Neyman-Pearson testing. Signal detection

6.011, Spring 2018

Lec 23

Likelihood ratio test (LRT) implemention of MAP rule

$$\text{`}H_1\text{'}$$
$$p_1 . f_{R|H}(r|H_1) \quad \substack{> \\ <} \quad p_0 . f_{R|H}(r|H_0)$$
$$\text{`}H_0\text{'}$$

$$\Lambda(r) = \frac{f_{R|H}(r|H_1)}{f_{R|H}(r|H_0)} \quad \substack{\text{`}H_1\text{'} \\ > \\ < \\ \text{`}H_0\text{'}} \quad \frac{p_0}{p_1} = \eta$$

Terminology

- prevalence (p_1)

- (conditional) probability of detection, sensitivity, true positive rate, recall

- specificity, true negative rate

- (conditional) probability of false alarm, false positive rate (= 1– specificity)

- (conditional) probability of a miss, false negative rate (= 1 – sensitivity)

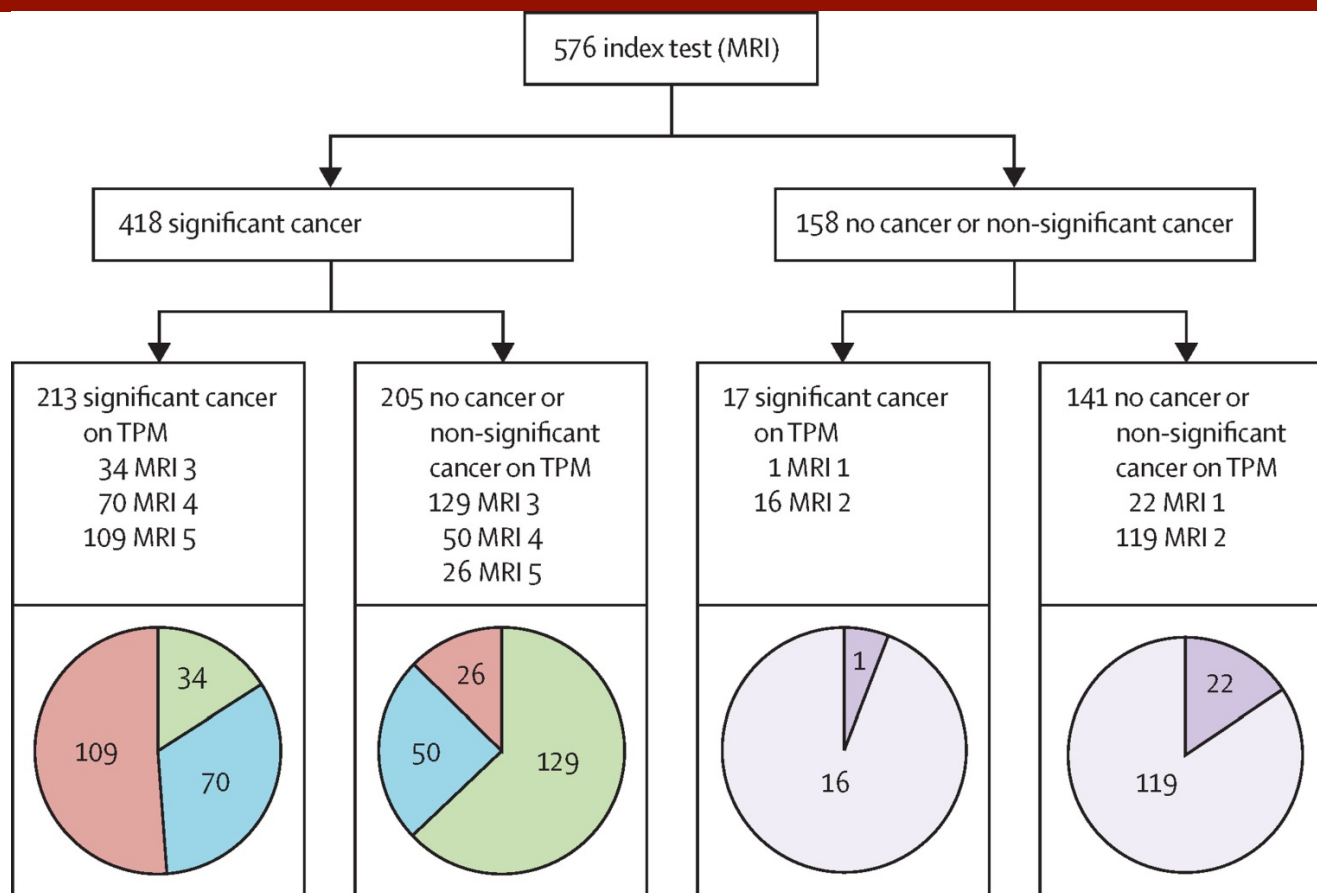- positive predictive value, precision

- negative predictive value

Testing for diabetes

Table 4. Performance of Serial Combination Screening for Undiagnosed Diabetes in the Australian AusDiab study populations[113]

	Risk assessment alone	*Plus FPG 5.5-6.9 mmol l^{-1}*	*Plus HbA$_{1c}$ ³ 5.3%*
Sensitivity (%)	87	78	68
Specificity (%)	48	75	93
PPV + (%)	7	13	31
PPV – (%)	99	99	98
% population requiring OGTT	53	25	8

Screening for Type 2 Diabetes, WHO 2003

Testing for prostate cancer

576 index test (MRI)

418 significant cancer | 158 no cancer or non-significant cancer

213 significant cancer on TPM
34 MRI 3
70 MRI 4
109 MRI 5

205 no cancer or non-significant cancer on TPM
129 MRI 3
50 MRI 4
26 MRI 5

17 significant cancer on TPM
1 MRI 1
16 MRI 2

141 no cancer or non-significant cancer on TPM
22 MRI 1
119 MRI 2

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For clinically significant cancer, MP-MRI was **more sensitive (93%)** than TRUS-biopsy (48%) and **less specific (41%)** for MP-MRI vs 96% for TRUS-biopsy. 5.9% of 740 patients reported serious adverse events, including 8 cases of sepsis.

Ahmed et al., *Lancet* Feb 2017