

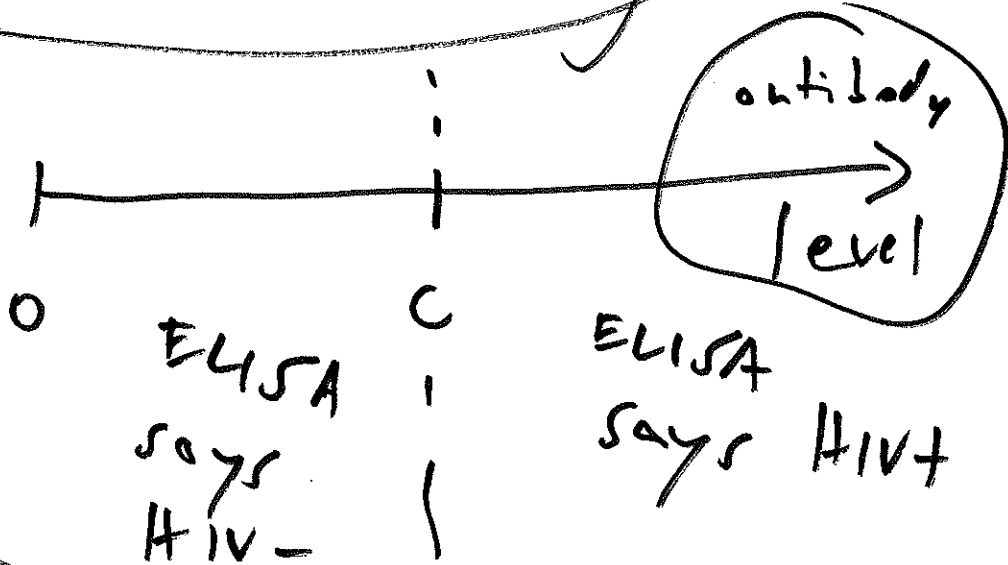
Discussion
section
week 3

Case study:
HIV screening

AMS 131
17 Apr 19

①

A = (blood
really is
HIV+)



⊕ = (ELISA says HIV+)
⊖ = (ELISA says HIV-)

$$P(A) = 0.4\% = 0.004 \quad (\text{prevalence})$$

$$P(+|A) = 96\% = 0.96 \quad (\text{sensitivity})$$

$$P(-|A^{\text{not}}) = 97\% = 0.97 \quad (\text{specificity})$$

$$P(A|+) = ?$$

A = (clouds overhead)

B = (raining on you)

$P(A|B) = \text{big}$

$P(B|A) = \text{small}$

↓ truth

Specificity (2x2 contingency table)

	A	not A	
what ELISA says (+)	384	2,988	3,372
(-)	16	96,612	96,628
	400	99,600	100,000

↑ prevalence

sensitivity

$$P(A|+) = \frac{384}{3372} = 11\% (!)$$

$$P(\text{not } A|-) = \frac{96612}{96628} = 99.98\%$$

truth

	A	not A	
what ELISA says (+)	ok	blood HIV- but ELISA says HIV+	
(-)	blood HIV+	ok	
↓ worse	but ELISA says HIV-		

$$P(\text{not } A|+) = \frac{2988}{3372} = 89\%$$

false positive rate

$$P(A|-) = \frac{16}{96628} = 0.02\%$$

false negative rate

better test: Western Blot (WB)
(better sensitivity & much better specificity)

Q1: Is this blood sample HIV (+)?
fact (statistical inference)

Q2: How should we screen for HIV in a cost-effective way?
decision (Bayesian decision theory)

- | | |
|--|---------------------------------------|
| test is cheapest
accurate
Q1: only ELISA | Q3: ELISA & WB |
| accurate but too
Q2: only WB | Q4: ELISA , only WB if ELISA + |