The relationship between Predictive value positive (Pvp), Predictive value negative (Pvn), Sensitivity (Se), Specificity (Sp), and Disease Prevalence (Pr) is described by Baye's Theorem.

<table>
<thead>
<tr>
<th>Outcome of Diagnostic Testing for Target Disease</th>
<th>Actual Disease Status - To be estimated by clinician</th>
</tr>
</thead>
<tbody>
<tr>
<td>(The Clinician's Axis)</td>
<td>The Target Disease is Present (D+)</td>
</tr>
<tr>
<td>Test is Positive (T+)</td>
<td>True Positive (Tp)</td>
</tr>
<tr>
<td>Test is Negative (T-)</td>
<td>False Positive (Fp)</td>
</tr>
<tr>
<td>Test is Negative (T-)</td>
<td>False Negative (Fn)</td>
</tr>
<tr>
<td></td>
<td>True Negative (Tn)</td>
</tr>
</tbody>
</table>

For the relationship between predictive values, which is what the clinician needs, and diagnostic test performance, remember the following 5 formulas and their relationships to the four bold cells above.

**Note:** If Prevalence, Se and Sp are expressed as percentages (a number between 0% and 100%), first convert each to probabilities (a number between 0.00 to 1.00) by dividing the percentage by 100.

Number with Disease Present = N x Pr (Pr: probability animal has disease prior to test or the true prevalence of the disease in a group - Clinician has to estimate this!).

- **Sensitivity (Se)** = Tp / (Tp + Fn)  
  (# True Positives / # Target Disease Positives)  
  (The probability that a diseased animal tests positive.)

- **Specificity (Sp)** = Tn / (Tn + Fp)  
  (# True Negatives / # Target Disease Negatives)  
  (The probability a target disease-free animal tests negative.)

- **Pvp** = Tp / (Tp + Fp)  
  (# True Positives / # Test Positives)  
  (The probability a test-positive animal has the target disease.)

- **Pvn** = Tn / (Tn + Fn)  
  (# True Negatives / # Test Negatives)  
  (The probability that a test-negative animal doesn't have the target disease.)

Apparent Prevalence = [# Test Positives / N]  
(Note: In most cases this isn't the true disease prevalence!)

If N = 1 (an individual animal) the numbers are the probabilities that the animal will be in one of the four interior cells. If the clinician is dealing with a group of N animals with a disease prevalence Pr in the group, the following are the relationships between the numbers in the cells, test performance and Pr.:

<table>
<thead>
<tr>
<th>Test Result:</th>
<th>The Target Disease is Present</th>
<th>The Target Disease is Absent</th>
<th>No. of Test Positives (Sum of Tp + Fp)</th>
<th>No. of Test Negatives (Sum of Fn + Tn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Se x (Pr x N)</td>
<td>(1 - Sp) x ((1 - Pr) x N)</td>
<td>Pr x N</td>
<td>(1 - Pr) x N</td>
</tr>
<tr>
<td>Negative</td>
<td>(1 - Se) x (Pr x N)</td>
<td>Sp x ((1 - Pr) x N)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To obtain the numbers for calculating **Pvp** and **Pvn** from **Se**, **Sp**, **Pr** and **N**, follow steps 1 through 9:

1) Put group size **N** in this cell.
2) Multiply **Pr** x step 1) cell.
3) Subtract step 2) cell from step 1) cell.
4) Multiply **Se** x step 2) cell.
5) Subtract step 4) cell from step 2) cell.
6) Multiply **Sp** x step 3) cell.
7) Subtract step 6) cell from step 3) cell.
8) Add step 4) cell and step 7) cell.
9) Add step 5) cell and step 6) cell.

**Pvp**: Divide step 4) cell by step 8) cell.

**Pvn**: Divide step 6) cell by step 9) cell.