The material below is a version of:

Scanlan JP. Study raises a number of issues about analyzing disparities between and among demographic groups. *Journal Review* march 23, 2009 (responding to Harper S, Lynch J, Meersman SC, *et al.* Trends in area-socioeconomic disparities in breast cancer screening, mortality, and survival among women ages 50 years and over (1987-2005). *Cancer Epidemiol Biomarkers Prev* 2009;18(1):121-131): http://journalreview.org/v2/articles/view/19124489.html

The compression function of journalreview.org eliminated the paragraph breaks. Those breaks have been restored.

Title: Study raises a number of issues about analyzing disparities between and among demographic groups

Harper *et al.*[1] attempted to analyze changes in area-socioeconomic and race-ethnic disparities in certain breast cancer-related health and healthcare outcomes between 1987 or 1992 and 2004. Several aspects of the study warrant comment: (a) the measuring of disparities in terms of relative differences in adverse outcomes without acknowledgment that choosing to do so could affect the identified direction of change or addressing the implications of the effects of overall prevalence on relative differences between rates; (b) the treating of differences adverse to advantaged groups the same as differences adverse to disadvantaged groups; and (c) the measuring of disparities across all groups.

A. Measuring Disparities in Terms of Relative Differences in Adverse Outcomes

Though the title of the Harper article refers to certain favorable outcomes like breast cancer screening and breast cancer survival, the authors make clear in the Materials and Methods section that all outcomes are examined in terms of adverse outcomes (*i.e.*, in the case of screening, the absence of screening; in the case of survival, mortality). In noting such fact, the authors cite articles by Keppel and Pearcy [2] and Keppel *et al.*[3] for the proposition that whether one examines the favorable or the adverse outcome may affect the magnitude of ratio measures of health disparities.

While both references make such point, both also make the much more important point that whether one examines the favorable or the adverse outcome can affect the direction of change in relative differences. Such point raises the difficult question of whether one can support a determination that a disparity has increased or decreased when the choice of whether to measure relative differences in the favorable outcome or in the adverse outcome dictates the results. But, by ignoring a key point of their references, Harper *et al.* avoid that issue.

Further, the articles by Keppel and Pearcy and Keppel *et al.*, which cited references 4 and 5 below for the proposition that determinations of the direction of changes of disparities could turn on whether one examines the favorable or the adverse outcome, did so without

mention that those references in fact maintained that relative differences in one outcome and relative differences in the opposite outcome would tend to change systematically in opposite directions as the overall prevalence of an outcome changed.[4-6] Such tendency, which is also elaborated upon and illustrated in reference 7, as well as in about 100 references made available on the Measuring Health Disparities page (MHD) of jpscanlan.com., heightens the significance of the issue ignored by Harper *et al*.

While the abstract highlights the study's finding that relative area-socioeconomic differences in mammography increased by 161%, that figure is in fact the figure for relative differences in failure to receive mammography. The story is quite different for relative differences in receipt of mammography, which substantially decreased.

I cannot replicate the concentration index approach employed by the authors (nor, for reasons set out in Section C, do I think it very useful to do so). But Table A (which can be accessed by this link) illustrates the implications of choosing to rely on relative differences in adverse outcomes rather than relative differences in favorable outcomes with regard to the three issues as to which disadvantaged groups consistently have worse outcomes than advantaged groups (*see* Section B), as well as the problem with reliance on either relative difference to appraise the comparative size of disparities at different points in time.

The first two rows in the table address the socioeconomic disparity in mammography/no mammography between the groups with the best and worst rates. It shows that, consistent with the findings of Harper *et al.* as to the change in relative disparity in adverse outcomes across all groups, the relative difference in failure to receive mammography between the groups with the best and worst rates increased substantially (from a situation where persons in the disadvantaged group were 30% more likely to fail to have a mammogram to one where they were 98% more likely, an increase in the relative difference of more than 200%). But it also shows that the relative difference in receipt of mammography decreased substantially (from a situation where persons in the disadvantaged group were 52% less likely to receive mammography to one where they were 29% less likely, a decrease in the relative difference of about 45%).

The final column shows the size of the disparity at the two points in times using a method that in theory ought not to be affected by the overall prevalence of an outcome. The method, described more fully on the Solutions sub-page of MHD, derives a difference between means of hypothesized underlying distributions of risk in terms of percentages of a standard deviation. This method reveals a very slight increase in the disparity (from .60 standard deviations to .62 standard deviations). Thus, while there may in fact have been a meaningful increase in the disparity (that is, meaningful in the sense of being other than the consequence of the change in overall prevalence), by no means was such increase on the order of the size suggested by the proportionate increase in the relative difference in the adverse outcome.

(Because there occurred here a larger percentage increase in the relative difference in the adverse outcomes than percentage decrease in the relative difference in the favorable

outcome, and the method theoretically unaffected by overall prevalence also showed an increase in the disparity, some might be inclined to attach significance to the comparative size of the contrary changes in the two relative differences. Such an interpretation is not warranted. As shown in Table 1 of reference 8, the comparative sizes of percentage increases or decreases will tend to be substantially influenced by the prevalence range at issue. As discussed below, however, one might infer a meaningful change in the disparity in circumstances where both relative differences change in the same direction.)

While it is in the case of the changes in the socioeconomic gradient in mammography highlighted by the authors that one observes the most striking contrast between the changes in the two relative differences, the patterns of changes for other outcomes set out in Table A also warrant discussion. In the case of the socioeconomic disparity in late diagnosis, where the authors found a decrease in the relative disparity (again, through a method that analyzes the disparity across all socioeconomic levels), Table A shows a decrease in both the relative differences in the adverse outcome and the relative difference in the favorable outcome. When both relative differences change in the same direction, one may infer that there in fact occurred a meaningful change in the disparity (in the same direction as the changes in the relative differences)[4,7] – in this instance a decrease – which one also finds through the methodology underlying the final column on the table (from .18 to .14 standard deviations).

In the case of socioeconomic differences in 5-year survival/mortality, where Harper *et al.* found an increase in the relative disparity, Table A shows an increase in the relative difference in the adverse outcome but a decrease in the relative difference in the favorable outcome. And the methodology underlying the final column indicates no change at all.

Harper *et al.* also measured race-ethnic disparities across groups, with the relative disparity analyzed in terms of the mean log deviation. As with the concentration index, I cannot replicate those analyses (and, as with the concentration index, it does not seem useful to do so). But it is still useful to briefly discuss, for the three outcomes where rates of whites were consistently better than rates of both blacks and Hispanics, the overall findings of Harper *et al.* and the patterns of changing relative differences in adverse outcomes underlying those findings, as well as changes in other measures.

In the case of mammography/no mammography, Harper *et al.* found an increase in the relative race-ethnic disparity. For the black-white disparity, Table A shows an increase in the relative difference in the adverse outcome but a decrease in the relative difference in the favorable outcome. The methodology underlying the final column shows an increase in the disparity (from .07 to .09 standard deviations). For the Hispanic-white disparity, Table A also shows an increase in the relative difference in the adverse outcome but a decrease in the relative difference in the favorable outcome. But in this case, the methodology underlying the final column shows a decrease in the disparity (from .26 to .22 standard deviations.). Thus, to the extent that changes in disparities can be measured in a way that is not affected by changes in overall prevalence, the black-white disparity and the Hispanic-white disparity changed in opposite directions.

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In the case of late diagnosis, Harper *et al.* found a decrease in the relative race-ethnic disparity. For the black-white disparity, Table A shows decreases in both the relative difference in the adverse outcome and the relative difference in the favorable outcome. As discussed above, such pattern suggests a meaningful decrease in the disparity, which is also indicated by the methodology underlying the final column (from .34 to .22 standard deviations). By contrast, for the Hispanic-white disparity, Table A shows increases in both the relative difference in the adverse outcome and the relative difference in the favorable outcome. For reasons just mentioned, this pattern suggests a meaningful increase in the disparity, which is also indicated by the methodology underlying the final column (from .15 to .18 standard deviations). Thus, again the black-white and the Hispanic-white disparities appear to have changed in opposite directions.

In the case of racial differences in 5-year survival/mortality, Harper *et al.* found an increase in the relative race-ethnic difference. For the black-white disparity, Table A shows an increase in the relative difference in the adverse outcome but a decrease in the relative difference in the favorable outcome. The methodology underlying the final column shows a very slight decrease in the disparity (from .44 to .43 standard deviations). For the Hispanic-white disparity, Table A also shows an increase in the relative difference in the adverse outcome but a decrease in the relative difference in the favorable outcome. But in this case the methodology underlying the final column shows a very slight increase in the disparity (from .11 to .12 standard deviations). Thus, once more the black-white and Hispanic-white disparities appear to have changed in different directions, though the change seems negligible in both cases.

While this comment is principally concerned with relative differences, the authors also show results of absolute differences (using their across-group methodologies). For instant purposes it suffices to note that while absolute differences between rates are the same whether one examines favorable or adverse outcomes, like relative differences, absolute differences are problematic for appraising changes over time because absolute differences are also affected by the prevalence of an outcome. As discussed Section E.4 of MHD and the references identified therein, as well as in the introductory materials of the Scanlan's Rule page of the same site, increases in relatively uncommon outcomes tend to increase differences between rates while increases in relatively common outcomes tend to decrease absolute differences. Consistent with these tendencies, Table A shows decreases in absolute differences for all differences except for mammography as to the socioeconomic and the black-white comparisons and for late diagnosis as to the Hispanic-white comparison. In the case of mammography, the prevalences were originally in ranges where increases in prevalence would tend to increase absolute differences but increased to ranges where further increases tend to reduce absolute differences. Hence, identifying an expected pattern of change is difficult, though, as discussed, the method underlying the final column found small increases in as to both disparities. In the case of late diagnosis, throughout the period examined the Hispanic-white prevalences were in ranges where further increases in overall prevalence would generally tend to reduce absolute differences, and where a contrary pattern might be suggestive of a meaningful

increase in the disparity. As noted, the method underlying the final column also showed an increase in the disparity.

B. Treating Differences Adverse to Advantaged Groups the Same as Differences Adverse to Disadvantaged Groups

Few question that disadvantaged groups, whether defined by race/ethnicity or some measure of socioeconomic status, frequently receive poorer healthcare and experience greater rates of adverse health outcomes than more advantaged groups. These patterns are typically called "health disparities" or "health inequalities." Most people regard them as important societal concerns and believe that efforts should be made to address them.

But there also exists some situations where advantaged groups are somewhat worse off with regard to some health outcome. These are quite a different matter from the disparities just mentioned. The rates at which advantaged groups experience these outcomes are an important societal concern as a general matter, at least because advantaged groups often comprise the majority of the population (and sometimes because the fact that disadvantaged groups have better rates may indicate that the rates of the advantaged groups can be improved). But whether the disparities aspect of the matter constitutes a societal concern is far from clear. In any event, it seems to makes little sense to group these disparities along with disparities adverse to disadvantaged groups in a disparities study.

That, however, is what Harper *et al*. have done here. The higher figures for breast cancer incidence and mortality of advantaged groups are treated as health disparities in exactly the same way as are the worse figures for disadvantaged groups for mammography, late-stage diagnosis, and 5-year survival. Indeed, the most striking disparities reduction noted in the abstract – the roughly 100% reduction in the area-socioeconomic disparity for mortality – involves a situation where a seemingly substantial relative difference in mortality adverse to higher socioeconomic groups was transformed into a slight difference adverse to disadvantaged groups. While that matter is eventually clarified in the study, many readers might not get that far.

Whether the worse outcomes for advantaged groups should be treated as disparities at all is doubtful. But it certainly is unwise to group them along with disparities adverse to disadvantaged groups. Such grouping is especially unwise with regard to cancer mortality in the instant case (that is, overall breast cancer mortality in the population as distinguished from the five-year survival/mortality among persons who have breast cancer), where reductions in the area-socioeconomic disparities in diagnosis and care would tend to toward increasing, rather than decreasing, the difference in mortality rates originally adverse to more advantaged groups.

C. Measuring Disparities across the Entire Range of Groups

Endeavoring to measure changes in disparities across multiple groups, Harper *et al*. rely on the relative and absolute concentration index for the analyses of socioeconomic

differences and the mean log deviation and the between group variance for race-ethnic differences. These approaches are affected by both changes in the rates of various groups and changes in the proportion each group comprises of the total population. It is doubtful that such approaches add anything but confusion to analyses that examine differences between pairs of groups even for the socioeconomic analysis. But in the case of the race-ethnic analysis, such approaches utterly obscure the crucial questions.

For example, there exist many differences between the health status of blacks and whites and between the health status of Hispanics and white, the two largest minority groups. For reasons illustrated in Section A above, as well as in numerous references on MHD, attempting to determine whether these differences are increasing or decreasing is extremely difficult given that all standard measure of differences between rates are systematically affected by the overall prevalence of an outcome. But, even if only blacks and whites were involved, the approach employed by Harper *et al.* would allow changes in the relative size of the black and white population to affect the interpretation of changes in disparities. That is, even if the rates of both groups remained the same, the determination of the amount of disparity could be altered by a change in the relative sizes of the two populations. But in fact the determinations of changes are influenced by the changing size of any of the race-ethnic groups in the analysis. Equally important, however, as shown in Section A, the disparities between whites and each of these two groups can change in opposite directions. Further, the third largest minority group, Asian and Pacific Islanders, have health outcomes equal to or better than whites on most indicators. Allowing changes in disparities adverse to white also to affect the results additionally confuses the matter.

Thus, rather than attempting to determine whether there has occurred a change in the disparity between any two groups (whether defined by race-ethnicity or neighborhood poverty level), something that is extremely difficult to do in any case, the authors have but further obscured that issue by intertwining this issue with other matters. Until researchers have mastered ways of evaluating the size of the difference between the rates at which two groups experience an outcome that is unaffected by the prevalence of an outcome, it is a mistake to include any other matters in the analysis.

References:

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