Mortality and Survival: The Curious Relationship between Relative Differences in Mortality and Relative Differences in Survival (Feb. 2, 2010; rev Dec. 24, 2011)

Format note: This is a PDF version of the Mortality and Survival page of jpscanlan.com, with endnotes converted to footnotes.

Summary: This item principally addresses the pattern whereby relative differences in mortality and relative differences in survival tend to change in opposite directions as mortality changes in overall prevalence. The item gives special attention to the way, particularly with regard to cancer disparities issues, researchers discuss one relative difference while examining the other without realizing that one may commonly reach different conclusions depending on which relative difference is analyzed. Usually the names of the journals in which references are published are mentioned in the text because it is the journals that are principally at fault in this area. Researchers can hardly be blamed for failing to understand issues the journals and their statistical consultants fail to understand. And while researchers can be faulted for failing even to set out the rates that would allow a reader to reappraise the researchers' conclusions, a greater fault lies with the journals that permit such practices.

[1] In the many places where I have described the statistical pattern whereby 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 (which, following Bauld et al.,[1] I lately have called "Scanlan's Rule," sometimes identified as "SR" herein), I have often noted the pattern whereby declining mortality will tend to lead to increasing relative differences in mortality and decreasing relative differences in survival (unless, that is, other factors outweigh one tendency while enhancing the other). See, e.g., among items found according to the way they are listed in Section A of the Measuring Health Disparities page (MHD) of jpscanlan.com, A1 (*Plain Dealer* 1987), A3 (*Public Interest* 1991), A5 (*Chance* 1994), A10 (*Society* 2000), and A12 (*Chance* 2006).[1] And I commonly point out that in fact during a period of substantial decreases in infant mortality in the United States, increasing racial differences in infant mortality were accompanied by declining racial differences in infant survival. Though I have criticized the way the National Center for Health Statistics (NCHS) has dealt with issues regarding the way measures of differences between outcome rates are affected by the prevalence of an outcome (see, e.g., *Chance* 2006 and Section A.6 of the Scanlan's Rule page, as well as the discussion several paragraphs below), I note that NCHS has at least acknowledged the association between increasing relative differences in infant mortality and declining relative differences in infant survival.[2,3]

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[1] The complete references for these items are: The "feminization of poverty" is misunderstood. *The Plain Dealer* Nov 11, 1987 (reprinted in *Current* 1988;302(May):16-18 and *Annual Editions: Social Problems 1988/89.* Dushkin1988; The perils of provocative statistics. *The Public Interest* 1991;102:3-14: Divining difference. *Chance* 1994;7(4):38-9,48; Race and mortality. *Society* 2000;37(2):19-35 (reprinted in *Current* 2000 (Feb)); Can we actually measure health disparities? *Chance* 2006:19(2):47-51.

But, as with other aspects of Scanlan's Rule, the way relative differences in mortality and survival tend to change systematically in opposite directions as mortality declines (or increases) has otherwise been almost universally overlooked.[2] In Race and Mortality (*Society* 2000), I noted that observers had even casually referred to increasing differences in survival in the discussion of increasing relative differences in mortality, without recognizing that the relative difference in survival had actually decreased, an allusion to a 1995 *American Journal of Public Health* study by Singh and Yu.[4] In Race and Mortality, I also discussed the way that within advantaged subpopulations (where adverse outcomes are less common) relative differences in adverse outcomes tend to be large while relative differences in favorable outcomes tend to be small, referencing a 1992 *New England Journal of Medicine* study by Schoendorf et al.[5]. That much-publicized study found large racial differences in infant mortality where parents were college-educated, a finding that led some to wonder whether genetic differences might underlie racial differences in infant mortality without understanding that large relative differences in an outcome are driven by the low overall prevalence in the setting. I have often made the same point about the observed large relative differences in adverse outcomes in various advantaged subpopulations, including with regard to the steep mortality gradient observed among British civil servants in the Whitehall Studies, as in *Chance* 2006 and BSPS 2006, as well as the references in Section E.1 of MHD and B.5 of the Scanlan's Rule page.

The pattern whereby the lower the mortality within a subpopulation, the larger will tend to be the relative difference in mortality and the smaller will tend to be the relative difference in survival is also evident when one examines racial or socioeconomic difference by age group, as discussed in BSPS 2006 and as illustrated in Table A of the Irreducible Minimums sub-page of MHD and the Life Tables Illustrations sub-page of SR. (As also discussed on the Irreducible Minimums sub-page, in various contexts, irreducible minimums may have an impact on patterns of relative differences in mortality and survival; but the matter seems unlikely to be of particular consequence to the instant discussion.)

A similar illustration may be found in Table 1 below. Using data from a 2006 *Journal of the American Dental Association* article by Morse and Kerr,[6] Table 1 shows the patterns of relative differences in five-year survival and mortality rates by age group for black and white patients with oral and pharyngeal cancer. While there are some exceptions,[3] at least until the over-75 group, the predominant pattern is one whereby, as

[2] See Section E.7 of MHD for a discussion of the agreement or disagreement with my descriptions of the ways measures of differences between rates tend to be correlated with the overall prevalence of an outcome.

[3] The reader solely of this item should not be misled to think that the described tendencies always dictate the outcomes. The observed patterns will invariably be a function of (a) the size of the difference between the distributions (and the larger such difference, the larger will be every measure of difference between rates) and (b) the prevalence of the outcome. This is discussed in, among many other places, Race and Mortality, BSPS 2006, Comment on Huijts, Comment on Eikemo. See Section A.9 of the Scanlan's Rule page and the note *infra* regarding the Henry article for discussion of some of the reasons the statistical tendencies may be more predominant with regard to some types of comparisons than others.

survival rates decline generally, relative differences in survival rates increase while relative differences in mortality rates decline. Although it involves something of a digression from the main point of the instant item, the final column shows the "EES" or "estimated effect size," reflecting a measure of differences in outcomes theoretically unaffected by the overall prevalence of an outcome (as described, among other places, on the Solutions sub-page of MHD[4]). Warranting note is a comparison of the relative differences in mortality and survival for men under age 45 with those in the 65-74 group. The relative difference in mortality is substantially greater among the younger group while the relative difference in survival is substantially greater among the older group.[5] The EES suggests that within the two age groups racial differences are about equal.

Table 1: Five-year survival and mortality ratios by age group (based on Morse et al.)

Gen	Category	WSurv	BSurv	WMort	BMort	W/BSurvRatio	B/WMortRatio	EES
M	< 45	76.70%	51.10%	23.30%	48.90%	1.50	2.10	0.72
M	45-54	66.10%	34.10%	33.90%	65.90%	1.94	1.94	0.85
M	55-64	59.10%	30.80%	40.90%	69.20%	1.92	1.69	0.75
M	65-74	56.30%	29.70%	43.70%	70.30%	1.90	1.61	0.71
M	≥ 75	50.50%	17.10%	49.50%	82.90%	2.95	1.67	0.99
F	< 45	86.30%	70.50%	13.70%	29.50%	1.22	2.15	0.56
F	45-54	73.20%	50.50%	26.80%	49.50%	1.45	1.85	0.62
F	55-64	66.10%	48.30%	33.90%	51.70%	1.37	1.53	0.48
F	65-74	57.20%	37.80%	42.80%	62.20%	1.51	1.45	0.51
F	≥ 75	45.70%	42.80%	54.30%	57.20%	1.07	1.05	0.08

A similar illustration may be found in the Comment on Berrington de Gonzalez NEJM 2010, where the authors found that the relative effects of high body mass index on mortality decreased with age, but where the relative effects on survival increased with age.

Frequently, authors either make broad references to differences in survival, or specifically purport to be examining differences in survival, when they are in fact examining differences in mortality. Of course, where there are differences in survival rates there will be differences in mortality rates. But as suggested above, whether one in

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[4] The approach involves deriving from a pair or rates the difference, in terms of percentage of a standard deviation, between means of hypothetical underlying (normal) distributions of risk of experiencing the outcome. As discussed in a recently-added introductory note to the Solutions sub-page and a Second Comment on Morita, a probit analysis yields the same result. See Truncation Issues sub-page of SR for additional treatment of the problems with the approach when the groups analyzed are truncated portions of larger populations, as in the case, for example, of the analysis of control of hypertension among persons deemed hypertensive. The point is further developed with respect to the difference between analyzing differences in rates of surviving to certain ages and differences in rate of surviving from one age to the next in the Life Tables Illustrations sub-page of SR and the Cohort Considerations sub-page of MHD.

[5] See note *infra* regarding the Baker and Middleton study regarding my practice of recent years of reversing the numerators in the two rate ratios that both are greater than 1.

fact examines relative differences in mortality or relative differences in survival will have important implications if one is appraising changes over time or the size of differences within subpopulations or with respect to particular conditions.

In any case, I recently posted a Comment on Gregory addressing Gregory et al.[7] a 2009 *British Medical Journal* article, and a Comment on Harper addressing Harper et al.,[8] a 2008 article in *Cancer Epidemiology Biomarkers and Prevention* (*CEBP*), both of which involved discussions of survival (or other favorable outcome) disparities while in fact examining adverse outcome disparities. And in observing a number of recent articles raising the same issue, I came to realize that this pattern of discussing survival disparities but analyzing mortality disparities seems especially common with regard to cancer-related disparities (as in the study by Harper et al. just mentioned). There seem to be two related reasons for this. The first is that most rates of cancer survival (or mortality) are in ranges where the choice of which outcome to analyze seems less obvious to the researcher than in the case of many other health issues (though not healthcare issues, as discussed in [2] and [3] *infra*). The second, which likely stems somewhat from the first, is that cancer prognoses are so often couched in terms of x-year survival rates. For the same reasons, regardless of whether the authors correctly characterize what they are analyzing, there is more variation as to which outcome is analyzed than in the case of most other health outcomes.

A much-publicized 2009 article in *CEBP* by Tehranifar [9] illustrates several aspects of the matter. The article purported to analyze relative racial differences in cancer survival according to level of treatability. But it in fact analyzed relative differences in mortality. As discussed above, SR would tend toward causing larger relative differences in mortality rates among more treatable cancers (where mortality is lower) but smaller relative differences in survival rates among those cancers. Unfortunately, the authors presented no actual survival rates for any cancers and only graphically presented the survival rates according to level of treatability. Figure 1 of the article nevertheless allows one to derive estimates of the actual rates, and, for example, those estimates indicate that the black-white relative difference in mortality and survival both increase with increasing level of treatability. That would tend to indicate that, in a meaningful sense, the difference in factors driving black-white outcome differences are greater for more treatable cancers than for less treatable cancers. But, as discussed below, data on particular cancers might show varying patterns. And with regard to all treatable cancers, as treatment improves and survival rates increase further, the increases in survival rates may well be attended by decreasing relative differences in survival but increasing relative differences in mortality.[6]

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[6] Data in a 2009 *International Journal of Health Geographics* by Henry et al.[10] provide a useful illustration with regard an aspect of cancer severity that is akin to treatability. Table N1 below is based on survival rates shown in Table 2 of Henry et al. on five-year rates of survival from colorectal cancer for various demographic groups, which were shown separately for localized cases and regional cases of the disease. Table N1 shows that relative differences in survival are smaller in localized cases (where survival is more common), while relative differences in mortality are smaller in regional cases (where mortality is more common).
[note continued on next page]

Issues regarding particular cancers and the importance of distinguishing mortality differences from survival differences can be further illustrated by two articles that caught my attention when creating the first few (early February 2010) versions of this item. In a 2002 article in the *Journal of the American Medical Association*, Bach et al.[11] undertook to "estimate the magnitude of overall and cancer-specific survival differences between blacks and whites who receive comparable treatment for similar-stage cancer." But the authors in fact analyzed differences in terms of relative differences in mortality, finding such differences generally to be modest, save for breast cancer, cancer of the uterine corpus, and cancer of the bladder. In order to understand the true meaning and implications of these findings as to different types of cancer, one would need to see the actual rates (not shown in the article). One could then determine whether the observed patterns might be different if one in fact examined survival rather than mortality and also endeavor to quantify the outcome differences in ways that are not affected by the overall prevalence of the outcome (as in the final column of Table 1 *supra*).

Data in a 2009 *CEBP* study by Jeffreys et al.[12], which analyzed socioeconomic differences in cancer survival in New Zealand in terms of relative differences in survival rates (that is, in the manner in which it purported to analyze the disparities), illustrate some of the potential for differences in interpretation in this area. The data in Table 2 of the study reveal that, for the three cancers specifically cited by Bach et al., breast cancer showed the 2nd largest relative differences in mortality rates (of 19 cancers where the most deprived group had poorer outcomes than the least deprived group) but the 14th largest relative difference in survival rates; uterine cancer showed the 3rd largest relative difference in mortality rates but the 9th largest relative difference in survival rates; and bladder cancer showed the 6th largest relative difference in mortality rates but the 10th largest relative difference in survival rates. Again, as discussed in note iii (or 3 in the pdf

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Table N1 Patterns of Relative Differences in Survival and Mortality of Localized and Regional Cases of Colorectal Cancer (from Henry et a.)

GroupType	Type	AG-DG	AGSurv	DGSurv	AG/DGSRatio	DG/AGMRatio	EES
Racial	Local	White-Black	92.20%	87.60%	1.05	1.59	0.27
Racial	Regional	White-Black	77.60%	65.70%	1.18	1.53	0.36
Area Poverty	Local	LowestPov-HighestPov	92.20%	87.90%	1.05	1.55	0.26
Area Poverty	Regional	LowestPov-HighestPov	73.20%	64.40%	1.14	1.33	0.26

Table 3 of the study presented survival rates within and without certain areas, which rates showed that the pattern as to the size of (within area/without area) relative differences in mortality was similar to the pattern as to relative differences in survival. This is hardly surprising because the without-area rates were all very similar. The size of the difference between reference rates is one of the factors affecting the extent to which the statistically-driven pattern will predominate. See also discussion in Section A.9 of Scanlan's Rule.

version) *supra*, to the extent that the effects of factors correlated with socioeconomic status would in a meaningful way have greater effect upon cancer outcomes for different cancers, such differences would tend towards increasing both relative differences for such cancers.

A 2007 *American Journal of Epidemiology* article by Robbins et al.[13] provides another illustration. The article purported to address survival disparities between black and white men in survival from prostate cancer, but analyzed relative differences in mortality. In the course of concluding that factors including grade, SES, and year of diagnosis explained the observed survival (actually mortality) disparity,[7] Table 4 of the study presented the effects of various factors separately on black mortality and on white mortality, showing, for example, that being in the highest SES category compared with the lowest reduced mortality by 44 percent for whites but only 33 percent for blacks. But the study did not present the actual rates, hence precluding one from determining whether, as there is reason to expect, one would observe the opposite patterns if one were in fact examining survival rather than mortality.[8]

The authors did present mortality figures broken down by under and over age 68, stating that "[b]ecause some have hypothesized that the survival disadvantage for Black men might be worse at younger ages, we also examined racial differences in death from prostate cancer after stratifying by age." They concluded that "the elevation in risk for Black men was quite similar above and below the median age at diagnosis." Table 2 below shows the mortality rates presented in the study, along with the black-white mortality ratios and the white-black survival ratios for both age groups. While I do not quarrel with the authors' conclusion that the mortality disparities were similar in the two groups, I note that one would reach different conclusions as to within which age group the disparity was larger (as well as how much larger) depending on whether one examined the mortality ratio or the survival ratio. The table shows that the mortality disparity was greater in the younger group while the survival disparity was greater in the older group. Digressing again, I note that the final column indicates the outcome disparities were exactly the same for the two age groups.

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[7] Since the discussion of the conclusion of the elimination of the mortality disparity by adjustment for certain factors may raise in the readers mind that the effect of the adjustment might differ as to the survival disparities, I note that (as discussed with regard to relative and absolute differences in the Second Comment on Lynch JECH 2006 and Section 3 of the Adjustment Issues sub-page of the Vignettes page of jpscanlan.com), so long as the adjustment technique involves attributing one groups' risk profile to the other, an adjustment should achieve the same proportionate reduction in each relative difference. While the proportionate reductions to the two relative differences may differ if the adjustment technique involves attributing the total risk profile to each of the two groups, I assume that even with such a technique, an adjustment that completely eliminated one relative difference would completely eliminate the other.

[8] As discussed, among other places, in *Public Interest* 1991 and *Society* 2000, based on the fact that socioeconomic differences in adverse outcomes tend to be greater among whites (where such outcomes are less common) than among blacks, there exists a perception that socioeconomic difference affect whites more than blacks. But one generally observes the opposite pattern if one examines socioeconomic differences in the favorable outcomes (which are less common among blacks than whites).

Table 2: Survival and mortality ratios by age group (based on Robbins et al.)					
AgeGroup	WhMort	BlMort	W/BSurvRatio	B/WMortRatio	EES
68 and above	11.50%	24.40%	1.17	2.12	0.52
under 68	6.90%	16.70%	1.12	2.42	0.52

Data made available in a 2009 study appearing in *Cancer Causes Control* by Keegan et al.,[14] which, while discussing various disparities in survival from Hodgkin lymphoma, analyzed disparities in mortality, also make it possible to examine the ways in which one might reach opposing conclusions about the comparative size of outcome disparities depending on whether one examines relative differences in survival or relative differences in mortality. See the Tables accompanying the Comment on Keegan, which also apply to the data the approach reflected in the final column of Tables 1 and 2 above.

Illustrative data are also found in the abstract to a 2009 *Journal of the National Cancer Institute* article by Albain et al.[15] (which though discussing survival disparities in its title apparently analyzed disparities in terms of relative difference in mortality). While I have not seen the entire article, the abstract presented some actual ten-year survival rates for blacks and whites. Table 3 illustrates how those rates showed that the comparative size of relative differences in survival for each type of cancer exhibited a pattern that was the reverse of that shown for relative differences in mortality.

Table 3: Survival and mortality ratios by cancer type (based on Albain et al.)					
Type	BSurv	WSurv	W/BSRatio	B/WMortRatio	EES
premenopausal breast cancer	68.00%	77.00%	1.13	1.39	0.27
postmenopausal breast cancer	52.00%	62.00%	1.19	1.26	0.26
advanced ovarian cancer	13.00%	17.00%	1.31	1.05	0.18
for advanced prostate cancer	6.00%	9.00%	1.50	1.03	0.21

[2] Because mammography or its absence, as well as the presence or absence of a variety of other screening procedures, importantly affect cancer mortality/survival, disparities in rates of receipt or nonreceipt of such procedures often will be discussed in articles on cancer-related disparities. It used to be that disparities in beneficial health procedures like cancer screening, immunization and prenatal care were measured in terms of relative differences in receipt of the procedure. And as such procedures were increasing in overall prevalence, relative differences tended to decline, and disparities were regarded as decreasing.

A 2003 *Journal of Epidemiology and Community Health* study by Baker and Middleton [16] illustrates what had been the standard approach. The study found decreasing socioeconomic disparities in cervical cancer screening in England between 1991 and 1999 based on decreasing relative differences in screening rates. Table 1a below shows the key figures, including both the ratios of receiving and failing to receive cancer

screening (as well as the EES), and reflects the common pattern where the two ratios changed in opposite directions.[9]

Table 4 Cervical Cancer Screening Rates for Least and Most Deprived Area of England, 1991-1999 (from Baker and Middleton)

Year	LstDep	MostDep	Lst/MostDepScRatio	Most/LstNoScRatio	EES
1991	84.09%	39.03%	2.15	3.83	1.27
1999	98.60%	76.00%	1.30	17.14	1.49

In Race and Mortality (*Society* 2000), I pointed out that, because they were measured in terms of relative differences in favorable outcomes, disparities in healthcare procedures were perceived to be decreasing even as the disparities in the outcomes the procedures were intended to address were perceived to be increasing. The point was not that one measure was preferable to another but that both are affected by overall prevalence and hence that neither was necessarily providing useful information about whether a disparity was increasing or decreasing in a meaningful sense.

In a 2005 monograph (*Methodological Issues in Health Disparities Research* [17]) purporting to provide guidance on the measurement of health disparities, NCHS obliquely responded to Race and Mortality. The monograph cited Race and Mortality article in the context of illustrating that relative differences between whites and Hispanics in receipt of mammography had decreased between 1990 and 1998, while relative differences in failure to receive mammography had increased. But, ignoring the issues the article raised about whether either relative differences was providing useful information about the comparative size of disparities at different points in time, NCHS simply recommended that all disparities be measured in terms of relative differences in adverse outcomes. If the NCHS recommendation is followed, as in the case of the white-Hispanic mammography disparities, often disparities that previously were deemed to be decreasing now will be perceived to be increasing. As shown in Table 4 *supra*, for example, in the case of the cervical cancer screening issues where Baker and Middleton found decreasing disparities, NCHS not only would have found the disparities to have increased but would have found them to have increased dramatically.

But, but while NCHS statisticians have repeated this recommendation in a variety of forums (including references 2 and 3 hereto) it is not clear how much the recommendation will be followed. The *Journal of Epidemiology and Community Health*, in which the Baker and Middleton study appeared, is published in the United Kingdom. And while that study appeared before the NCHS issued its recommendation, there is little reason to expect journals outside the United States to follow that recommendation even if

[9] Baker and Middleton showed the relative difference in rates of receiving screening in terms of the ratio of the most deprived to the least deprived, which reflects the more common way of presenting data (with the disadvantaged group's figure always as the numerator in ratio). My reasons for using the advantaged group's rates as the numerator in the favorable outcome ratio and disadvantaged group's rate as the numerator in the adverse outcome ratio, thereby keeping both figures above 1.0, are discussed in the Semantic Issues sub-page of the Scanlan's Rule page. The choice of numerator, however, does not affect the directions by which the relative differences are changing.

they know about it. Even in the United States, it is not clear how many researchers even know about the recommendation. A striking illustration of the implications of the recommendation (and whether it is followed or not in the United States) may be found in the 2007 study in *Pediatrics* by Morita et al.,[18] which won a Robert Wood Johnson Foundation award for health disparities research. The study examined the impact of a school-entry Hepatitis B vaccination requirement on racial and ethnic disparities in vaccination rates. Relying on relative difference in vaccination rates as a measure of disparities, the authors found that the requirement, which dramatically increased overall vaccination rates, dramatically reduced racial and ethnic disparities. As shown in Tables A and B accompanying the Comment on Morita, NCHS, relying on relative differences in failure to be vaccinated, would have found dramatic increases in disparities.

Researchers who are following the NCHS recommendation include the authors of the previously mentioned 2009 *Cancer Biomarkers and Prevention* study by Harper et al.[8] (which include Lynch, one of the authors of the 2005 NCHS position). And as discussed in the Comment on Harper, what the authors describe in the abstract as a 161% in increase in the socioeconomic disparity in mammography is in fact an increase in the disparity in the failure to receive mammography; the disparity in rates of receiving mammography actually decreased. See also the Concentration Index sub-page of the main Measuring Health Disparities page for its illustration of the way a concentration index analysis in a National Cancer Institute handbook on measuring disparities authored by Harper and Lynch,[19] which showed negligible changes between 1990 and 2002 in educational disparities in failing to receive mammography, would show substantial decreases in disparities in receiving mammography.[10]

I have not thoroughly studied how most researchers who use relative differences to measure mammography and other healthcare disparities are currently measuring things.

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[10] Appropriately measured, demographic disparities in mammography seem to be decreasing. But as indicated in the text above there is considerable room for confusion arising from different measurement approaches. Table N2 below presents data from a 2009 *International Journal for Equity in Health* study of demographic disparities in mammography rates in Israel by Baron-Epel et al.[20] While the study presents data on four groups, Table N1 is limited to a comparison between immigrant women and Arab women, which comparison illustrates a particular point.

Table N2 Changes in Mammography Rates of Immigrant and Arab Women In Israel (2002-2007) (from Baron-Epel et al.)

Period	ImMam	ArMam	I/A MRatio	A/I No MRatio	OddsRatio	AbsDiff	EES
2002	30.50%	26.30%	1.16	1.06	1.23	0.042	0.13
2007	71.10%	67.20%	1.06	1.13	1.20	.039	0.11

One observes that during the period of increasing mammography, the relative differences in receipt of mammography decreased while the relative difference in non-receipt increased. The differences measured by the odds ratio (the measure employed by the authors) and the absolute difference between rates also changed in opposite directions (see Introduction to the Scanlan's Rule page regarding the way absolute differences and differences measured by odds ratios tend to change in the opposite direction as the prevalence of an outcome changes). The EES indicates that the disparity decreases slightly, but not sufficiently to cause any standard measure to change in a direction contrary to that driven by the shapes of the distributions.

What is clear enough, however, is that regardless of which relative difference is used – and even in the studies where authors might use both the relative difference in the favorable outcome and the relative difference in the opposite outcome in the same paragraph [21] – almost never will one observe a recognition even that the two measures can lead to opposite conclusions as to such things as whether disparities are changing over time, much less that they tend systematically to do so.[1112]

Presumably, there are scores or hundreds of articles on cancer mortality and survival (screening and non-screening) that raise similar issues, whether or not the authors conflate survival disparities with mortality disparities, just as there are hundreds or thousands of articles raising similar issues with regard to other health and healthcare disparities. Some of those may eventually get further treatment here. All journals ought to carefully consider whether, in light of the patterns whereby the standard measures of differences between outcome rates are affected by the overall prevalence of an outcome, they ought to publish any health disparities research that fails to take such patterns into account. But journals publishing articles on cancer outcome disparities need to be especially careful to ensure that statements made in articles about survival and mortality disparities are in fact true.

[3] The possibility to reach different conclusions about patterns of disparities depending on whether one examines a favorable or adverse outcome is among reasons some researchers prefer to measure disparities in terms of absolute differences between rates, which are the same regardless of which outcome one examines. The Health Policy Group of Harvard Medical School does a great deal of research into healthcare disparities while usually, but not invariably, measuring disparities in terms of absolute differences between rates (as in the subjects of Comment on McWilliams, Comment on Trivedi *JAMA 2006*, Comment on Sequist, Comment on Schneider, Comment on Escarce, Comment on Trivedi *NEJM* 2005). But, like relative differences, absolute differences are affected by the overall prevalence of an outcome and hence are problematic measures for appraising the comparative size of health disparities in different settings. As discussed in the Introduction to the Scanlan's Rule page and many other places (including ICHPS 2008), roughly, as an uncommon outcome increases in overall prevalence, absolute differences between rates tend to increase; as common outcomes become even more common, absolute differences tend to decrease. The failure to understand this pattern has led to a variety or misinterpretations, including a perception in the United States that incentive-based improvements in healthcare will tend to increase healthcare disparities

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[12] For its part, although it casts most of its measures in terms of the favorable outcome, the Agency for Healthcare Research and Quality, which is responsible for the National Healthcare Disparities Report, measures healthcare disparities in terms of whichever relative difference (in the favorable or the adverse outcome) is larger. Thus, for example, as a healthcare procedure or level of care becomes increasingly more common –and the (increasing) relative difference in failing to receive the procedure or level of becomes larger than the (decreasing) relative difference in receipt of the procedure or level of care, AHRQ will tend to change its appraisal from one where the disparity is decreasing to one where it is increasing. It also warrants note that the larger of the two relative differences tends to move in the opposite direction of the absolute difference between rates. See discussion in Comment on Morita and APHA 2007 Addendum and [3] *infra*.

and a perception in the United Kingdom that incentive-based improvements in healthcare will tend to decrease healthcare disparities, as discussed on the Pay for Performance sub-page of MHD.

With regard to healthcare, the potential for misunderstanding absolute differences between rates as a measure of disparity is the same with respect to cancer-related issues as with respect to other areas of disparities research. For all areas involve procedure rates in ranges where, solely for reasons related to the shapes of normal distributions, increases in prevalence may tend either to increase or to decrease absolute differences between rates. But while most other mortality/survival rates that are the subjects of health disparities research are in ranges where health improvements (i.e., declines in mortality, increases in survival) will tend to reduce absolute differences between rates, cause-specific and stage-specific cancer mortality/survival rates are often in ranges where health improvements may tend either to increase absolute differences between rates or decrease absolute differences between rates (as in some of the rates shown in the Tables accompanying the Comment on Keegan). But while possibly misinterpreting the meaning of patterns of changes in absolute differences between mortality/survival, at least such research will not be misdescribing the observed pattern of absolute difference changes. That is, such research will not say that an absolute difference has changed in one direction when it actually changed in the opposite direction.

Finally, I note that the above discussion singles out cancer disparities research because it is an area that particularly lends itself to misstatements about survival and mortality disparities. The articles chosen to illustrate certain points here are simply those that caught my attention in initially examining this issue. But these simply reflect standard work in the area. In fact, a number of the articles were chosen simply because they actually presented the survival/mortality rates underlying their analysis (something, as noted in the summary to this item, much research fails to do). In any case, to my knowledge, the flaws arising from the failure to recognize the way that measures of differences are affected by the prevalence of an outcome undermine all health disparities research that attempts to appraise the size of a disparity either in the abstract or in comparison with another disparity (save as may be reflected in some of the works addressed in Section E.7 of MHD).

References:

1. 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

2. Keppel KG, Pearcy JN. Measuring relative disparities in terms of adverse events. J *Public Health Manag Pract* 2005;11(6):479–483)

3. Keppel, K.G., and J.N. Pearcy. 2009. Healthy People 2010: Measuring Disparities in Health. *Chance* 2009;22: 6-9.

4. Singh GK, Yu SM. Infant mortality in the United States: trends, differentials and projections, 1950 through 2010. *Am J Public Health* 1995;85:957-64.

5. Schoendorf KC, Hogue CJR, Kleinman JC, Rowley D. Mortality among infants of black as compared with white college-educated parents. *N Engl J Med* 1992;326:1522-26.

6. Morse DE, Kerr AR. Disparities in oral and pharyngeal cancer incidence, mortally and survival among black and white Americans. *JADA* 2006;137:203-212.

7. Gregory IN. Comparison between geographies of mortality and deprivation from the 100s and 2001: spatial analysis of census and mortality statistics. *BMJ* 2009;339:b3454

8. 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.

9. Tehranifar P, Neugut AI, Phelan JC, et al . Medical advances and racial/ethnic disparities in cancer survival. *Cancer Epidemiol Biomarkers Prev* 2009; doi:10.1158/1055-9965.EPI-09-0305.

10. Henry KA, Niu X, Boscoe FP. Geographic disparities in colorectal cancer survival. *Int J Health Geographics* 2009;8:48.

11. Bach PB., Schrag D, Brawley OW. Survival of blacks and whites after a cancer diagnosis. *JAMA* 2002;287:2106-2113.

12. Jeffreys M, Sarfati D, Stevanovic V, et al. Socioeconomic inequalities in cancer survival in New Zealand: The role of extent of disease at diagnosis. *Cancer Epidemiol Biomarkers Prev* 2009;18(3):915-921.

13. Robbins AS, Yin D, Parikh-Patel A. Differences in prognostic factors and survival among white men and black me with prostate cancer, California, 1995-2004. *Am J Epidemiol* 2007;166:71-78.

14. Keegan, THM, Clarke CA, Chang ET, et al. Disparities in survival after Hodgkin lymphoma: a population based study. Cancer Causes Control 2009;20:1881-1892.

15. Albain KS, Unger JM, Crowley JJ, et al. Racial disparities in cancer survival among randomized clinical trials patients of the Southwest Oncology Group. *J Nat Cancer Inst* 2009;101:988-992.

16. Baker E, Middleton D. Cervical screening and health inequality in England in the 1990s. *J Epidemiol Community Health* 2003;57:417-423.

17. Keppel K., Pamuk E., Lynch J., et al. Methodological issues in measuring health disparities. Vital Health Stat 2005;2 (141): http://www.cdc.gov/nchs/data/series/sr_02/sr02_141.pdf

18. Morita JY, Ramirez E, Trick WE. Effect of school-entry vaccination requirements on racial and ethnic disparities in Hepatitis B immunization coverage among public high school students. Pediatrics 2008;121:e547-e552: http://pediatrics.aappublications.org/cgi/reprint/121/3/e547?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=morita&andorexactfulltext=and&searchid=1&FIRSINDEX=0&sortspec=relevance&resourcetype=HWCIT

19. Harper S. Lynch J. Methods for Measuring Cancer Disparities: Using Data Relevant to *Healthy People 2010* Cancer-Related Objectives. NCI Cancer Surveillance Monograph Series, Number 6. Bethesda, MD: National Cancer Institute, 2005. NIH Publication No. 05-5777: http://seer.cancer.gov/publications/disparities/

20. Baron Epel O, Friedman N, Lernau O. Reducing disparities in mammography-use in a multicultural population in Israel. *International Journal for Equity in Health* 2009;8:19: http://www.equityhealthj.com/content/8/1/19

21. Smith-Bindman, Miglioretti DL, Lurie N. Does utilization of screening mammography explain racial and ethnic differences in breast cancer? *Ann Intern Med* 2006;144:541-553.