Comment

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Dr. Gastwirth has correctly noted that the predictive value of a positive test (PVP) is always estimated rather than known. His main theorem provides a formula for the variance of the estimate of PVP when it is computed from independent binomial estimates of the sensitivity, specificity and proportion of positive tests. Note that the PVP is one of several measures of the uncertainty of a screening test. Thus, the variance of the estimated PVP is a measure of the uncertainty of the measure of uncertainty of the test. Although useful at times, this level of refinement serves no practical purpose in many settings. I will consider several situations.

One use for screening tests is simply to estimate the prevalence of the disease or trait that the test is designed to identify. Walter Rogan and I look at this situation in our 1978 paper, and Dr. Gastwirth mentions some of our results. In this case, the predictive values of the test are of no interest; the focus is on the group rather than on individuals. Dr. Gastwirth notes that our estimate may need to be truncated at 0 or 1; this has been noted previously by Hilden (1979).

The other major use of screening tests is to classify individuals, and this is the context in which most of Dr. Gastwirth's discussion is set. However, the two examples he gives, AIDS and polygraphs, illustrate two very different situations with different consequences. In only one of the two cases is the variance of the estimated PVP likely to play any role.

When screening is done in a medical context, it is not unusual for prevalence to be quite low. In a recent newspaper report, an AIDS expert (James Curran of the Centers for Disease Control) estimated that in states with the highest rates, about 3% of all men were infected. Looking at Table 1, we see that screening of these populations by using the enzyme-linked immunosorbent assay (ELISA) would produce a PVP of about .290. Regardless of the variance associated with this estimated PVP, the implications are clear; most of the positives would be false positives, and thus anyone with a positive ELISA test would be given a more definitive test (in this case, the Western blot). In the case of an extremely high-risk group where the prevalence is presumed to be 50% and thus the expected PVP is .93, even if the variance of the estimated PVP is 0, it is difficult to imagine any action being taken (beyond those taken solely on the basis of the high prior risk) without administering the more definitive test. The fact that positive results on medical screening tests simply lead to further testing makes the PVP considerably less interesting than the PVN in these contexts, as noted by Dr. Gastwirth in his discussion. The PVP indicates the degree of concern warranted by the positive test and the degree of urgency associated with the second test. The variability of the estimated PVP does not seem particularly important in this context.

The polygraph example (and perhaps the AIDS test when used for nonmedical purposes) differs in that there is no confirmatory test that follows a positive result. When one relies on a single test, it may be more important to have as much information as possible about the meaning of a positive (or negative) test result. A positive result on a test with an estimated PVP of .99 with a standard error of .01 may well be taken as proof of deceit; if the standard error is increased substantially, it probably would not. However, it is quite unusual to have an estimated PVP this high, and a lower PVP means that the test is not definitive regardless of the variance of the estimate of PVP. Note that in Table 2, even a prevalence of .5 produces a PVP of only .86. No matter how small the variance, a test with this error rate will be unfair to significant numbers of people.

I certainly share Dr. Gastwirth's concerns about the use of screening tests in the absence of confirmatory tests, but my skepticism is largely based on the estimates of PVP rather than on the variances of these estimates. The final sentence of Section 4 summarizes the point well.

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ADDITIONAL REFERENCE

HILDEN, J. (1979). A further comment on "Estimating prevalence from the results of a screening test." *Amer. J. Epidemiol.* **109** 721–722.