



Diagnosis

Computation of Post Test
Probability

Sensitivity and Specificity

Test results	True Status (Golden Standard)		
	Diseased	Not Diseased	Total
Positive	a	b	a + b
Negative	c	d	c + d
Total	a + c	b + d	a + b + c + d



Using Sen. and Spec. to Revise Probability

We often use maternal serum α -fetoprotein (MSAFP) test to screen the fetal abnormalities.

Pretest Probability = $P(D^+) = 0.20$

Sensitivity = $P(T^+|D^+) = 0.34$

Specificity = $P(T^-|D^-) = 0.86$

→ $PV^+ = ?$

→ $PV^- = ?$



Methods to Revise Probability

- 2 by 2 Table Methods
- Decision Tree Methods
- Bayesian Methods
- Likelihood Ratio Methods



The 2 by 2 Method (1)

	D ⁺	D ⁻
T ⁺		
T ⁻		
Total	200	800



The 2 by 2 Method (2)

	D ⁺	D ⁻
T ⁺	68	112
T ⁻	132	688
Total	200	800



The 2 by 2 Method (3)

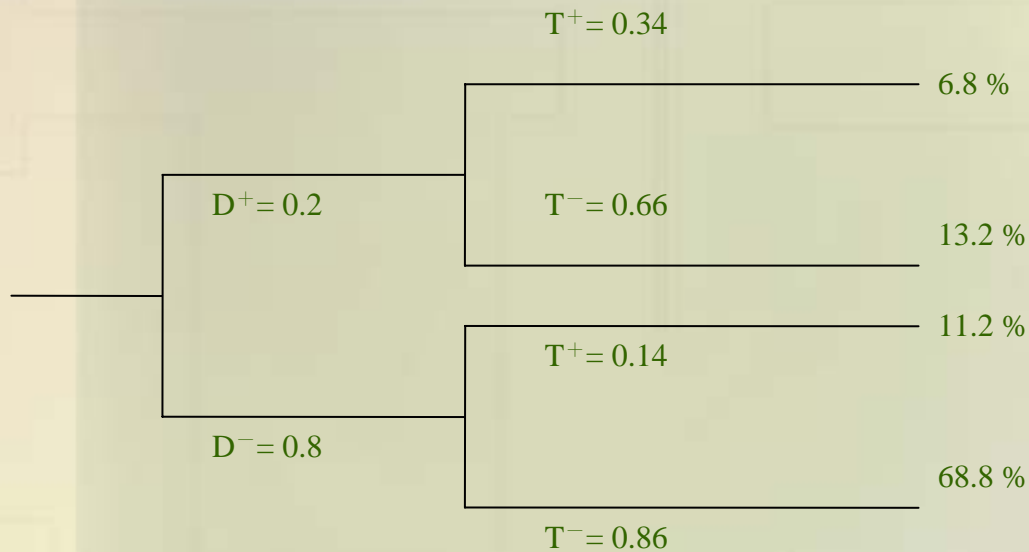
	D ⁺	D ⁻	total
T ⁺	68	112	180
T ⁻	132	688	820
Total	200	800	1000

$$PV^+ = P(D^+ | T^+) = 68/180 = 0.378$$

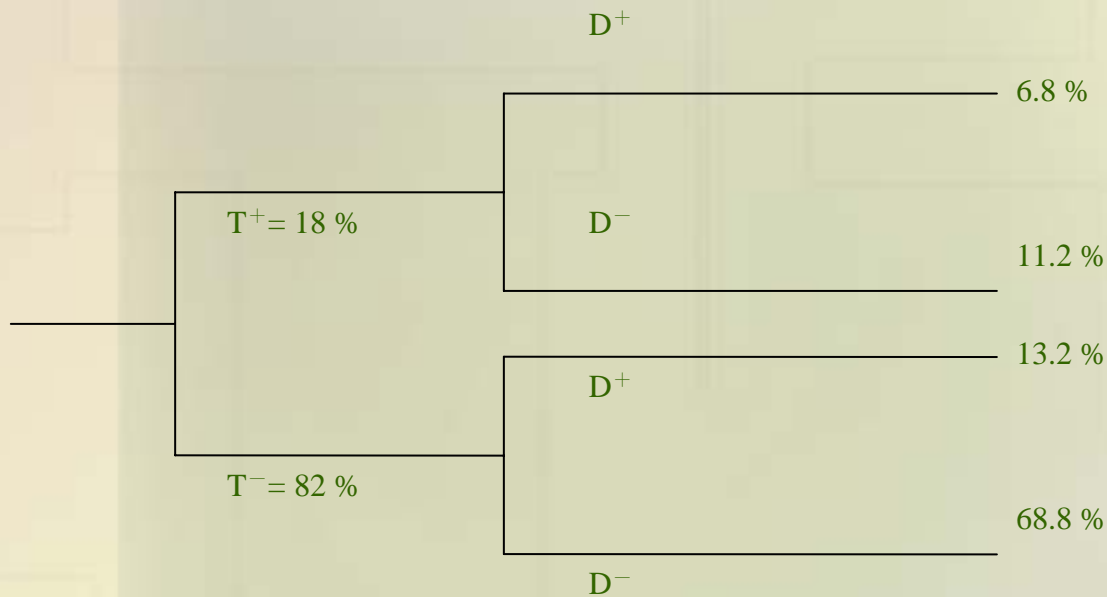
$$PV^- = P(D^- | T^-) = 688/820 = 0.839$$



Decision Tree Method (1)



Decision Tree Method (2)



Bayesian Methods

$$\begin{aligned}P(D^+ | T^+) &= \frac{P(T^+ | D^+)P(D^+)}{P(T^+ | D^+)P(D^+) + P(T^+ | D^-)P(D^-)} \\ &= \frac{0.34 \times 0.20}{(0.34 \times 0.20) + (0.14 \times 0.80)} = 0.378\end{aligned}$$

$$\begin{aligned}P(D^- | T^-) &= \frac{P(T^- | D^-)P(D^-)}{P(T^- | D^-)P(D^-) + P(T^- | D^+)P(D^+)} \\ &= \frac{0.86 \times 0.80}{(0.86 \times 0.80) + (0.66 \times 0.20)} = 0.839\end{aligned}$$



Likelihood Ratio Method (1)

$$LR^+ = \text{Sen.} / (1 - \text{Spec.})$$

$$LR^+ = 0.34 / 0.14 = 2.43$$

$$\text{Pretest Odds} = 0.2 / 0.8 = 0.25$$

$$\text{Posttest Odds} = 0.25 \times 2.43 = 0.607$$

$$\text{Posttest Prob.} = \text{Posttest Odds} / (1 + \text{Posttest Odds})$$

$$PV^+ = \text{Posttest Prob.}$$

$$= 0.607 / (0.1 + 0.607) = 0.378$$



Likelihood Ratio Method (2)

$$LR^- = (1 - \text{Sen.}) / \text{Spec.}$$

$$LR^- = 0.66 / 0.86 = 0.767$$

$$\text{Pretest Odds} = 0.2 / 0.8 = 0.25$$

$$\text{Posttest Odds} = 0.25 \times 0.767 = 0.192$$

$$\text{Posttest Prob.} = \text{Posttest Odds} / (1 + \text{Posttest Odds})$$

$$\text{Posttest Prob.} = 0.192 / (1 + 0.192) = 0.161$$

$$PV^- = 1 - 0.161 = 0.839$$

