Mini EBM Lecture Series 2007-2008

Lecture III: Thresholds

**Action Threshold:**
How do we decide when to test for a disease, just treat without testing, or just observe without testing? To understand this you need to first understand Action Thresholds (AT).

- **Action Threshold (AT)** = the probability of a disease at which treatment of patients *thought* to have the disease causes as much benefit to those who do have disease as it does harm to those who actually do not have disease.

- **AT (odds) = Net Harm/Net Benefit**
  - Net Harm = difference b/w not treating someone *without* disease and treating someone *without* disease.
  - Net Benefit = difference between treating someone *with* disease and not treating someone *with* disease.

Let’s do an example: 78 yo bed-bound patient develops clinical findings of nosocomial pneumonia. Do you treat him?

Below are the probability outcomes:

<table>
<thead>
<tr>
<th>Disease (PNA)</th>
<th>Tx (ABX)</th>
<th>Live</th>
<th>Die</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>Yes</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Present</td>
<td>No</td>
<td>30%</td>
<td>70%</td>
</tr>
<tr>
<td>Absent</td>
<td>No</td>
<td>65%</td>
<td>35%</td>
</tr>
<tr>
<td>Absent</td>
<td>Yes</td>
<td>60%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Net Harm = value of not treating someone *without* disease minus value of treating someone *without* disease.
= 65 - 60 = 5

Net Benefit = value of treating someone *with* disease minus value of not treating someone *with* disease
= 50 - 30 = 20

AT (odds) = Net Harm/Net Benefit = 5/20
AT (probability) = 5/25 = 0.2 = 20%

Put in words, if the clinical probability of PNA is >20%, prompt empiric antibiotics is indicated as the benefits of treatment with PNA are greater than the risks of antibiotics in people without PE. For your individual patient, if his clinical probability of PNA is > 20% he is more likely to receive benefit from empiric treatment that harm.
**Observe/Test and Test/Treat Thresholds:**
For many clinical conditions, we have tests that help us decide on the probability of disease and whether or not we should treat. How do we decide when we need to test, just treat without testing, or just observe without even testing? It depends on how good the test is. What is our marker of how good a test is? LRs!

- **Observe/Test Threshold** (odds) = \(O/T\)
- **Test/Treat Threshold** (odds) = \(T/Tx\)

\[
\begin{align*}
O/T & \times LR(+) = AT \\
O/T & = AT/LR (+) \\
T/Tx & \times LR(-) = AT \\
T/Tx & = AT/LR(-)
\end{align*}
\]

Put in words, if your clinical suspicion for disease is below the Observe/Test (O/T) threshold, you should just observe and not even test, because even a positive test will not get you above the Action Threshold (AT) prompting you to treat. If your clinical suspicion is above the Test/Treat (T/Tx) threshold, then you should just treat and not even test, because even a negative test will not get you below the action threshold. If you are between the Observe/Test (O/T) and Test/Treat (T/Tx), then you should test because the test result will determine whether you are above or below the Action Threshold (AT) and thus helping you decide whether or not to treat.

**Let’s do another example:**
You are evaluating a patient above in a nursing home and need to decide quickly whether or not to begin treatment for nosocomial PNA. The only test available to you at this time is CXR.
You know that the Sn for CXR for PNA is 60% and the Sp is around 70%.
The net benefit of treatment is 3%. The net harm is 1%.

What is the AT?
What is the O/T?
What is the T/Tx?

*Answers:* AT = 1:3 odds, 25% prob; O/T = 1/6 odds, 14% prob; T/Tx = 0.58:1 odds, 37% prob.

>Note -
- AT depends on disease and treatment characteristics only.
- Testing and treatment thresholds depend on test characteristics.