*The following is a comment on references 1 and (to some degree) 2 that was submitted to the International Journal on Equity in Health on October 3, 2009. Approximately a month later the Journal advised that it had sent to the comment to the authors of references 1 and 2 and would post the comment along with the response by the authors. Following inquiry in May 2010, I was advised by the Journal that the authors had failed to submit a response. The Journal, however, advised that it did not wish to post the comment at its current length post but would post it at a length of no more than 900 and not more than four references. I have not yet revised the comment pursuant to those specifications. The comment below differs from that submitted to the Journal in that a working link has been added to reference 19 because the Journal Review site has ceased to exist.*

Title:

The relationship between overall prevalence and measures of differences between outcome rates

Comment:

The article by Eikemo et al.[1] is the second recent article in this journal to address my views on the relationship between the size of relative differences in experiencing (or avoiding) an outcome and the overall prevalence of an outcome. The first was a 2007 article by Houweling et al.[2].

The principal matter at issue is a pattern whereby the rarer an outcome the greater tends to the relative difference in experiencing it and the smaller tends to be the relative difference in avoiding it. Since 1987, I have described the pattern in a hundred or so places, which descriptions are available on the Measuring Health Disparities page of jpscanlan.com.[3] In recent years I had termed the pattern "Interpretive Rule 1" (or "IR1")[4] or "heuristic rule X" (or "HRX"),[5] the term employed by Eikemo et al. After researchers in the United Kingdom termed the pattern "Scanlan's rule,"[6] I adopted that usage, and on the Scanlan's Rule page of jpscanlan.com, I address nuances of the patterns of correlations of various measures of differences between outcome rates with the overall prevalence of an outcome and discuss various examples of research that fails to consider the implications of those correlations.[7]

The article by Eikemo et al. references a 2006 guest editorial in the American Statistical Association magazine Chance, styled "Can We Actually Measure Health Disparities?,[5] in which I addressed the ways relative differences between rates, as well as absolute differences between rates and differences measured by odds ratios, tend to be correlated with the overall prevalence of an outcome. The article by Houweling et al. referenced a 2000 article in the social science journal Society, styled "Race and Mortality,"[8] in which I had solely addressed relative differences. Both the article by Eikemo et al. and that by Houweling et al. recognize the existence of correlations between relative differences in experiencing an outcome and the overall prevalence of an outcome similar

to those I had identified and thus the need in some manner to take overall prevalence into account in interpreting relative differences between health or healthcare outcome rates of advantaged and disadvantaged groups. Houweling et at., while unaware of my treatments of absolute differences in the Chance editorial and other works between 2005 and 2007, reached essentially the same conclusions I had reached as to the correlations of between absolute difference and the overall prevalence of an outcome.

(Houweling et al. briefly discussed the odds ratio as a measure that avoids the interpretive issues resulting from the correlations described in their study. That view is contrary to points I made in the Chance editorial and other works going back as far as 1991,[9] which illustrate the way odds ratios are also correlated with the overall prevalence of an outcome. But there is no need to address that area of disagreement at any length in this comment.)

Though both Eikemo et al. and Houweling et al. crucially agree with my view that relative and absolute differences between rates cannot be evaluated without consideration of the implications of overall prevalence, several aspects of their analyses warrant comment. First, while both articles puzzle over possible explanations for the observed patterns of correlations of relative (or absolute) differences with overall prevalence, they ignore what I suggest is a quite sound explanation for such correlations. Such explanation, as expressed in Race and Mortality and many other places (and adopted by Carr-Hill and Chalmers Dixon [10]), lies in the shapes of normal distributions of factors associated with the likelihood of experiencing an outcome. It is best illustrated in terms of the distributions themselves in Figure 1 of a 1994 Chance article.[11] But Figure 1 and Table 1 of the 2006 Chance editorial also usefully illustrate the way that the patterns are inherent in the shape of other than highly irregular risk distributions. Table 1 shows how in the United States African Americans comprise a higher proportion of the population falling below each point defined by a decreasing multiple of the poverty line than they do of the population falling below each higher point, but that they also comprise a higher proportion of the population falling above the point than they do of the population falling above each higher point. Correspondingly, the lower the income level the greater tends to be the relative difference between rates of falling below it and the smaller tends to be the relative difference between rates of falling above it. Hence, for example, reducing poverty will tend to increase relative differences in poverty rates but reduce relative differences in rates of avoiding poverty.[5,8] The same factors underlie the observed reverse U-shaped pattern of absolute differences identified by Houweling et al. (and also reflect why Houweling et al. are mistaken in the view that odds ratios are unaffected by the overall prevalence of an outcome).[4,5,12]

The patterns can also be illustrated by hypothetical test score data, which show how lowering a cutoff (or improving test performance such that all persons previously falling just below the cutoff are enabled to reach the cutoff) will tend to increase relative differences in failure rates but decrease relative differences in pass rates.[4,7,10] The patterns can also be illustrated in a wide range of data available from the U.S. National Health and Nutrition Survey, which show, for example, how lowering blood pressure for the entire population will tend to increase relative differences in hypertension rates while

reducing relative differences in rates of avoiding hypertension.[11] Presumably, the patterns could also be consistently illustrated in the five-point scaled morbidity data that underlie the analysis in Figure 1A of Eikemo et al. That is, moving down the five categories from best to worst health and dichotomizing the data at each point, one would likely find that within the great majority of respondent groups the relative difference between rates of falling below each point increases while the relative difference between rates of falling above each point decreases

Second, both the Eikemo article and the Houweling article fail to reflect a clear vision of the mechanisms necessarily underlying the patterns they observe or any patterns that involve comparisons across multiple populations (or the same populations at different points in time). Such patterns will generally be functions of both the overall prevalence of an outcome in the various settings and the size of the difference between the underlying risk distributions of the advantaged and disadvantaged groups in each setting, as was explained at some length in Race and Mortality. For example, consider two settings in each of which two groups differ in average test performance – in setting A by .5 standard deviations and in setting B by .4 standard deviations. In any circumstance where the cutoff is set at a point where the same proportion of the higher-scoring group passes in each setting, the relative difference between failure rates of higher- and lower-scoring groups, and the relative difference between pass rates of the higher- and lower-scoring groups will be greater in setting A (as will all other measures of differences between rates).[13] But if the cutoff score is lowered in setting B, according to HRX, or Scanlan's rule, the relative difference between failure rates will tend to increase (possibly, but not necessarily, enough to make it larger than in setting A), while the relative difference in pass rates will tend to decrease (further increasing the extent to which that relative difference is larger in setting A than in setting B).

In examining health and healthcare inequalities, a difficulty is that usually we are able to observe only the outcome rates. And from those we must endeavor to divine the difference between the underlying distributions of advantaged and disadvantage demographic groups. Commencing in January 2008,[14], I have described an approach to doing so in about 20 commentaries or presentations, which are made available on the Solutions page of jpscanlan.com,[15] and which apply that approach to data from various studies. The procedure involves inferring from a pair of rates the difference, in terms of the percentage of a standard deviation, between the means of hypothesized underlying distributions. For example, from adverse outcome rates of 14.4% and 4.8% one can infer that the difference between means is .60 standard deviations; from adverse outcome rates of 45.0% and 30.0% one can infer that the difference between means is .39 standard deviations. As I have repeatedly explained, this approach has a number of imperfections. But it at least reflects a theoretically sound effort to determine what a pair of outcome rates indicate about the extent of health inequality in a particular setting unobscured by the effects of overall prevalence of the outcome in that setting. In any case, the approach is discussed at length on the above-mentioned Solutions page and its references, and a database with which to implement the approach is made available on the Solutions Database page of jpscanlan.com.[16]

The lack of clear vision as to the mechanisms underlying the patterns they observe, or as to precisely what an appraisal of the size of health inequalities ought to seek to identify, undermines the analyses of both Eikemo et al. and Houweling et al. in a number of respects. While both Eikemo et al. and Houweling et al. conclude that relative (and absolute) differences must be interpreted by taking overall prevalence into account, they do not offer guidance on how to do that (save that Eikemo et al. suggest that relative inequalities should be “interpreted hand-by-hand with total rates and estimates of absolute inequalities…”). Both articles imply that in two cases with the same relative difference between rates, the one with the larger absolute difference would involve the greater inequality. That is certainly correct, as illustrated in Table 3 of a 2008 presentation.[17] But they do not suggest how one might evaluate a situation where, say, in one setting the adverse outcome rates are 7.4% and 2.9% (a rate ratio of 2.5 and an absolute difference of 4.5 percentage points) and in another setting the rates are 2.7% and 0.9% (a rate ratio of 3.0 and an absolute difference of 1.8 percentage points). According to the procedure discussed above (and as shown in Table 3 just mentioned), the differences in the two settings are actually the same – i.e., a difference of .44 standard deviations between the hypothesized underlying means. An approach involving the exercise of intuitive judgment, such as the two groups of authors seem to have in mind, might reach the same result. But to the extent that the judgment exercised in such an approach is an informed one, it would be informed by an understanding of the same properties of normal distributions that underlie the Solutions Database.

An understanding of the underlying mechanisms is also necessary to draw sound inferences as why the strength of the relationship between the prevalence of an outcome may vary from setting to setting. It has been suggested that the greater cohesiveness of more egalitarian societies will lead to generally better health in those societies.[18] The point is by no means implausible; and whatever the effect of greater cohesiveness, diminishing marginally utility would seem also to lead to better overall health in more egalitarian societies. Certainly comparatively egalitarian countries like Norway and Sweden have excellent health. Assuming that egalitarian societies have comparatively better health generally (i.e., lower adverse outcome rates) and less health inequality in a meaningful sense (i.e., as reflected in the size of the difference between underlying risk distributions of advantaged and disadvantaged groups), there is reason to expect that the lower level of general inequality in those countries, by tending to reduce the relative difference in adverse health outcome rates, will tend to moderate to some degree the tendency for the lower overall prevalence rates in those countries to be associated with high relative differences in adverse outcomes.

On the other hand, the lower health inequality in countries with low adverse outcome rates should heighten the association between better health and smaller relative differences in favorable outcomes. Thus, it would be interesting to know, for example, whether, consistent with theory, the data underlying the Eikemo study would show a stronger positive correlation between adverse outcome rates and relative differences in rates of avoiding those outcomes – i.e., low adverse outcome rates associated with small relative differences in avoiding those outcomes – than the negative correlations such data show between levels of adverse outcomes and relative differences in rates of

experiencing those outcomes.

The point that the size of an inequality in a meaningful sense turns on the difference between the means of the underlying risk distributions (or some other measure of difference between the distributions) is not to suggest that no standard measure of differences between rates ought to be of concern to a society desiring to eliminate health inequality. Because a greater number of disadvantaged persons are affected by an outcome with a large absolute difference between rates than one with a small absolute difference between rates, a society might decide that more resources are warranted to address an inequality in an outcome with a large absolute difference between rates than an inequality in an outcome with a small absolute difference between rates, even when the latter involves a greater inequality (properly measured). But even though the larger absolute difference might prompt the attention to reducing the particular inequality, it should be recognized that whether society is achieving progress in reducing that inequality cannot be determined by simply examining whether the absolute difference between rates increases or decreases. For the absolute difference can decrease even when the inequality is increasing and increase even when the inequality is decreasing.

Regardless of the points I raise above, and regardless of such disagreements as Eikemo et al. or Houweling may have with my work or the discussion here, both of their articles are potentially quite significant. For both articles importantly state or imply that prior studies that have relied on relative (or absolute) differences in outcome rates without consideration of the role of overall prevalence – which is to say almost all health and healthcare inequalities studies – need to be reinterpreted with consideration of overall prevalence, as well as that all work going forward must consider the implications of overall prevalence with regard to any standard measure of difference between outcome rates And while Eikemo et al. make the point in the context of comparisons of inequalities among different countries and different age groups, the point is equally germane to the study of whether inequalities are changing over time, which is probably the most important health inequalities issue. But, to my knowledge, the Houweling authors have so far failed to reevaluate prior work of their own or others in light of the reasoning of their recent article here, and some have gone on to do further work without regard to the implications of overall prevalence and without citing their 2007 article in this journal.[19] One hopes the Eikemo authors will take greater cognizance of the implications of their own and the Houweling study in their further health inequalities work and that the Houweling authors soon will do the same.

References:

1. Eikemo TA, Skalicka V, Avendano M. Variations in health inequalities: are they a mathematical artifact? International Journal for Equity in Health 2009;8:32: http://www.equityhealthj.com/content/pdf/1475-9276-8-32.pdf

2. Houweling TAJ, Kunst AE, Huisman M, Mackenbach JP. Using relative and absolute measures for monitoring health inequalities: experiences from cross-national analyses on maternal and child health. International Journal for Equity in Health 2007;6:15:

http://www.equityhealthj.com/content/6/1/15

3. http://jpscanlan.com/measuringhealthdisp.html

4. Scanlan, JP. The Misinterpretation of Health Inequalities in Nordic Countries, presented at: 5th Nordic Health Promotion Research Conference, Esbjerg, Denmark, June 15-17, 2006. http://www.jpscanlan.com/images/Esbjerg_Oral.pdf

5. 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

6. 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.
7. http://jpscanlan.com/scanlansrule.html

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

9. Scanlan JP. The perils of provocative statistics. The Public Interest 1991;102:3 14: http://jpscanlan.com/images/The_Perils_of_Provocative_Stat.pdf

10. Carr-Hill R, Chalmers-Dixon P. The Public Health Observatory Handbook of Health Inequalities Measurement. Oxford: SEPHO; 2005: http://www.sepho.org.uk/extras/rch_handbook.aspx

11. Scanlan JP. Divining difference. Chance 1994;7(4):38-9,48: http://jpscanlan.com/images/Divining_Difference.pdf

12. Scanlan JP. Can we actually measure health disparities?, presented at the 7th International Conference on Health Policy Statistics, Philadelphia, PA, Jan. 17-18, 2008: PowerPoint Presentation: http://www.jpscanlan.com/images/2008_ICHPS.ppt; Oral Presentation: http://www.jpscanlan.com/images/2008_ICHPS_Oral.pdf

13. 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: http://www.jpscanlan.com/images/BSPS_2006_Complete_Paper.pdf

14. Scanlan J.P. 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://journalreview.org/v2/articles/view/12850975.html

15. http://www.jpscanlan.com/measuringhealthdisp/solutions.html

16. http://www.jpscanlan.com/measuringhealthdisp/solutionsdatabase.html

17. Scanlan JP. An approach to measuring differences between rates that is not affected by the overall prevalence of an outcome. Presented at the British Society for Populations Studies Conference 2008, Manchester, England, Sept. 10-11, 2008:http://jpscanlan.com/images/BSPS_2008_Presentation_2.ppt

18. Wilkinson R. The politics of health. Lancet 2006;368:1229-1230.

19. Scanlan JP. Measurement lessons learned, then forgotten. Journal Review May 6, 2009 (responding to Mackenbach JP, Stirbu I, Roskam AJ, et al. Socioeconomic inequalities in health in 22 European countries. N Engl J Med 2008;358:2468-2481: http://journalreview.org/v2/articles/view/18525043.html http://jpscanlan.com/images/Comment_on_Mackenbach.pdf