

bayes' rule & diagnostic testing

early HIV testing in the military

- ▶ first screen with ELISA
- ▶ if positive, two more rounds of ELISA
- ▶ if either positive, two Western blot assays
- ▶ only if both positive, determine HIV infection

data

ELISA

- ▶ sensitivity (true positive): 93%
- ▶ specificity (true negative): 99%

$$P(+ | HIV) = 0.93$$
$$P(- | \text{no HIV}) = 0.99$$

Western blot

- ▶ sensitivity: 99.9%
- ▶ specificity: 99.1%

prevalence: 1.48 / 1000

$$P(HIV) = 0.00148$$

$$P(\text{has HIV} \mid ELISA +) = ?$$

Sources:

- Petricciani (1985). Licensed tests for antibody to human T-lymphotropic virus type III: sensitivity and specificity. Annals of internal medicine, 103(5), 726-729.
- Burke et. al. (1987). Diagnosis of human immunodeficiency virus infection by immunoassay using a molecularly cloned and expressed virus envelope polypeptide: comparison to Western blot on 2707 consecutive serum samples. Annals of internal medicine, 106(5), 671-676.
- Burke et. al. (1987). Human immunodeficiency virus infections among civilian applicants for United States military service, October 1985 to March 1986. New England Journal of Medicine, 317(3), 131-136.

prior probability

Prior to any testing, what probability should be assigned to a recruit having HIV?

$$P(HIV) = 0.00148$$

posterior probability

When a recruit goes through HIV screening there are two competing claims: recruit has HIV and recruit doesn't have HIV. If the ELISA yields a positive result, what is the probability this recruit has HIV?

posterior probability

