[Note Added March 20, 2011: In April 2010, the [Explanatory Theories](#) sub-page was added to the [Scanlan's Rule](#) of jpscanlan.com addressing some subsequent developments concerning the subject of this comment.]

The material below is a version of:

Scanlan JP. "Inverse equity hypothesis" overlooks important statistical tendencies. *Journal Review* Dec. 2, 2008 (responding to Victora CG, Vaughan JP, Barros FC, et al. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet* 2000;356:1093-1098), which appears at http://journalreview.org/v2/articles/view/11009159.html.

The compression function of journalreview.org site eliminates the paragraph breaks. The version below restores those breaks. It also contains several typographical corrections.

Title: "Inverse equity hypothesis" overlooks important statistical tendencies

Text: Relying on hypothetical and actual data, Victora et al.[1] posit an "inverse equity hypothesis" to explain patterns of health inequalities during times of overall improvements in health. According to the hypothesis, following the introduction of a new intervention, health inequalities, measured in terms of relative differences in outcome rates, will initially tend to increase as advantaged populations are the first to benefit from the new intervention; but eventually inequalities will tend to decrease as rates of advantaged groups approach a "minimum achievable level" beyond which further improvements are difficult or impossible.

The authors' analysis suffers from a failure to recognize certain statistical tendencies inherent in normal risk distributions. And, though they present data on relative differences in favorable outcomes (which outcomes increase during periods of overall improvement) as well as relative differences in adverse outcomes (which outcomes decrease as the opposite, favorable outcomes increase), the authors overlook the way that the overall prevalence of an outcome tends to systematically affect relative differences in the two types of outcomes in contradictory ways.

As I have illustrated in a number of places,[2-6] solely for reasons related to the shapes of underlying risk distributions, the rarer an outcome the greater tends to be the relative difference in experiencing it and the smaller tends to be the relative difference in avoiding it. Thus, as favorable outcome like receipt of some beneficial intervention become more common, relative differences in receipt of the intervention tend to decline while relative differences in failure to receive the intervention tend to increase. Correspondingly, relative differences in the (increasing) favorable outcome that the intervention promotes tend to decrease while relative differences in the (decreasing) adverse outcome tend to increase. But, without more, one cannot regard either the decreasing relative difference in one outcome or the increasing relative difference in the opposite outcome as reflecting a meaningful change in health inequality. Nor can one

even say that one group has disproportionately benefited from the intervention since the intervention tends to raise the favorable outcome rate proportionately more for the disadvantaged group while decreasing the adverse outcome rate proportionately more for the advantaged group.

Focusing on declining adverse outcomes, Victora et al. show how the relative differences in such outcomes may tend to decrease when the advantaged groups rate approaches or reaches a minimum achievable level, which decrease the authors consider to reflect a meaningful reduction in inequality. I had previously shown why the tendency for declines in adverse outcomes to be accompanied by increasing relative difference in such outcomes may be halted or reversed when the advantaged group's rate approaches what I termed an "irreducible minimum"[4] – a concept equivalent to what Victora et al. term the "minimum achievable level." But while a decrease in the relative difference in a declining adverse outcome ordinarily would suggest a meaningful reduction in health inequality (since it is contrary to the statistically driven pattern), it is questionable whether a decrease in the relative difference in a declining outcome should be regarded as a meaningful reduction in inequality when the decrease in the relative difference occurs because the advantaged group's rates has approached an irreducible minimum. For society's real concern is with the inequality in avoidable outcomes; and, even though the relative difference in adverse outcome rates may have decreased, relative differences in avoidable outcome rates may have continued to increase.[4,6]

(Of course, when the irreducible minimum has been not merely approached, but achieved, in which case the advantaged group's rate of the avoidable adverse outcome is zero, further reductions in the rate of the disadvantaged group would seem to suggest a meaningful reduction in disparity. But the avoidable adverse outcome ratio would be undefined at that point.)

The inverse equity hypothesis of Victora et al. – including the pattern whereby improvements in care will initially increase then reduce inequalities – has been recently cited in support of a view that overall improvements in health would tend to reduce inequalities by authors who examined health inequalities in terms of absolute differences between rates of achieving certain blood pressure controls.[7] The authors regarded the reductions in absolute differences they observed as involving the same phenomenon identified by Victora et al. It is true that there are circumstances where improvements in health care will tend to first increase, then later reduce, absolute differences between rates (which difference, of course, is the same for the favorable as the adverse outcome). But those circumstances are entirely different from those involved in the reversal of patterns of relative differences in adverse outcomes. As discussed in references 2-6, improvements in health tend to increase relative differences in adverse outcomes across almost the entire spectrum of prevalences of the favorable outcome – that is, until the adverse outcome is so rare as to be deemed difficult or impossible to further reduce, as in the case, for example, of infant mortality in some European countries [6] or among especially advantaged segments of particular populations. By contrast, absolute differences between rates tend to increase as a rare outcome becomes fairly common and tend to decline as a rather common outcome becomes even more common (as explained,

for example, in references 5, 6, 8, 9 and in some detail on the Scanlan's Rule page of jpscanlan.com).

The patterns by which various measure tend to change solely as a result of changes in overall prevalence, to be sure, are merely tendencies that can be mitigated or enhanced by various factors, including meaningful changes in inequalities. But without understanding these tendencies it is impossible to recognize meaningful changes in health or healthcare inequalities. Similarly, without understanding these tendencies, it impossible to develop sound theories about the mechanisms underlying such changes.

References:

1. Victora CG, Vaughan JP, Barros FC, et al. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet* 2000;356:1093-1098.

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

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

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

7. Ashworth M, Medina J, Morgan M. Effect of social deprivation on blood pressure monitoring and control in England: a survey of data from the quality and outcomes framework. *BMJ* 2008;337:a2030.

8. Scanlan JP. 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://journalreview.org/v2/articles/view/16107620.html

9. Scanlan JP. Can We Actually Measure Health Disparities?, presented at the 7th International Conference on Health Policy Statistics, Philadelphia, PA, Jan. 17-18, 2008):
http://www.jpscanlan.com/images/2008_ICHPS_Oral.pdf