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Understanding patterns of absolute differences in vaccination rates in different settings

Schneider et al.[1] examined influenza vaccination rates of white and black Medicare enrollees in managed care plans (MMC) and fee-for-service plans (FFS) to determine whether racial disparities might be smaller in MMC. The authors found that rates of whites and blacks were higher in MMC. But, measuring racial disparities in terms of absolute differences between black and white vaccination rates, the authors found that the disparity was not reduced in MMC. The authors' analyses raise two issues. The first involves the interpretation of the sizes of differences between black and white rates in two settings. The second involves the interpretation of reductions in differences where the reduction is not statistically significant.

A. Interpreting the Size of Differences between Rates in Settings with Different Overall Prevalences of an Outcome.

Table 4 in the Schneider article provides vaccination rates for whites and blacks in MMC and FFS, both unadjusted and adjusted for propensity scores, along with the absolute differences between black and white rate in each setting. These figures along with (a) the ratio of the white vaccination rate to the black vaccination rate (Ratio 1), (b) the ratio of the black rate of failing to be vaccinated to the white rate of failing to be vaccinated (Ratio 2), and (c) the absolute difference between rates (along with several other figures) are presented in Table A to this comment, which may be accessed on the following web page: http://www.jpscanlan.com/images/Schneider_comment_table.pdf

Initially, let us put statistical significance issues aside. Vaccination rates are greater in MMC than FFS. Thus, as discussed in references 2-11, solely for statistical reasons (assuming no fairly strong countervailing factors), we typically would observe relative differences in vaccination rates to be smaller in MMC than in FFS; but we would observe relative differences in rates of failure to receive vaccination to be larger in MMC than FFS. Also, given that the white-black ratio of vaccination rates (Ratio 1) is smaller than the black-white ratio of failure to receive vaccination (Ratio 2) even in the setting with the lower vaccination rates (FFS, where Ratio 1 = 1.48 and Ratio 2 = 1.68), according to the reasoning in references 5-11, we would ordinarily expect to observe a smaller absolute difference in MMC than FFS.

Examining the unadjusted data in Table 4, we observe that, just as expected, in the setting where vaccination is more common (MMC), Ratio 1 is smaller, and Ratio 2 is larger, than in the setting where vaccination is less common (FFS). The absolute differences is essentially the same in both settings (21.6, as shown, in Table 4, which, presumably due to rounding, differs slightly from the figures derived from the rates, i.e., 21.7 for FFS and

21.6 for MMC). According to the reasoning in references 5-11, we might cautiously regard the failure of the absolute difference to be smaller in MMC than FFS as suggesting that, in a meaningful sense, the racial disparity is larger in MMC. But, apart from the factors expressed in those references to justify caution in such interpretations, it is also the case that in ranges where Ratio 2 is only moderately larger than Ratio 1, absolute differences would not be expected to differ very much according to overall prevalence of the outcome, as reflected in Figure 5 of reference 6. Further, the overall prevalence of vaccination in MMC, while larger than that in FFS, is not dramatically larger.

Finally, the last column of Table A shows the size of the disparity in each setting based on the approach described in references 10 and 11. Such approach derives an estimate (based on each group's rate) of the difference between means (in terms of percentage of a standard deviation) of hypothesized normal distributions of continuously-scaled risks of experiencing the outcome. As explained in those reference and other places, while such approach involves speculation as to the nature of the underlying distributions, it is unaffected by the overall prevalence of the outcome in each setting. That approach yields a difference of .58 standard deviations in FFS compared with a difference of .57 standard deviations in MMC. In essence, such result is consistent with the appraisal based on the patterns of standard measures of differences between rates in the two settings. That is, the data do not provide evidence of a difference between the sizes of the vaccination disparities in the two settings that is other than a function of differing overall vaccination rates in the settings.

Let us suppose, however, that a more informative picture is presented in the figures that are adjusted for propensity scores. According to the adjusted figures, Ratio 1 is smaller in MMC than FFS (as there would be reason to expect given that vaccination is more common in MMC than FFS). However, notwithstanding that Ratio 2 typically would be larger in MMC than FFS, in fact it is smaller. Thus, for reasons explained in references 2-11, we might cautiously regard the racial disparity to be smaller in MMC than in FFS.

According to the adjusted figures, the absolute difference between black and whites rates is smaller in MMC (18.6 percentage points) than in FFS (24.9 percentage points). Since the smaller absolute difference in MMC is to be expected in the circumstances, such difference would not seem to support an inference of a meaningfully smaller racial disparity MMC (though, of course, the fact that the 6.3 percentage point reduction in the absolute difference is large enough to cause a reduction in both Ratio 1 and Ratio 2 suggests that the reduction is larger than would typically result solely from the larger overall vaccination rates in MMC). As shown in the final column of Table A, the above-described method of estimating differences between means of hypothesized distributions shows a smaller disparity in MMC (.50 standard deviations) than in FFS (.65 standard deviations), thus providing the best quantification of the extent to which the disparity is likely smaller MMC than FFS.

Some consideration of the ways other researchers might regard the patterns set out in Schneider's Table 4 and Table A to this comment may also be warranted. The most common measure for evaluating the size of healthcare disparities in outcomes like

vaccination seems still to be relative differences between rates of receiving the type of care at issue, as in the study to which reference 11 responds. Using either adjusted or unadjusted figures, such approach would find the disparity to be smaller in MMC than FFS. As discussed in most of the references, the National Center for Health Statistics (NCHS) measures healthcare disparities in terms of relative differences in failure to receive the healthcare at issue. Thus, using unadjusted figures, NCHS would regard the disparity to be larger in MMC than FFS; using adjusted figures, it would regard the disparity to be larger in FFS than MMC. As discussed most completely in the Addendum to reference 7 and in reference 11, the Agency for Healthcare Research and Quality (AHRQ), which funded the Schneider study, would measure the disparity using the larger of the relative difference in the favorable or the relative difference in the adverse outcome. Thus, here, like NCHS, AHRQ would rely on relative differences in failure to be vaccinated and reach the same conclusions as NCHS as to the comparative size of the disparities in the two settings.

This is not to say that any of these approaches to comparing the disparities in MMC and FFS is more useful than that used by Schneider et al. The point is that none of the approaches, including that of Schneider et al. (or the difference measured by odds ratios), provides useful information about the comparative size of disparities without consideration of the way each measure is typically affected by the overall prevalence of an outcome.

B. The Lack of Statistical Significance in the Difference between the Absolute Difference between Vaccination Rates in MMC and FFS.

Schneider et al. rely solely on the absolute difference as an indicator of the size of the disparity but dismiss the 6.3 percentage point smaller absolute difference in MMC than FFS found in the adjusted analysis on the basis that the 6.3 percentage point reduction is not statistically significant. Putting completely aside the considerations in Section A, it is perfectly reasonable that the authors, on the basis of the fact that the 6.3 percentage point reduction is not statistically significant, should fail to conclude that the racial disparity in vaccination rates is smaller in MMC than FFS. But to conclude that the racial disparity is not reduced seems another matter. The best evidence is that the disparity is reduced. The sample was simply not large enough to allow one to reach such conclusion with the certainty that scientists would like.

It is not necessary that one express the findings in exactly the manner of the two preceding sentences. But to state, as in the Schneider abstract, that "the racial disparity is not reduced" indicates that the study has provided evidence that the disparity is not reduced. In fact, such evidence as the study has yielded – whatever one may say of the strength of that evidence – is to the contrary.

Further with regard to the absence of statistical significance, the authors observe that the absence of a finding of a statistically significant reduction in the absolute difference in MMC suggests "that even if there is a reduction, it is probably small." But, the adjusted analysis reduced a 24.9 percentage point difference by 6.3 percentage points. That

reduction, which is the best evidence of the true size of the reduction, on its face would not necessarily be deemed small. And the confidence interval (-4.6 to 17.2) allows that it might be much larger. While the absence of statistical significance leaves open a greater than 5% chance that the disparity is actually smaller in FFS than MMC, such absence does nothing to suggest that with a much larger, and hence presumably more reliable, sample the reduction would be any smaller than 6.3 percentage points.

Finally, when one recognizes the statistical basis for the absolute difference to be smaller in MMC than in FFS, there is additional reason to regard the smaller absolute difference in MMC to be other than a result of chance. Thus, there is even greater reason to regard the study as providing evidence that the absolute difference is smaller in MMC than in FFS rather than evidence that there is no such difference. The same considerations, however, raise questions about the meaning of the smaller absolute difference in MMC than FFS that the study provides reason to believe in fact exists.

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