

Table 1. *The PI predicts the distribution of genetic evidence between fathers and nonfathers*

Class interval		Ratio of frequency among "fathers" and nonfathers	
W (%)	PI	Group A	Group B
99.75-99.99	400-10,000	4636/5 = 927	4779/5 = 954
99-99.74	99-399	4304/19 = 227	4305/19 = 227
95-98.99	19-98.9	4171/100 = 41.7	4275/100 = 42.8
90-94.9	9-18.9	899/54 = 16.6	825/54 = 15.3
80-89.9	4-8.99	392/54 = 7.3	435/54 = 8.1
0.01-79.9	0.0001-3.99	598/188 = 3.2	420/188 = 2.2

Adapted from Wenk R, Houtz T, Brooks M. *Transfusion* 1988;28:316-8.

Experimental validation of paternity probability

To the Editor:

Wenk, Houtz, and Brooks¹ point out that experimental validation of the paternity index (PI) and of the resulting probability of paternity (W) is limited in the literature and thus would be welcome. These authors contribute their own experimental results and analysis. They found that the "distribution of probabilities of paternity for true fathers and . . . false fathers [are] markedly different," so that, by using reasonable prior probabilities of paternity, even moderate genetic evidence in favor of paternity is strongly associated with true fathers. This is a useful result, but they have actually provided the data for a much stronger validation.

Consider that, by definition,² the PI is a quotient of population frequencies. A PI of 100 means that such evidence is found 100 times more frequently among fathers than among nonfathers. Thus, for equal numbers of fathers and nonfathers (50% prior probability), there are 100 times as many fathers with PI = 100 as nonfathers with PI = 100. It follows that at 50 percent prior probability, there should be between 50 and 100 times as many fathers with PIs between 50 and 100 as there are nonfathers with such evidence. Such predictions may be tested by modifying and rearranging Table 3 of the above authors¹ to produce the results seen in Table 1.

I have added a second set of "class intervals" based on the PI (the fundamental biostatistic) that correspond to the class intervals based on W selected by Wenk, Houtz, and Brooks.¹ Their lowest four intervals have been pooled. The ratio of the frequency among "fathers" to the frequency among nonfathers (the last column of the authors) has been calculated for Group A ("fathers" are nonexcluded men, a population of 99.1% actual fathers) and estimated for Group B ("fathers" are, in fact, mothers—ie. undisputed parents—but the calculations are suspect to the extent [0.9%] that the other, "known" parent is, in fact, a nonparent). The 12 experimentally determined ratios constitute a test of the

theory, as the PI range is a prediction of the ratio. In this presentation, the agreement of theory with experiment is excellent.

Deviations from theory, if they occur, are expected to be found primarily at the extremes of the PI range—on the high end in part because of small sample size in the denominator and on the low end in part because nonfathers within the population of "fathers" tend to accumulate there. Other possible causes of deviation include a failure to take recombination into account, the use of inappropriate data bases, and serologic irregularities. Note that the data of Wenk, Houtz, and Brooks do deviate from theory within their four lowest class intervals, and this is more marked for Group A than for Group B (data not shown). The experience of the authors—that for their test battery, 360 of 15,000 nonexclusion cases (2.4%) yield PIs less than unity—seems to me to be excessive and raises the issue of criteria for exclusion.

Perhaps my colleagues would consider restudying their data. By dividing their 15,000 cases into 15 or 20 groups of equal size based on PI, the theory could be tested more rigorously. A review of those cases with PI < 1 would also be of interest.

JEFFREY W. MORRIS, MD, PhD
Department of Pathology
Memorial Medical Center of Long Beach
Long Beach, CA 90807-1428

References

1. Wenk R, Houtz T, Brooks M. Paternity probabilities of biologic fathers and unexcluded, falsely accused men using blood group markers. *Transfusion* 1988;28:316-8.
2. Nijenhuis L. A critical evaluation of various methods of approaching probabilities of paternity. In: Walker R, ed. *Inclusion probabilities in parentage testing*. Arlington: American Association of Blood Banks, 1982:103-14.