes where Ratio B exceeded ratio A (the right hand part of the figure). Thus, both patterns were more or less what one would expect in the circumstances; and neither pattern, by itself, provided a useful indication of whether disparities were changing in any meaningful way. Several aspects of these and related studies are addressed at some length in reference D23, D40, and D41.

[SLIDE 15 – SEHGAL]

The next slide references a 2003 article in the *Journal of the American Medical Association* that found that, during a period of substantial increase in rates of adequate hemodialysis, absolute differences between black and white rates declined. It has been oft cited as showing how improving healthcare reduces disparities, including by AHRQ officials responsible for the disparities reports.[11] But, the underlying data show that how increasing rates of adequate care lead to increasing relative differences in inadequate

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[11] See Kaytur FA, Clancy CM. Improving quality and reducing disparities. JAMA 2003;289:1033-34 (to which D42 specifically responds); Moy E, Drayton E, Clancy CM. Compiling the evidence: The National Healthcare Disparities Reports. Health Affairs 2005;24(2):376-387.

care, which is how the disparities are measured in the disparities reports. But see further discussion of this matter in the Addendum.[12]

[SLIDE 16 – IMPLICATIONS]

• As healthcare and health improve, disparities will seem to increase.

I said this at the outset.

• Most effective measures to improve populations health (even ones seemingly focused on the disadvantaged) will seem to increase disparities (see D3 re Back to Sleep Program).[13]

That is not to say no program can be so focused on a disadvantaged group that it may reverse this pattern. But that is not going to be the usual case.

• Disparities will seem to be larger in areas or among subpopulations where adverse outcomes are rarest.

• Disparities tend to be larger with respect to outcomes that are rarer.

This is also pertinent to the National Healthcare Quality Report's analyses of variance across states, which measures variances in terms of relative differences in adverse outcomes. Hence, that report will tend to will find the across-state variance in situations where adverse outcomes are rarest.[14].

[SLIDE 17]

So which of these measures of disparity is the best?

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[12] In the original presentation the slide included the following line:

"Relative diff in adequate dialysis: decreased from 70% to 10%"
It should have read:
"Relative diff in adequate dialysis: decreased from 28% to 4%"
That has been corrected in the version of the slide maintained at jpscanlan.com. The difference does not affect the points made with regard to the slide either in the presentation or the addendum, which discusses other aspects of the slide.

[13] Changing social inequalities in SIDS. *Am J Pub Health* Dec. 11, 2005, responding to Pickett et al. Widening social inequalities in risk for sudden infant death syndrome. *Am J Pub Health* 2005;95:97-81:
http://www.ajph.org/cgi/eletters/95/11/1976

[14] See 2006 National Healthcare Quality Report (at 8): http://www.ahrq.gov/QUAL/nhqr06/nhqr06.htm

None alone can indicate whether a change is other than solely a consequence of changes in prevalence. Further, each measure can change in one direction even when there in fact occurred a meaningful change in the opposite direction – but one that is simply not large enough to outweigh the tendencies. Such pattern is illustrated in a few of the references. Finally, be mindful that it is not always the favorable outcome that is increasing – and that, for example, as adverse outcomes increase, relative differences in those outcomes will tend to decline.

[SLIDE 18]

Using dichotomous variables while taking the described tendencies into account is discussed at some length in a couple of places (*Chance* 2006, BSPS 2006). In summary, one can try and divine meaningful changes from departures from the expected pattern. But keep in mind that the underlying distributions are rarely going to be perfectly normal. That does not mean that the tendencies will have no effect or that we can reasonably interpret changes over time without consideration of these tendencies. But it does greatly complicate efforts to identify changes while taking the tendencies into account.[15]

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[15] Several efforts to measure the size of disparities between rates by estimating the difference between means of hypothesized underlying distributions of factors associated with an outcome may be found in:

Scanlan JP. Comparing the size of inequalities in dichotomous measures in light of the standard correlations between such measures and the prevalence of an outcome. Journal Review Jan. 14, 2008, responding to Boström G, Rosén M. Measuring social inequalities in health – politics or science? Scan J Public Health 2003;31:211-215:
http://www.journalreview.org/view_pubmed_article.php?pmid=12850975&specialty_id=
(version with properly formatted tables:
http://www.jpscanlan.com/images/Bostrom_and_Rosen_Comment.pdf)

Scanlan JP. Comparing health inequalities across time and place with an understanding of the usual correlations between various measures of difference and overall prevalences. Journal Review Jan. 30, 2008, responding to Moser K, Frost C, Leon D. Comparing health inequalities across time and place—rate ratios and rate differences lead to different conclusions: analysis of cross-sectional data from 22 countries 1991– 200. Int J Epidemiol 2007;36:1285-1291:
http://www.journalreview.org/view_pubmed_article.php?pmid=17898027&specialty_id=0

Scanlan JP. Pay-for-performance implications of the failure to recognize the way changes in prevalence of an outcome affect measures of racial disparities in experiencing the outcome. Journal Review Feb. 8, 2008 (responding to Werner, RM, Asch DA, Polsky D. Racial profiling: The unintended consequences of coronary artery bypass graft report cards. Circulation 2005;111:1257–63):
http://www.journalreview.org/view_pubmed_article.php?pmid=15769766&specialty_id=

Scanlan JP. Perceptions of changes in healthcare disparities among the elderly dependant on choice of measure. Journal Review Feb. 12, 2008 (responding to Escarce JJ, McGuire TG. Changes in racial differences in use of medical procedures and diagnostic tests among elderly persons: 1986-1997. Am J Public Health 2004;94:1795-1799):
http://www.journalreview.org/view_pubmed_article.php?pmid=15451752&specialty_id=0

The use of continuous variables is discussed in a few places. I'll merely say here that that there are some possibilities, but many things that look like continuous variables are actually functions of changes in dichotomous measures and hence implicate the general problems I have tried to describe here.

By the problematic implications of changes in smoking prevalence smoking, I mean that, as with any dichotomy, if we reduce smoking we are likely to see these same difficult to interpret patterns of different rates of changes for different groups – i.e., the group with the lower smoking rate will tend to show a larger proportionate decline in smoking while the other group will show a larger proportionate increase in rates of non-smoking. So suppose we find some seemingly meaningful change in true continuous variable, but then we trace it so some uninterpretable differential change in smoking rates. I am not sure what we actually will have found.

In summary, there are serious problems with the measurement approach in the NHDR, but those same problems affect all research into health and healthcare disparities. The priority in such research should be identifying techniques for measuring disparities that address or avoid the issues I have discussed here.