[Below is a version of the *Journal Review* comment that may be found at http://journalreview.org/v2/articles/view/12594194.html. As a result of the compression function of the *Journal Review* cite, the *Journal Review* version is somewhat difficult to follow. The version below is also corrected with regard to several minor textual errors.]

Identifying meaningful differences in inequalities in revascularization rates in different settings

By: James Scanlan - Fri 5/09/2008 PM

Hetemaa et al.[1] found that during a period of increasing availability of cardiac revascularization procedures in Finland, socioeconomic and gender inequalities in the use of such procedures, measured in terms of relative differences in rates of receipt of the procedures, declined. In a January 27, 2007 comment on the Hetemaa article on the Journal of Epidemiology and Community Health web site,[2] I explained the statistical pattern whereby, as outcomes increase in overall prevalence, relative differences in experiencing such outcomes tend usually to decrease while relative differences in failing to experience the outcome tend usually to increase. Thus, I explained, it was open to question whether inequalities had decreased in any meaningful sense.

An upcoming presentation on health inequalities measurement issues in Helsinki, as well as some further thinking on certain issues raised in the Hetemaa article, prompt me to give some detailed attention to the patterns exhibited by the data in the Hetemaa study.

Table A to this comment, which can be accessed at Hetemaa Comment Tables, is based on the information in Hetemaa's Table 1. Using persons hospitalized for cardiac heart disease (CHD) as the pool of persons who might receive revascularization procedures, Table A presents certain information regarding the 1988 and 1996 revascularization rates of the groups most and least likely to receive revascularization. To facilitate comparisons across years, the identification of the most and least likely groups is based on the 1988 figures (though the most likely group is the same in both years for all socioeconomic/educational categories and the least likely group is the same in most cases).

The table first presents the rates of receiving revascularization and the rates of failing to receive revascularization. It then shows the relative difference between rates of receiving revascularization and the relative difference between rates of failing to receive revascularization, as those figures would typically be calculated (that is, with the disadvantaged group's rate as the numerator in all cases, as discussed in references 3 and 4). And we observe with respect to those relative differences that, as typically happens when an outcome increases in overall prevalence, relative differences in experiencing the outcome decreased while relative differences in failing to experience the outcome increased (except in the case of social class differences among women where the relative difference in failure to receive revascularization declined).

Thus, as discussed in references 3 and 4, the approach of the US National Center for Health Statistics (NCHS), which measures all health and healthcare inequalities in terms of relative differences in adverse outcomes, the inequalities would be deemed to have increased in all cases but one. As also discussed in those references, the US Agency for Healthcare Research and Quality (AHRQ), which is responsible for the National Healthcare Disparities Report, would measure the inequalities in terms of whichever relative difference (in the favorable or the adverse outcome) is larger. Since here the former relative difference is larger than the latter in all cases, AHRQ would rely on relative differences in rates of receipt of revascularization and thus regard the inequalities to have declined in all cases. I note the approaches of these agencies not to suggest that either is a useful one. On the contrary, inasmuch as neither takes into consideration the way each relative difference tends typically to change as the overall prevalence of an outcome changes, neither is useful. But I note these approaches (as well as the use of absolute differences and odds ratios discussed in the next paragraphs) to emphasize the implications of the varying approaches to measurement in this area.

Table A also presents ratios of rates of receiving the procedure (Ratio 1) (with the advantaged group's rate of receiving the procedure as the numerator) and ratios of rates of failing to receive the procedure (Ratio 2) (with the disadvantaged group's rate of failing to receive the procedure as numerator). As explained in references 3-11, the relationship of these ratios provides a basis for determining whether, as an outcome increases in prevalence, the absolute difference between rates would tend to increase or to decrease. Where Ratio 1 is larger than Ratio 2, increases in the prevalence of the outcome would tend to be accompanied by increases in absolute differences between rates; but where Ratio 2 is larger than Ratio1, increases in the prevalence of the outcome tend to be accompanied by decreases in absolute differences between rates. Since Ratio 1 is invariably larger than Ratio 2 in both years, the standard pattern would be for further increases in the procedures to be accompanied by increases in absolute differences between rates, which we in fact observe in Table A for all cases except for the social class difference among women. Thus, researchers who evaluate healthcare inequalities in terms of absolute differences between rates, such as the authors of most of the studies to which references 5-8 respond, would regard the inequalities to have increased in most cases. But, as with the contrasting interpretations of patterns of relative differences, the interpretations would lack a sound basis because of the failure to consider the way the measure typically changes in the circumstances. (While not wishing to unduly complicate this comment, for purposes of completeness I include odds ratios in Table A. As discussed in various places, differences measured in odds ratios tend to change in the opposite direction of absolute differences, which here would mean a decrease in differences measured by odds ratios. Consistent with typical patterns of change in the circumstances, Table A (as well as Table B, discussed below) shows decreases in odds ratios in each case.)

As to whether inequalities changed in some meaningful sense – that is, changed in a way that was not simply a function of the change in overall prevalence – the only instance in which such change might be inferred on the basis of a departure from the usual pattern involves the aforementioned social class difference among women. There the atypical decline in the relative difference between rates of failing to receive revascularization and the atypical decline in the absolute difference could be cautiously regarded as indicating a meaningful decline in the social class disparity. In references 8-11, and a few other places (listed in Section E.6 of this page: MHD.) I have also described an approach to measuring disparities between rates that ought usually to be unaffected by changes in overall prevalence. Specifically, based on the rates at each point in time, the approach derives a difference between means of hypothesized underlying normal distributions of factors associated with an outcome. The approach is somewhat speculative given that we cannot observe the actual nature of the underlying distributions. But to my mind the approach is superior to anything else so far developed and is certainly superior to the simple reliance on the standard measures of differences between rates without regard to the way the measures tend usually to change solely because of a change in the overall prevalence of an outcome.

In any event, the results of that approach are set out in the last column of Table A. Such results indicate that for each type of comparison, the inequality in likelihood of receiving revascularization declined. The largest such decline (from .46 to .12 standard deviations) occurred in the case of the social class difference among women, which is consistent with the fact that the decline in inequality in that case was sufficient to outweigh the tendency for relative differences in rates of failing to receive revascularization and absolute differences between rates to increase as revascularization rates increased generally.

Table B, which can be accessed on the same web page as Table A, provides similar information with regard to gender differences in revascularization rates. Each of the standard measures of inequality by gender changed as would be expected in the circumstances (according to the reasoning set out above). That is, relative differences in receipt of revascularization declined, relative differences in rates of failing to receive revascularization increased, and absolute differences between rates increased. But as reflected in the final column, the approach just described indicates that the inequality declined from .39 to .29 standard deviations between 1988 and 1996.

Hetemaa et al. also use figures on CHD mortality as a proxy for the pool of persons eligible for revascularization. Even though such pool is actually smaller than the universe of persons receiving revascularization, because the proportion that each group being compared comprises of the pool is known, such pool allows one to calculate relative differences in rates of receiving revascularization. But because such pool does not enable one to determine the actual rates of each group, it does not allow one to calculate any of the other measures of difference. For purposes of illustration, consider two situations where we know that the disadvantaged group comprises 30% of the pool but only 20% of the persons selected to receive the desired outcome. Regardless of the size of the pool or number of selections, we can determine that the selection rate of the advantaged group is 1.7 times that of the disadvantaged group((80/70)/(20/30)). But we cannot derive the other standard measures of difference and we cannot calculate the difference between means of the underlying distributions. Thus, for example, consider one situation where the pool is comprised of 200 persons from which 100 are selected and another situation where the pool is comprised of 1000 persons from which 100 are selected. In the first case the rate of the disadvantaged group would be 33.3% (20/60) and the rate of the advantaged group would be 57.1% (80/140); in the second the rate of the disadvantaged group would be 6.7% (20/300) and the rate of the advantaged group would be 11.4% (80/700). The advantaged group's selection rate would be 1.7 times the disadvantaged group's rate in either case. But the other standard measures of differences between rates would differ substantially in the two cases. And, while the former situation would be consistent with a difference between means of distributions of factors associated with selection of .63 standard deviations, the latter would be consistent with a difference of .30 standard deviations.

Hetemaa et al. note the difficulties of assessing the implications of gender differences in coronary operation rates in light of gender differences in symptoms, natural history, and prognosis of CHD. But they find smaller gender differences in revascularization rates in districts with higher rates than districts with lower rates to suggest "that gender inequities favoring male patients persisted in access to coronary operations in the mid-1990s." If I understand the reasoning correctly, they find evidence of an inappropriate influence of gender on revascularization decisions on the basis of the fact that such influence was larger where resources were scarcer. I do not necessarily disagree (or agree) with that reasoning. But a problem with basing a conclusion on the existence of larger relative differences in revascularization rates in the districts with lower overall rates is that, for reasons explained above, the larger relative differences in revascularization rates in such districts does not mean that the influence of gender on decisions in such district is greater than in other district with higher overall rates and smaller relative differences in revascularization rates (though, probably, larger relative differences in rates of denial of revascularization). As noted above, however, the procedure underlying the last column of Table B supports an inference that the influence of factors associated with gender on the decision-making process did grow smaller over time, and, hence, that such influence did grow smaller as resources became less scarce. But the interpretation of the implications of that diminishing influence remains a matter of some complexity.

Finally, returning to the issues of the usual patterns of changes in standard measures of differences between rates as an outcome changes in overall prevalence, I note for comparisons purposes that the second and third rows of the table supporting reference 11 (a comment on a study of changes in racial differences in the use of medical procedures and diagnostic tests among elderly Americans between 1986 and 1997) show the same patterns as observed (usually) in the data from the Hetemaa study. That is, as revascularization procedures grew more common, relative differences in receiving the procedures declined, relative differences in failing to receive the procedures increased, and absolute differences between rates increased. Also, as with the Hetemaa study, the measurement approach that derives differences between hypothesized means showed a decline in such difference.

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