**Example:** X-ray screening for tuberculosis (TB)

<table>
<thead>
<tr>
<th></th>
<th>TB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>X-Ray</td>
<td>1739</td>
<td>8</td>
</tr>
<tr>
<td>+</td>
<td>51</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>1790</td>
<td>30</td>
</tr>
</tbody>
</table>
TB Example (continued):

\[ P(D^+) = \text{prevalence of the disease} \]
\[ = 0.000093 \text{ (9.3 in 100,000)}. \]

Note that you should not use as an estimate of prevalence 30/1820 from the table, as the 1820 subjects may not be representative of the general population. One may use estimates from other sources.

\[ P(D^-) = 1 - P(D^+) \]
\[ = 0.999907 \]
TB Example (continued):

\[ P(T^+|D^+) = \text{sensitivity of the X-ray} \]
\[ = \frac{22}{30} = 0.7333 \]

\[ P(T^-|D^-) = \text{specificity of the X-ray} \]
\[ = \frac{1739}{1790} = 0.9715 \]

\[ P(T^+|D^-) = \text{false positive} \]
\[ = 1 - P(T^-|D^-) = 1 - 0.9715 = 0.0285 \]

\[ P(T^+|D^+) = \text{false negative} \]
\[ = \frac{8}{30} = 0.2667 \]
TB Example (continued):

\[
P(D^+|T^+)=\frac{P(D^+P(T^+|D^+)}{P(D^+P(T^+|D^+)+P(D^-)P(T^+|D^-)}
\]

\[
=\frac{(0.000093)(0.7333)}{(0.000093)(0.7333)+(0.999907)(0.0285)}
\]

\[
=0.00239
\]

For every 100,000 positive x-rays, only 239 signal true cases of tuberculosis.
Probabilistic learning: revision of early beliefs in the presence of new evidence:

\[ P(D^+) = \text{prior probability (belief in the presence of disease)} \]
\[ = 0.000093 \]
\[ = 9.3/100,000 \]

\[ P(D^+|T^+) = \text{posterior probability (updated in the presence of evidence)} \]
\[ = 0.00239 \]
\[ = 239/100,000 \]