

Reducing Decision Errors in the Paired Comparison of the Diagnostic Accuracy of Continuous Screening Tests

Brandy M. Ringham,¹ Todd A. Alonzo,² John T. Brinton,¹
Aarti Munjal,¹ Keith E. Muller,³ Deborah H. Glueck¹

¹Department of Biostatistics and Informatics, University of Colorado Denver

²Department of Preventive Medicine, University of Southern California

³Department of Health Outcomes and Policy, University of Florida

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Outline

Science

- Case Study
- Cancer Screening Trial Design
- Cancer Screening Analysis

Statistics

- Bias Correction Algorithm
- Evaluation Studies
- Oral Cancer Screening Demonstration

Oral Cancer Screening Case Study

VISIBLE LIGHT



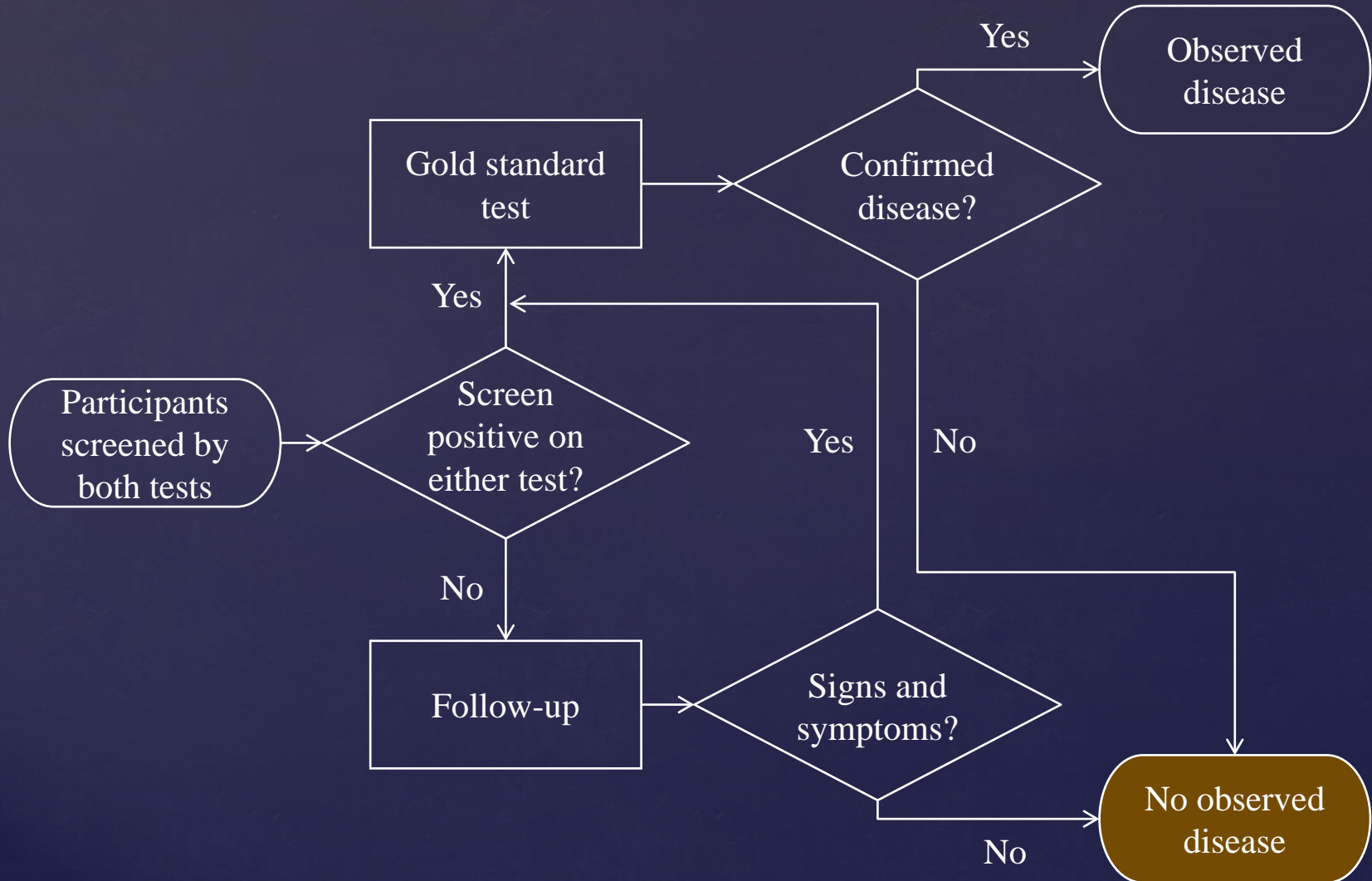
No visible lesion

AUTOFLUORESCENCE

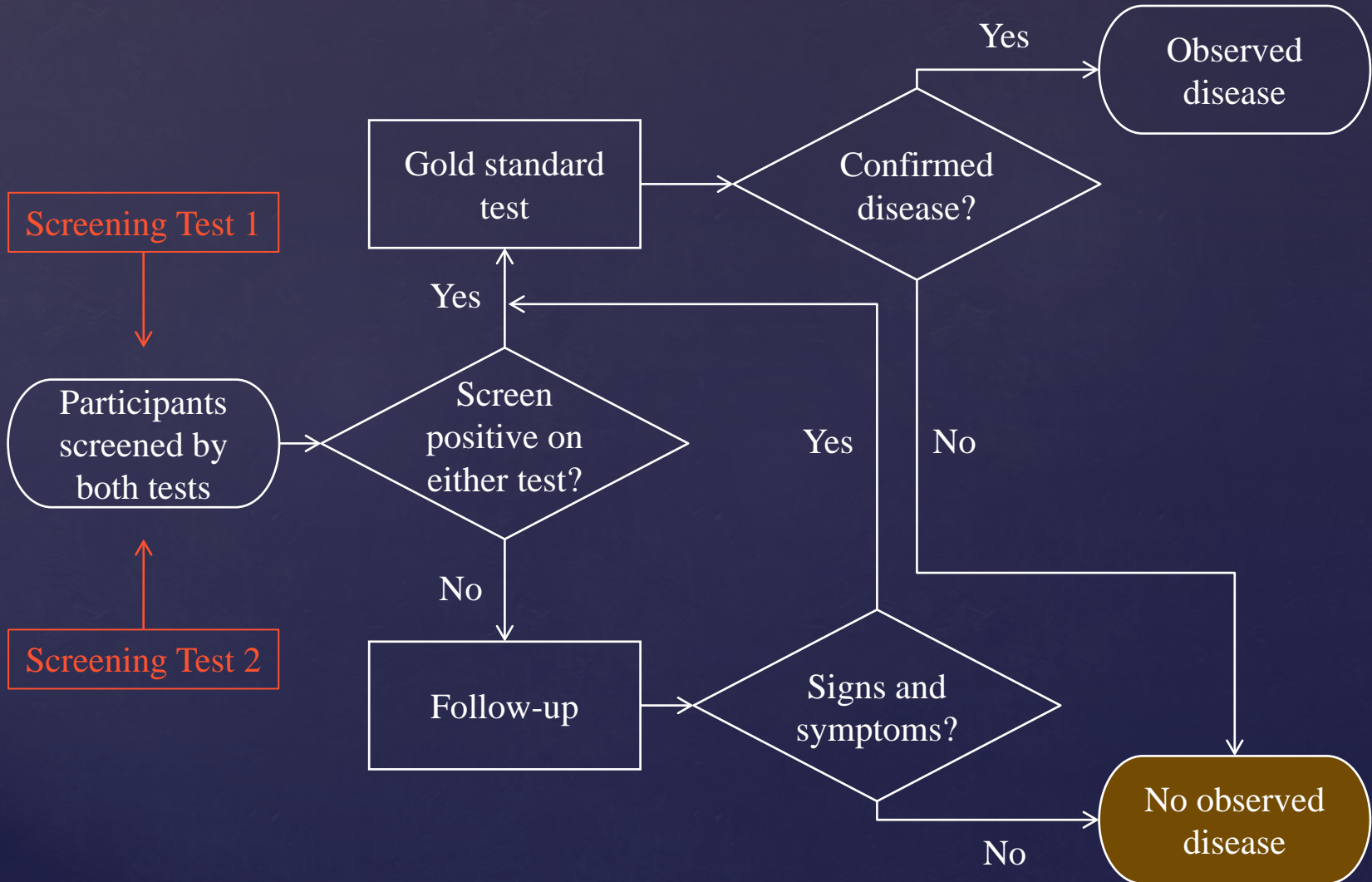


Dark region confirmed to be carcinoma in situ

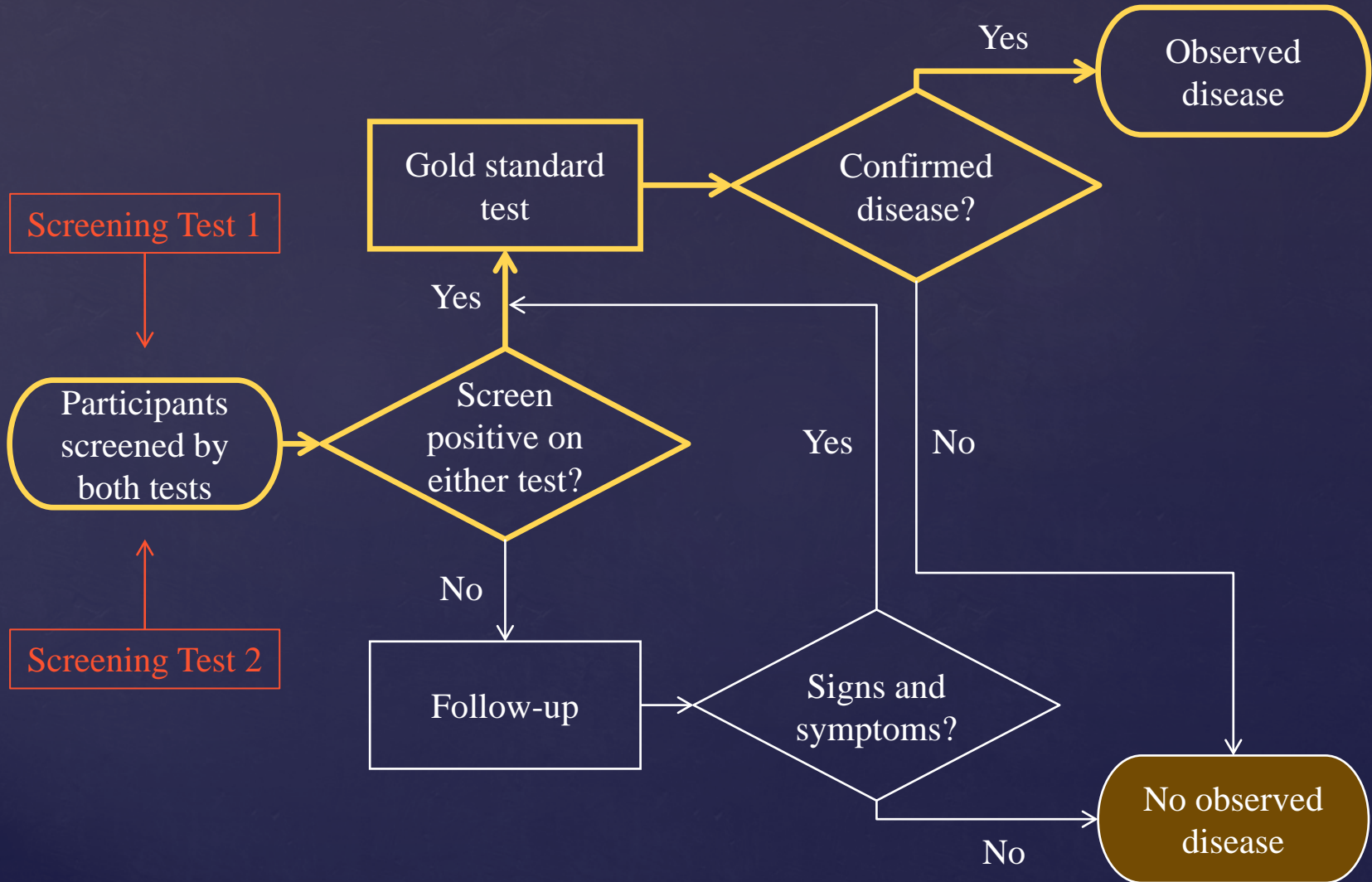
Paired Cancer Screening Trial



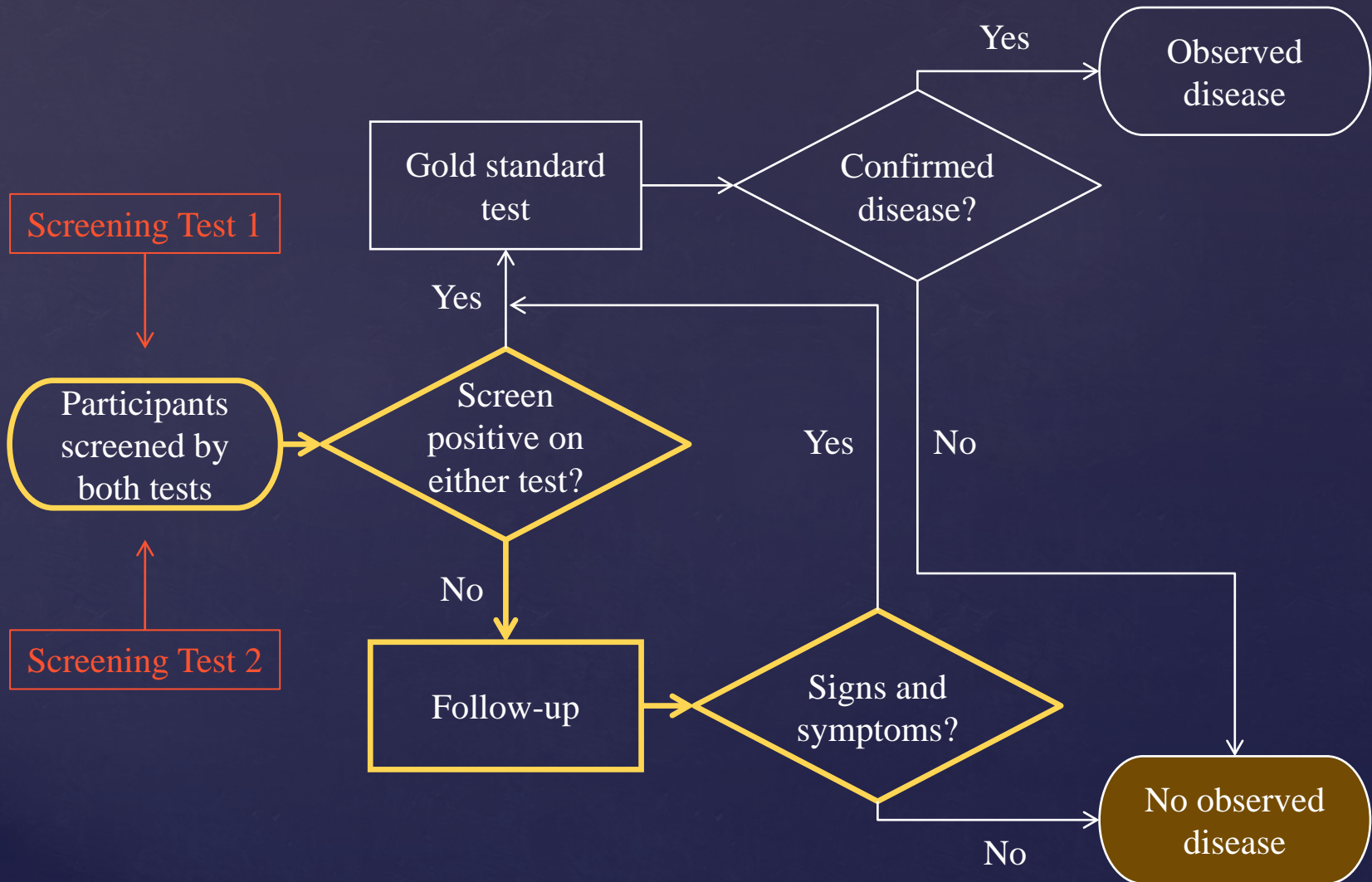
Paired Cancer Screening Trial



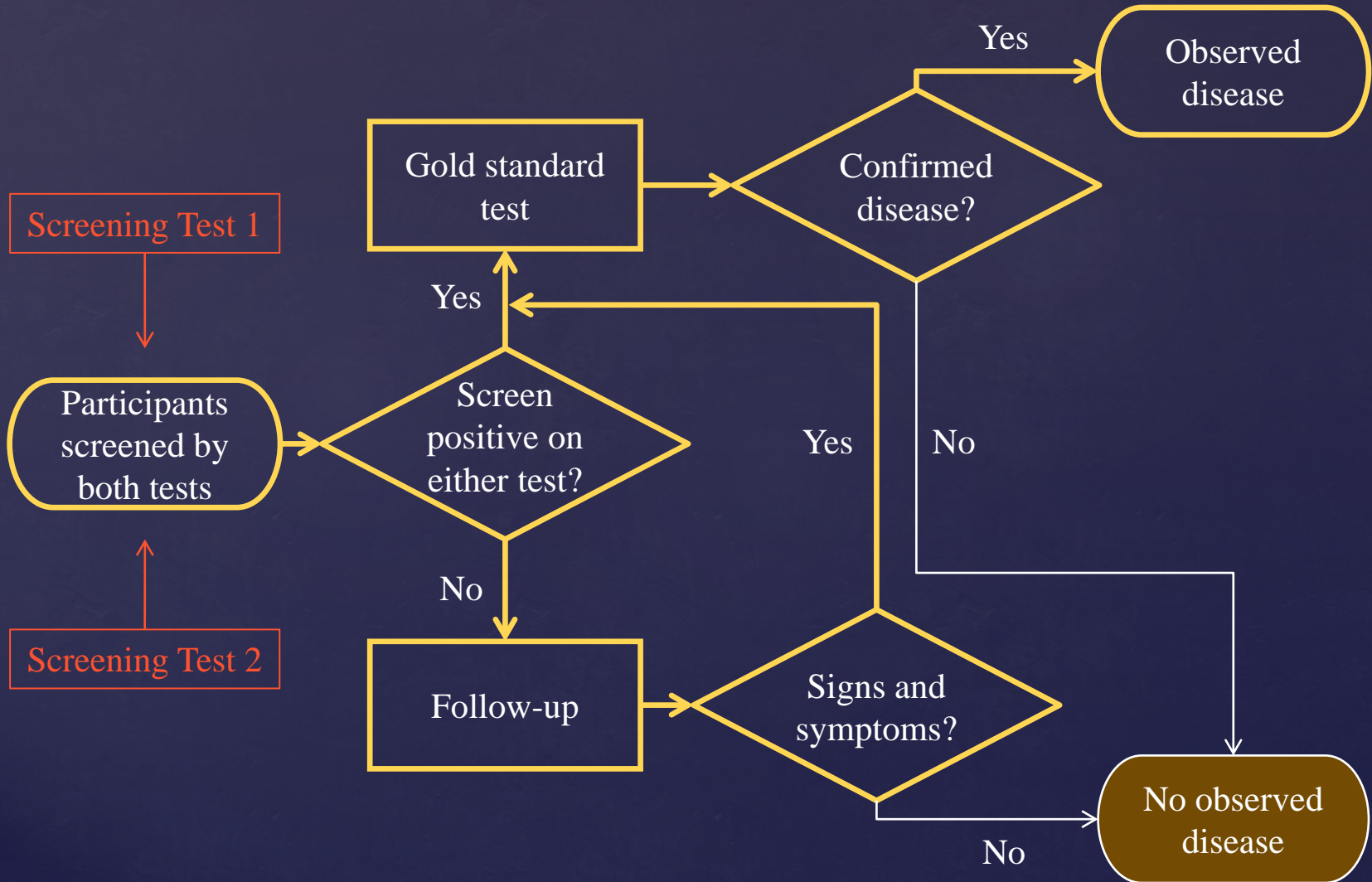
Paired Cancer Screening Trial



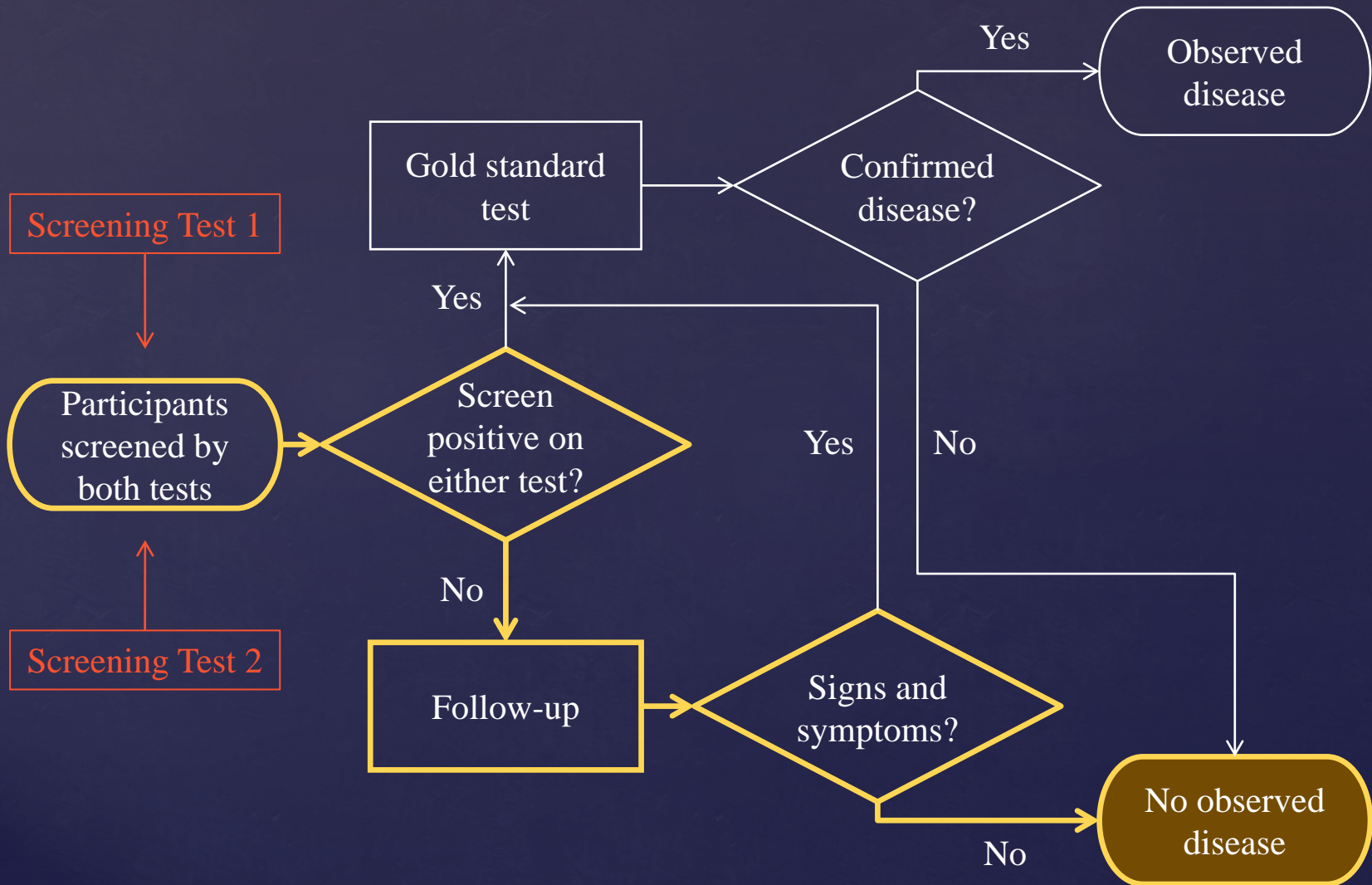
Paired Cancer Screening Trial



Paired Cancer Screening Trial

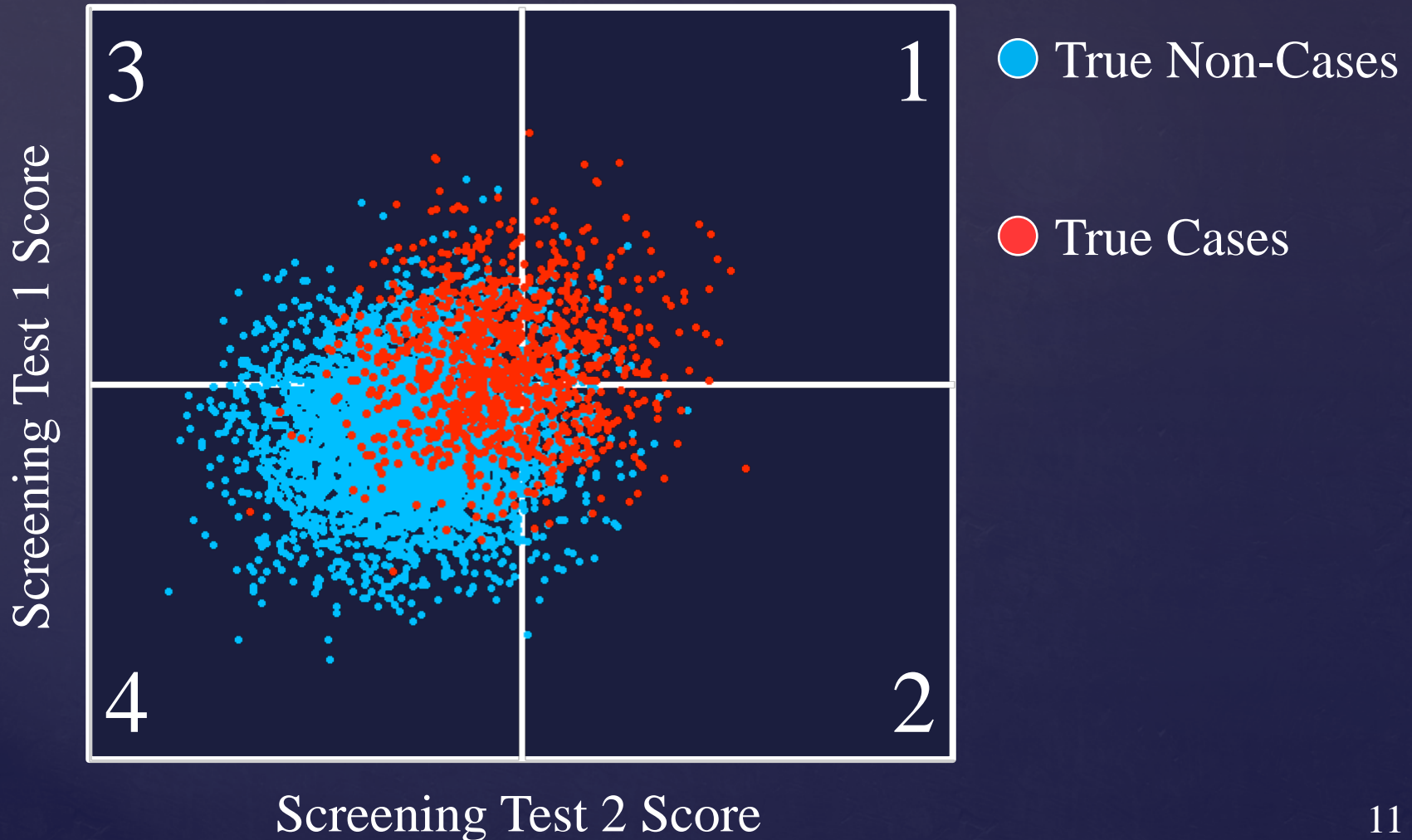


Paired Cancer Screening Trial



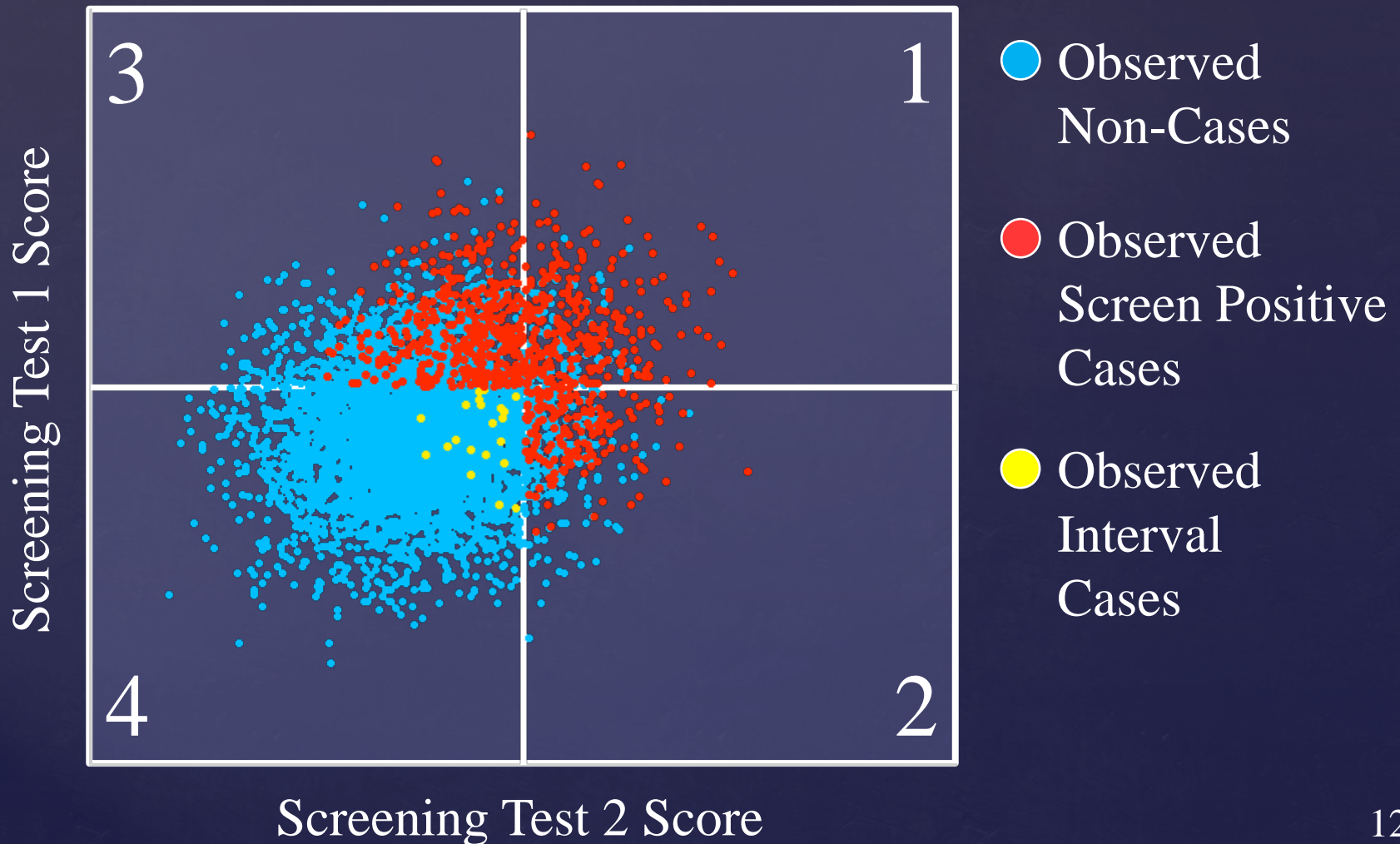
Hypothetical Cancer Screening Data

Omniscient Viewpoint



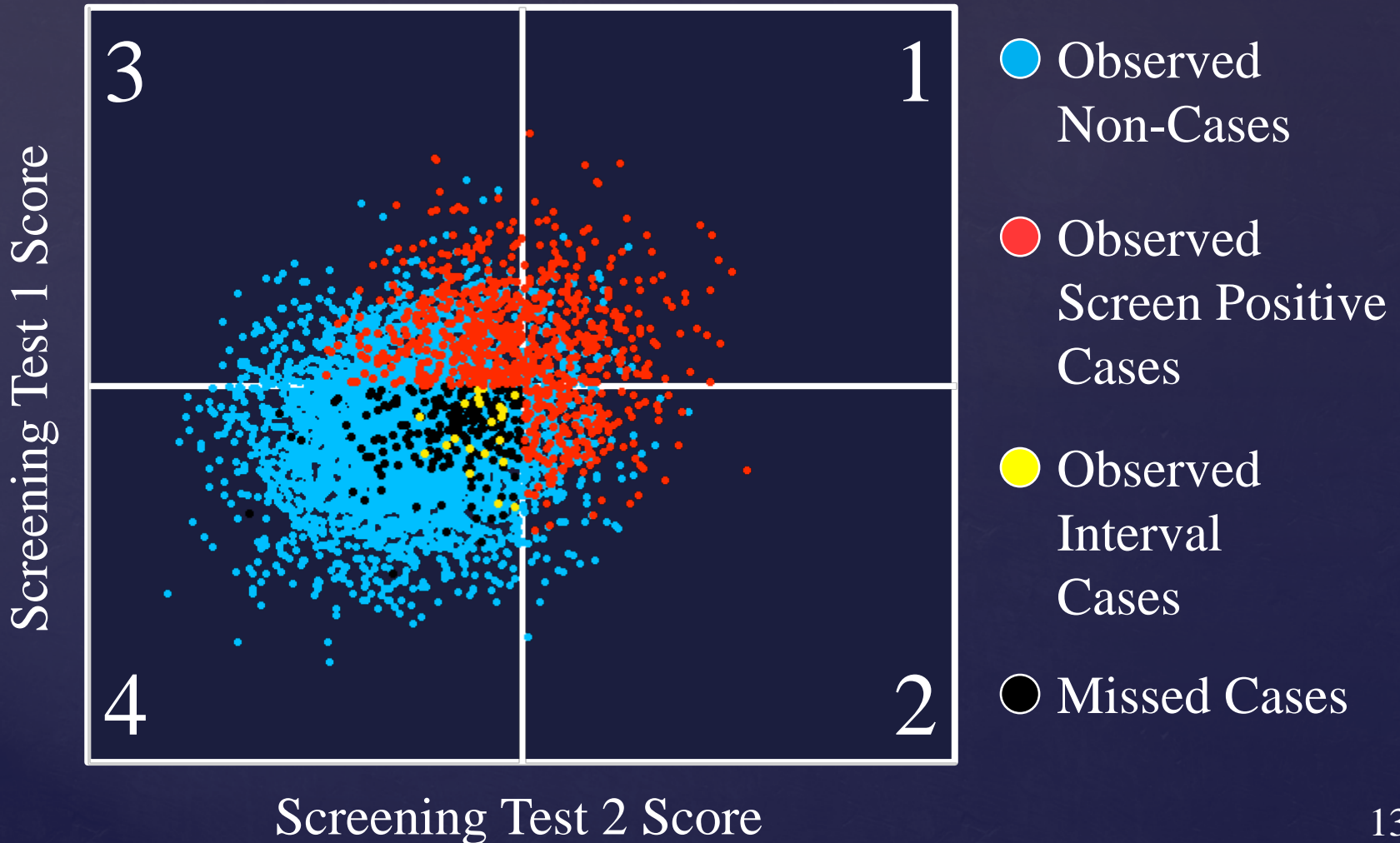
Hypothetical Cancer Screening Data

Study Investigator's Viewpoint

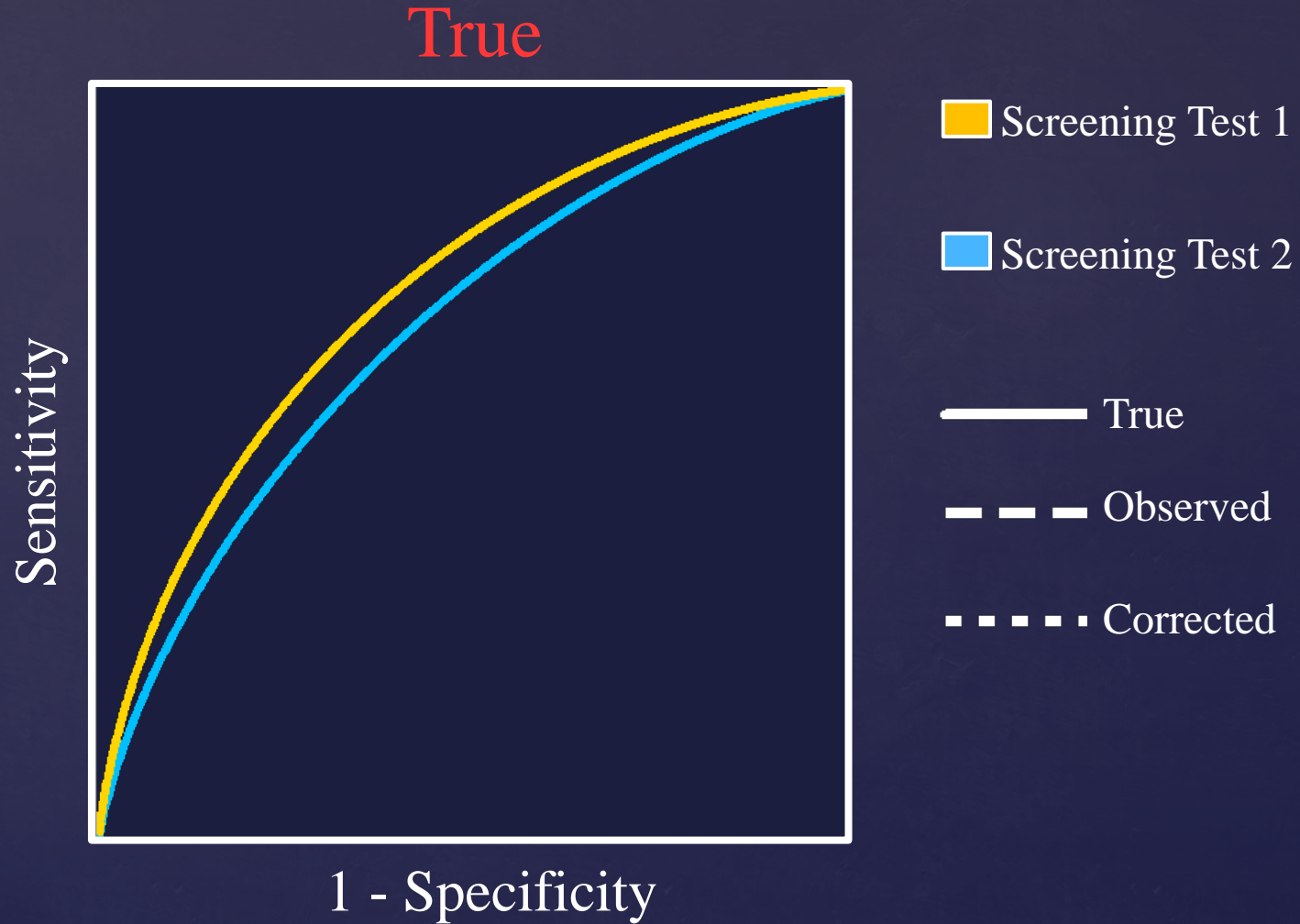


Hypothetical Cancer Screening Data

Omniscient Viewpoint

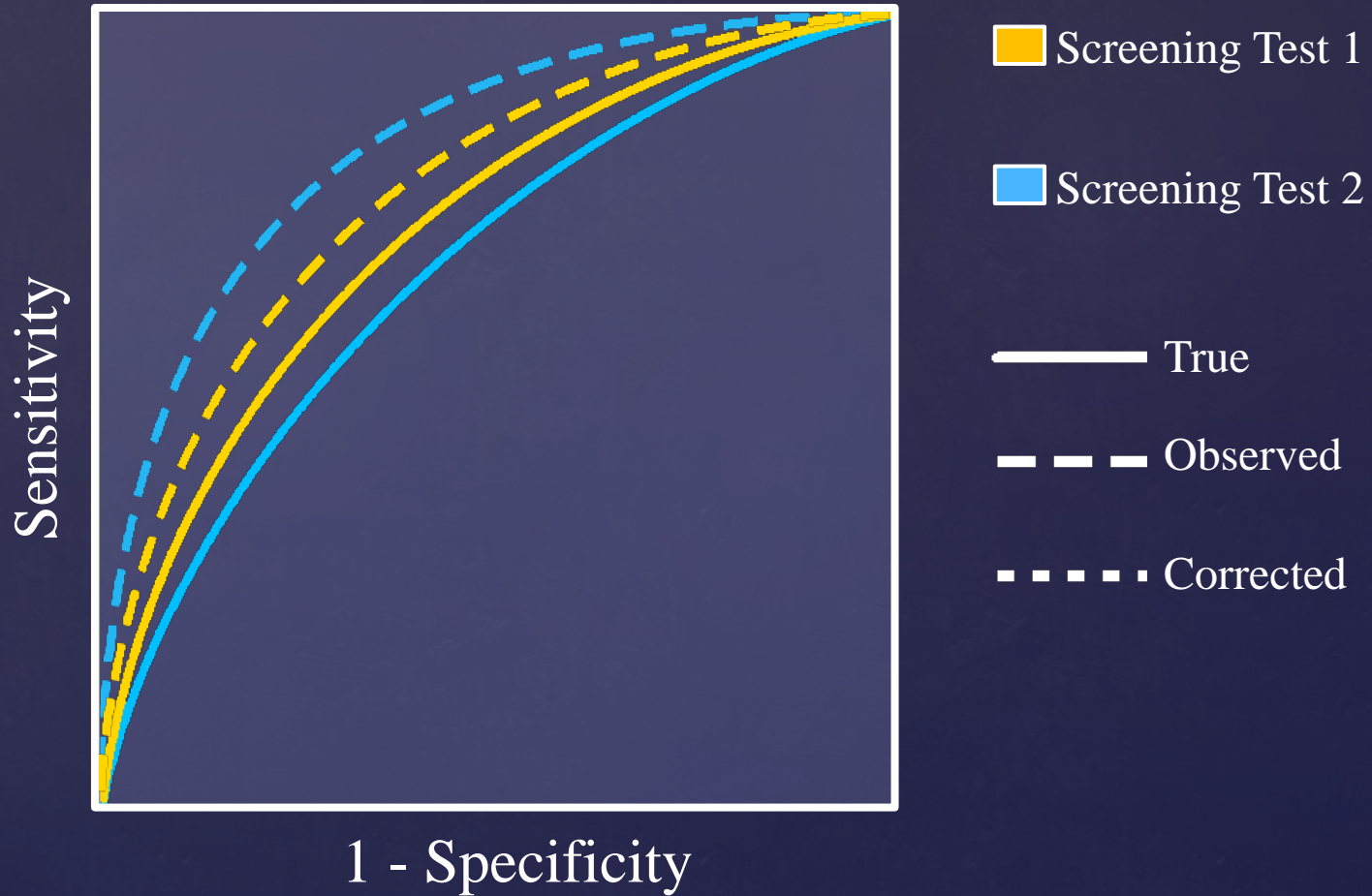


Comparing Two Continuous Screening Tests



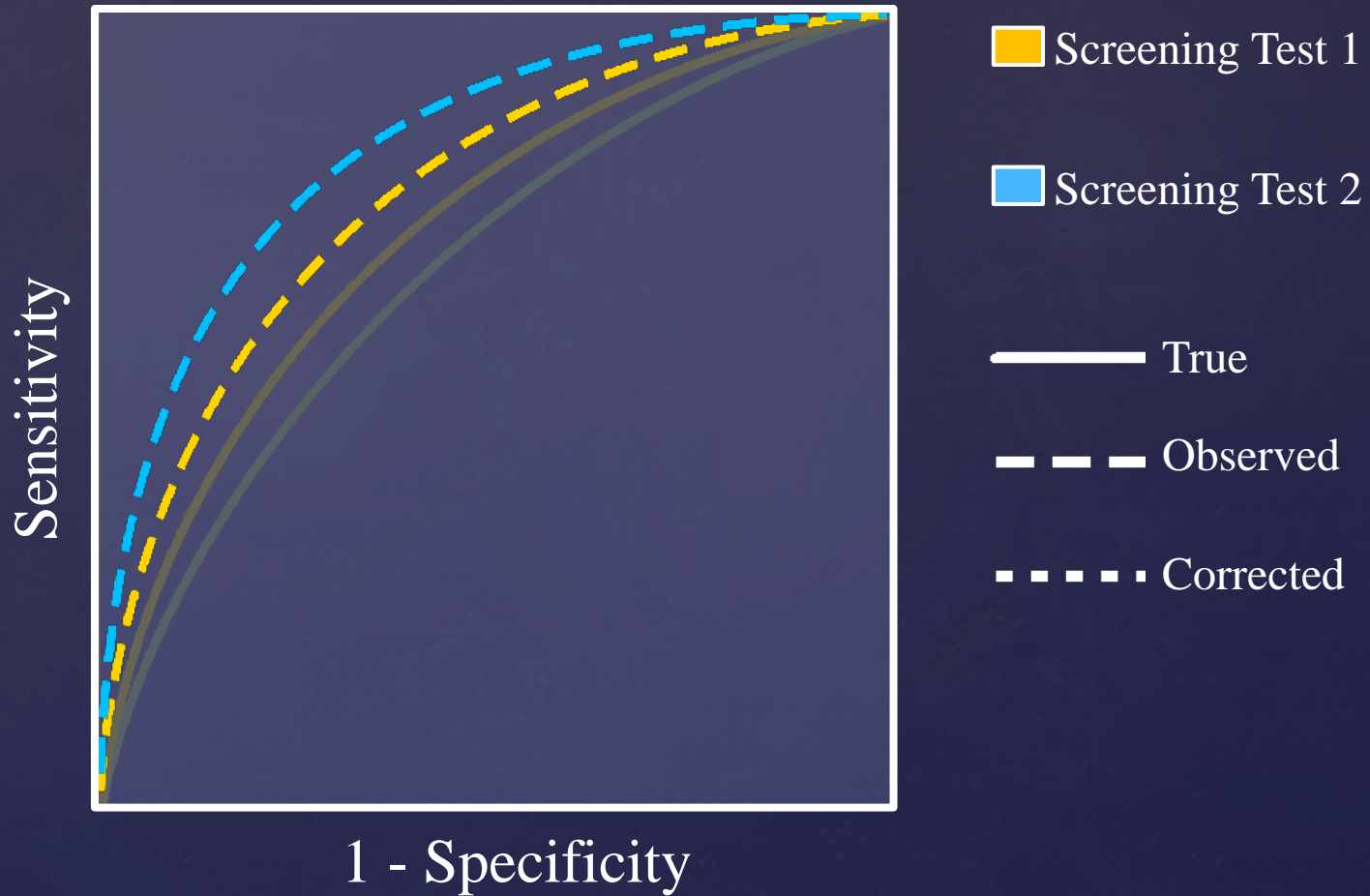
Comparing Two Continuous Screening Tests

Standard



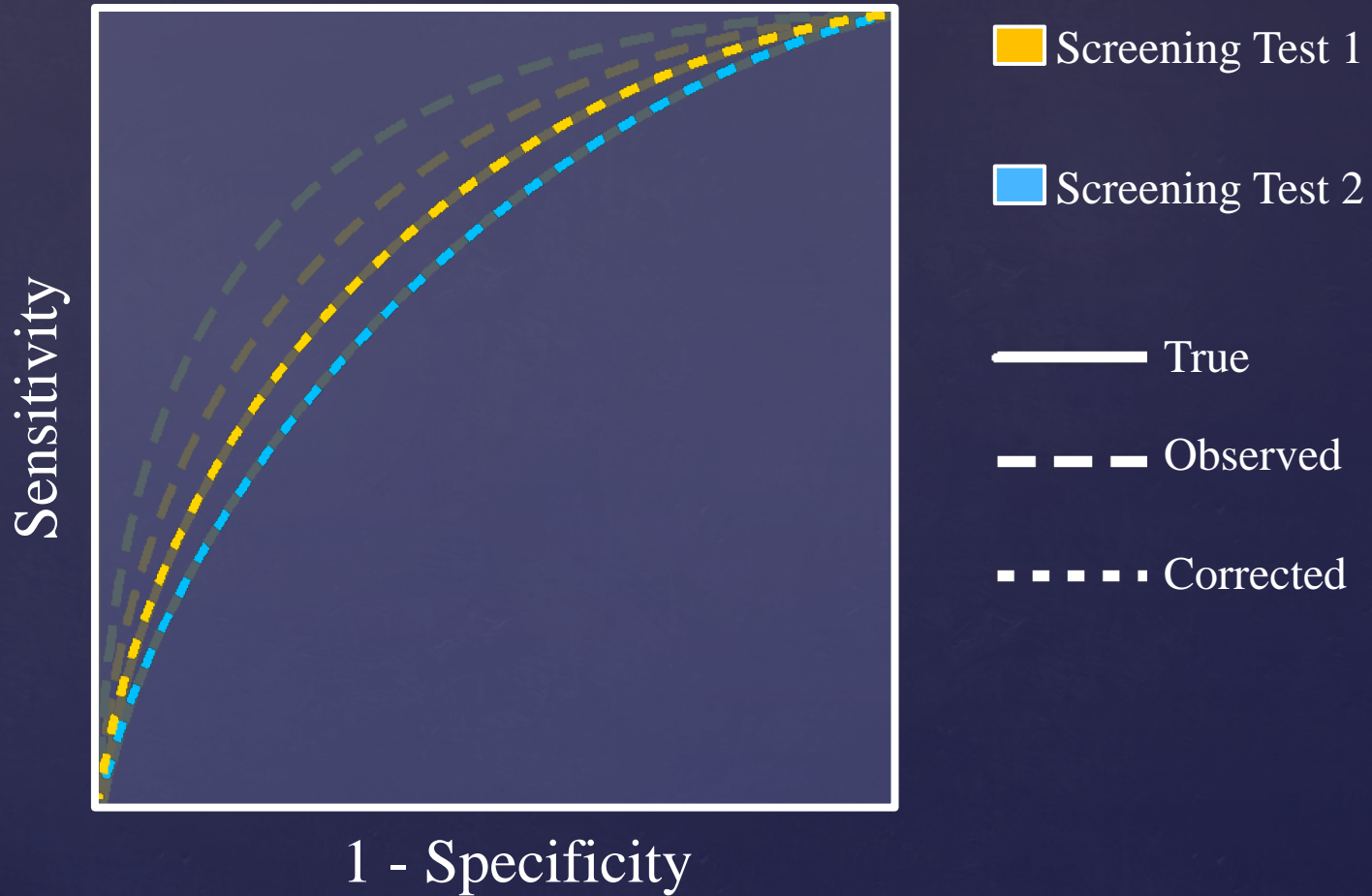
Comparing Two Continuous Screening Tests

Standard



Comparing Two Continuous Screening Tests

Corrected

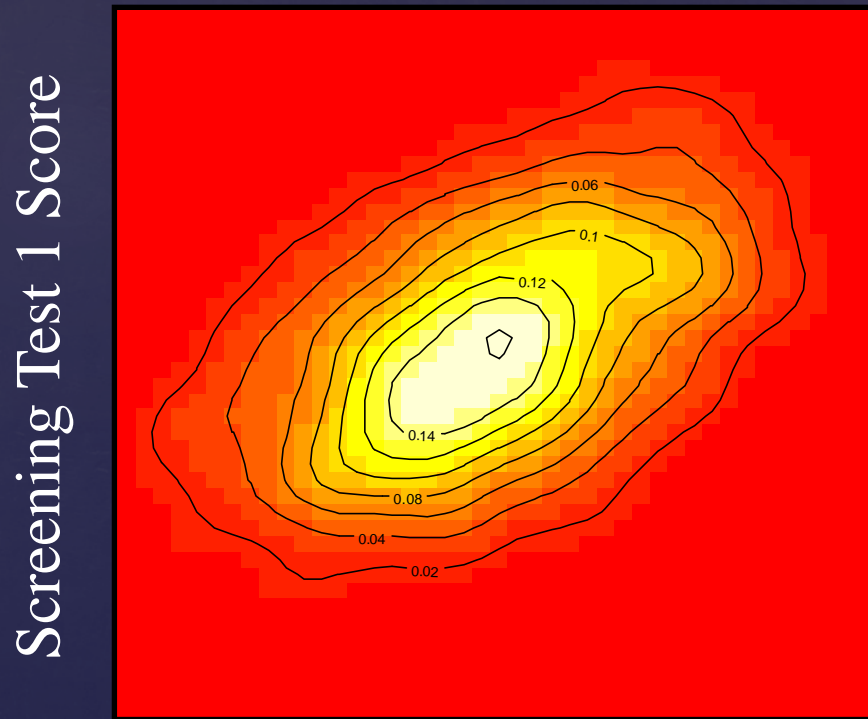


Bias Correction Algorithm

1. Find the maximum likelihood estimates of the parameters of the bivariate Gaussian distribution of test scores for the cases.
2. Use the maximum likelihood estimates and the sampling fractions in each partition to calculate weighted estimates.

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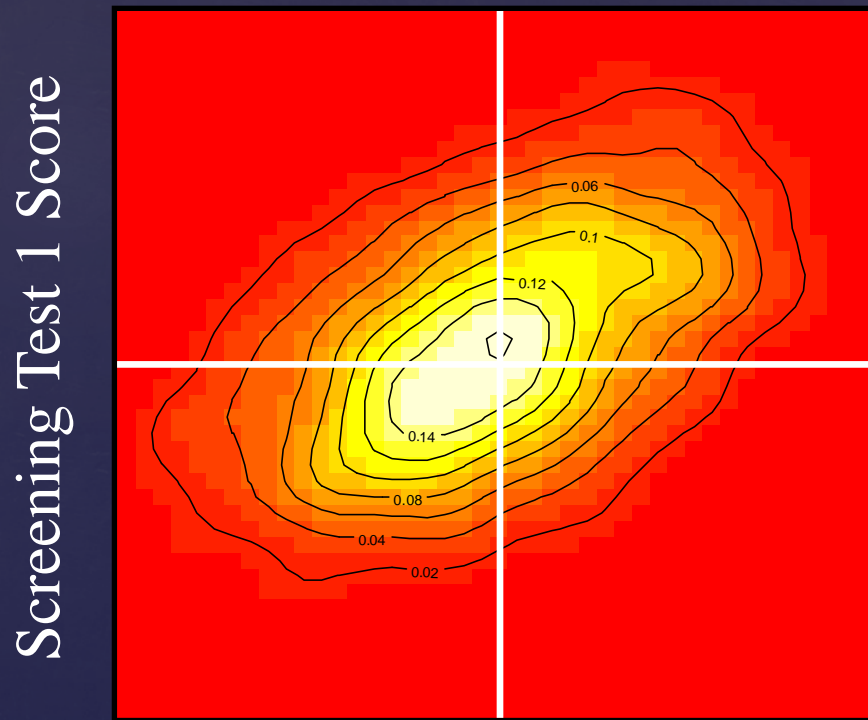


(Nath, 1971)

Screening Test 2 Score

Bias Correction Algorithm

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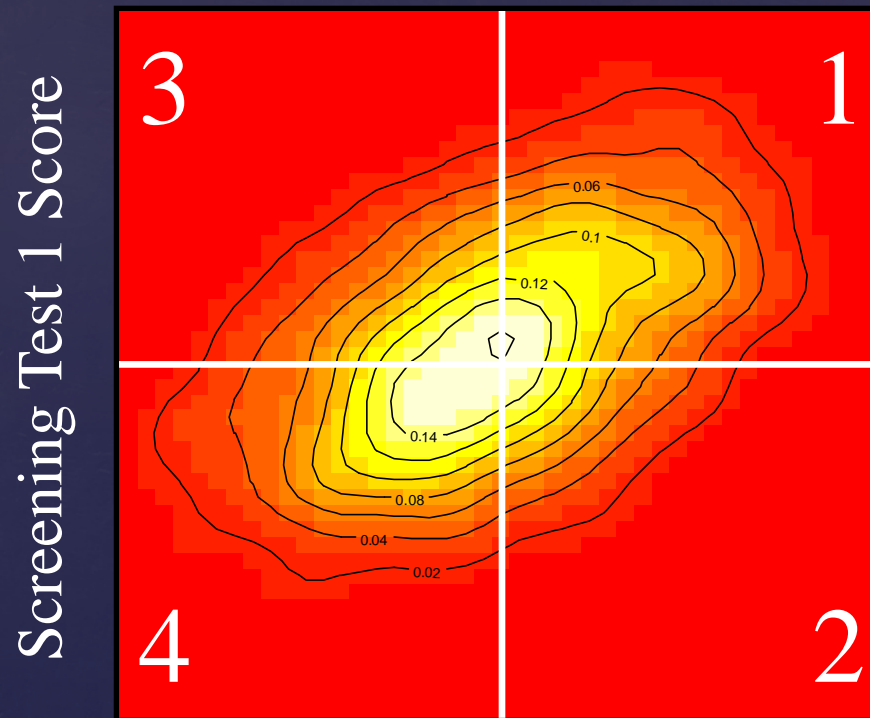


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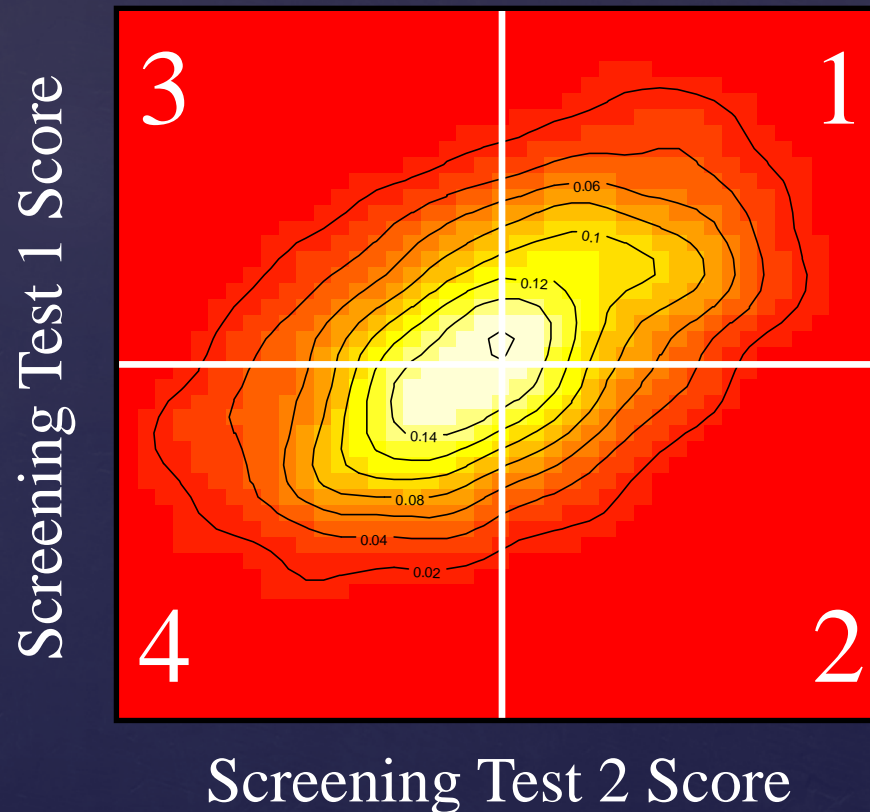
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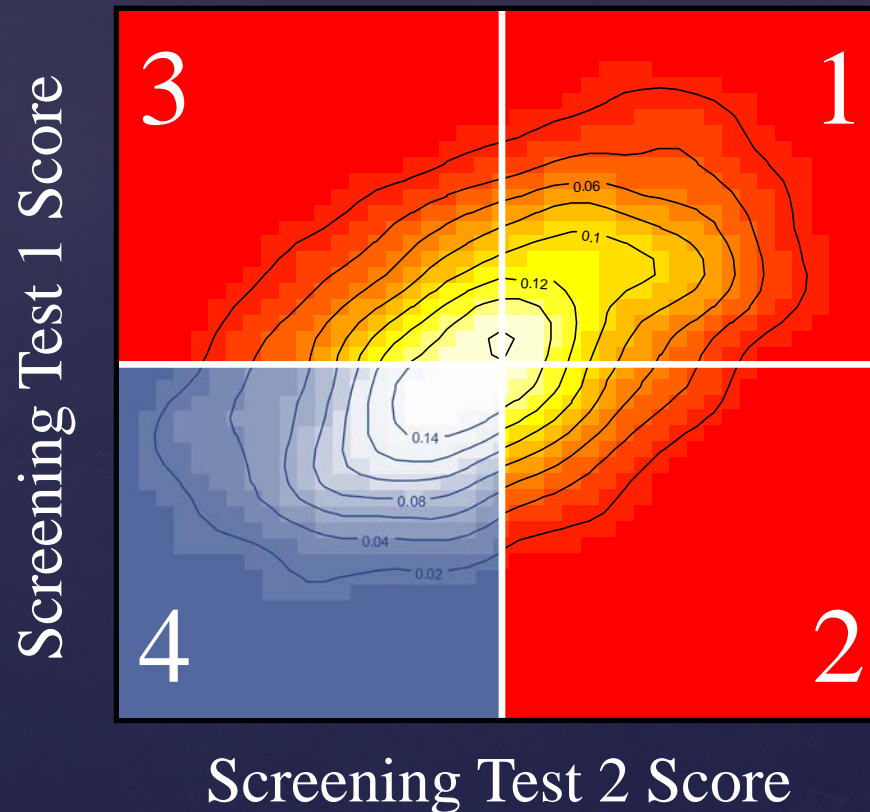
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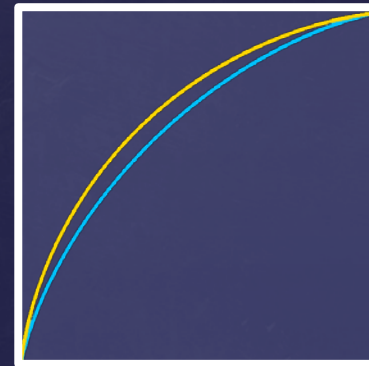
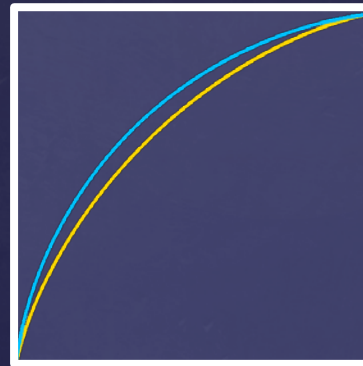
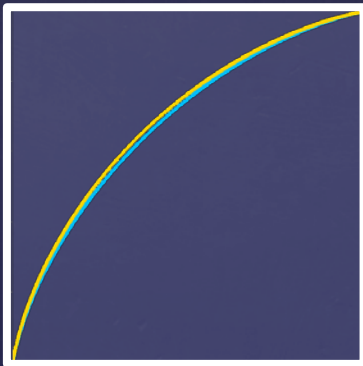
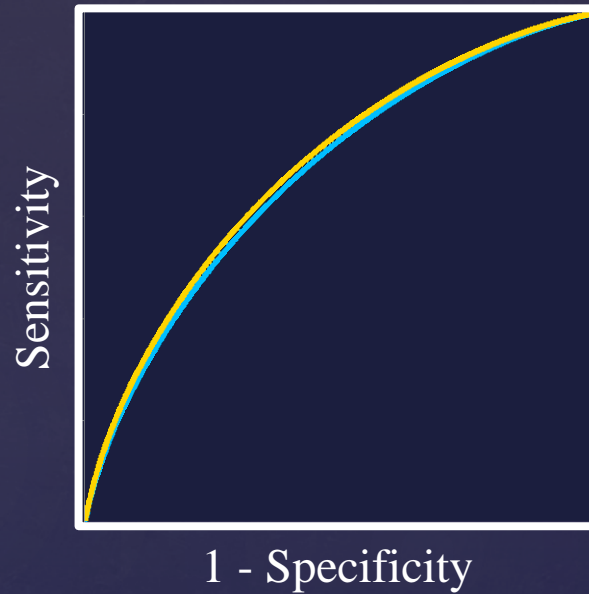


Bias Correction Algorithm

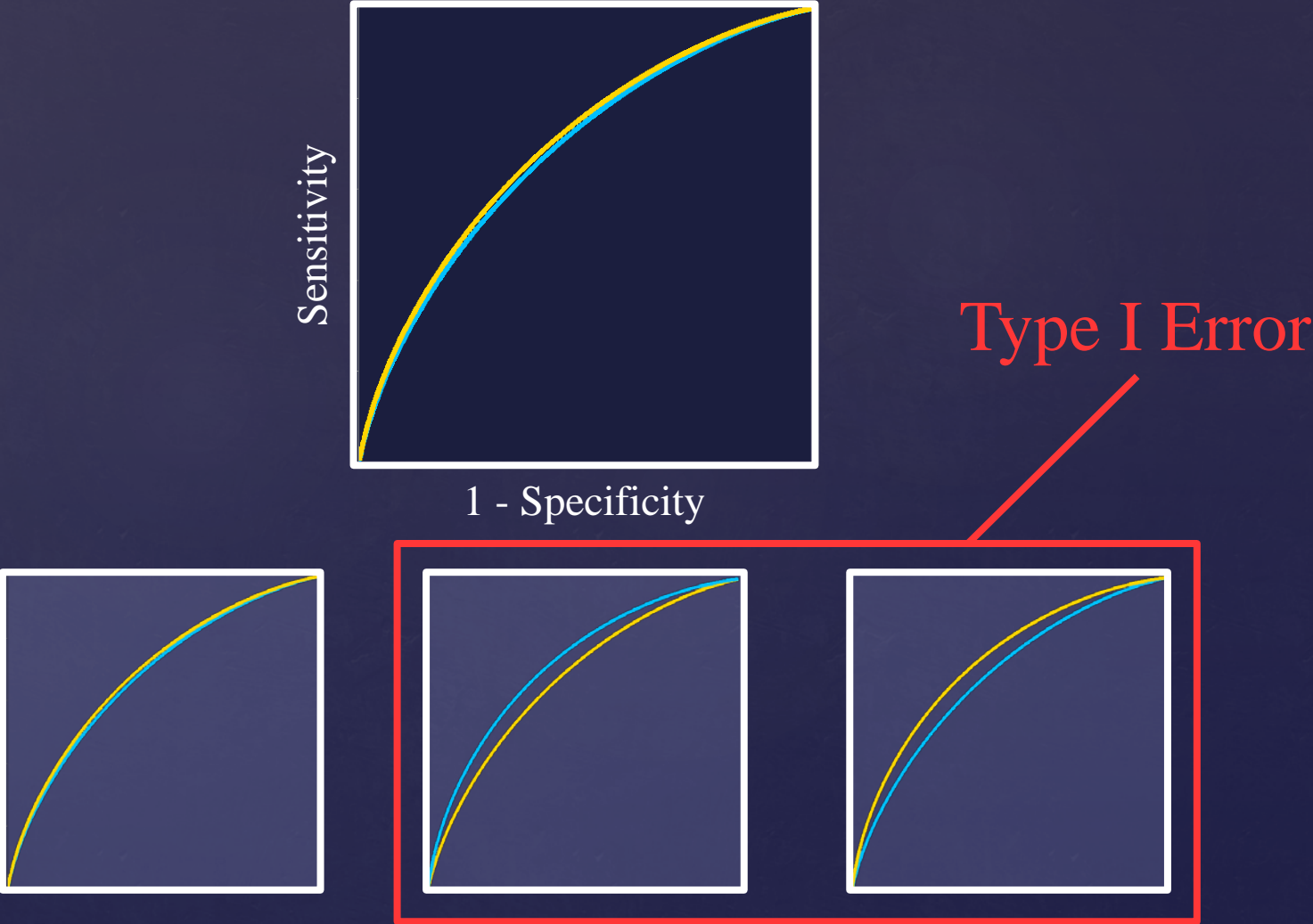
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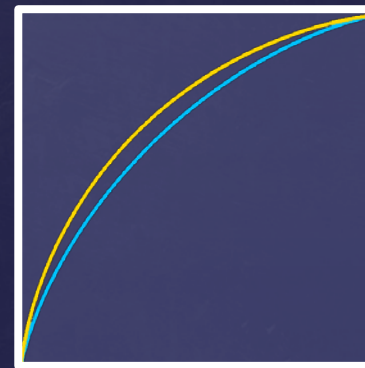
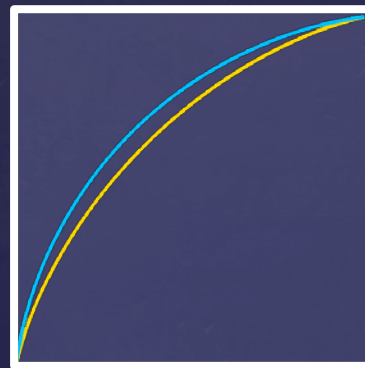
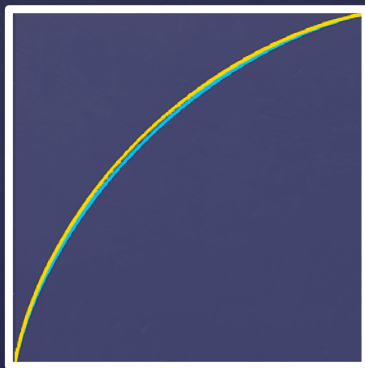
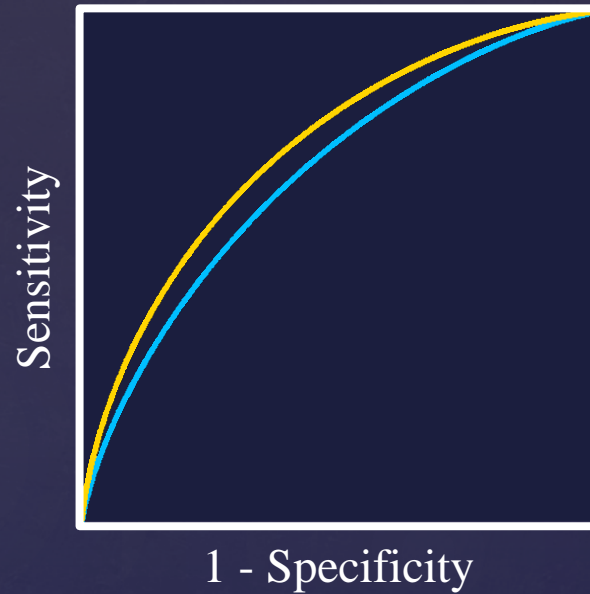
Evaluation of the Method



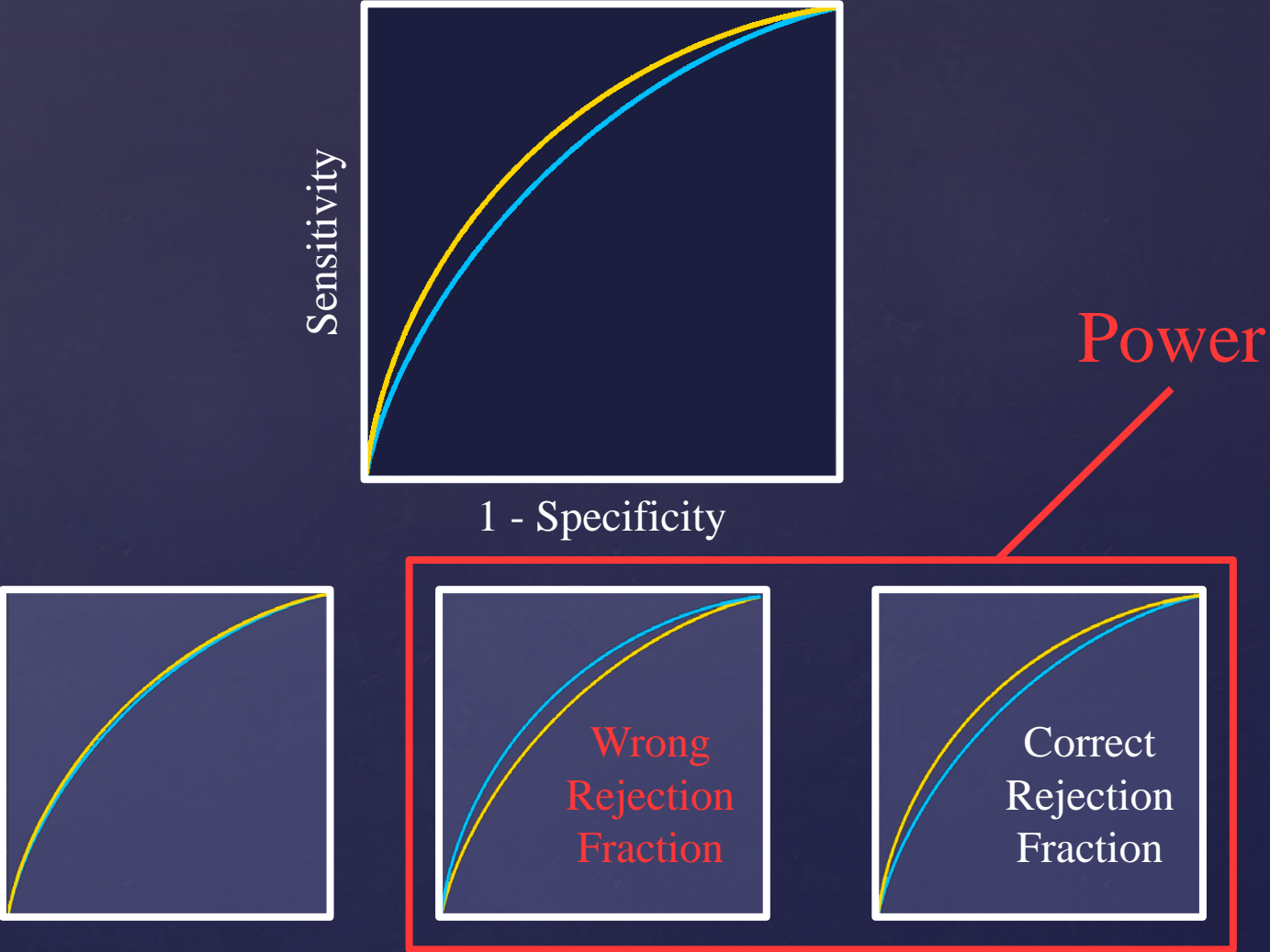
Evaluation of the Method



Evaluation of the Method



Evaluation of the Method



Recommendation

- Study investigators should conduct a **simulation of their study** using both the standard analysis and the bias correction method.
- Study investigators should choose the analysis plan that has a **nominal Type I error rate** and the **highest power** for the correct decision.

Oral Cancer Screening Demonstration

VISIBLE LIGHT



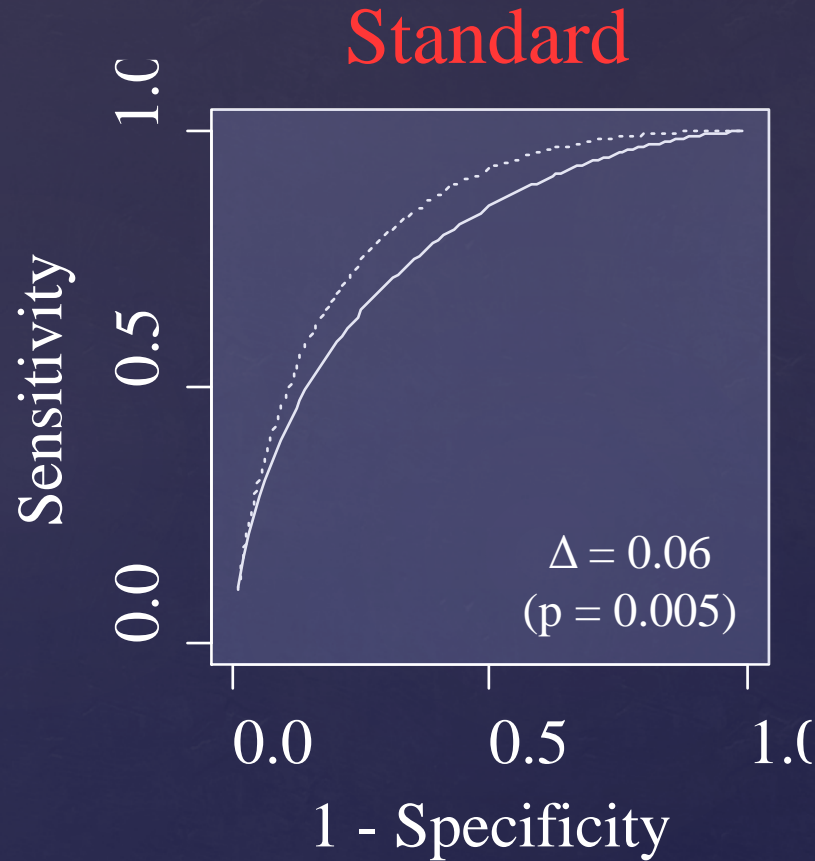
No visible lesion

AUTOFLUORESCENCE



Dark region confirmed to be carcinoma in situ

Oral Cancer Screening Analysis

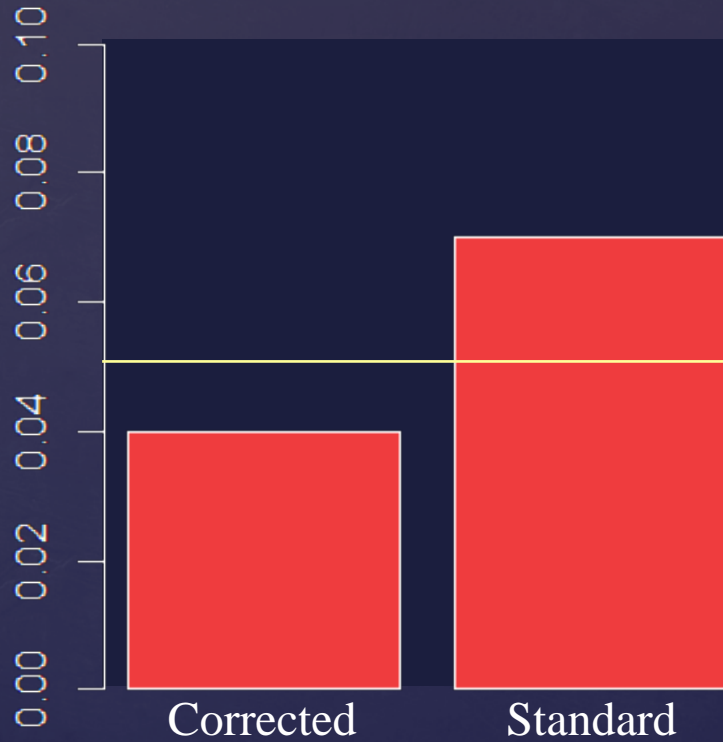


..... Autofluorescence

— Visible Light

Decision Errors Simulation

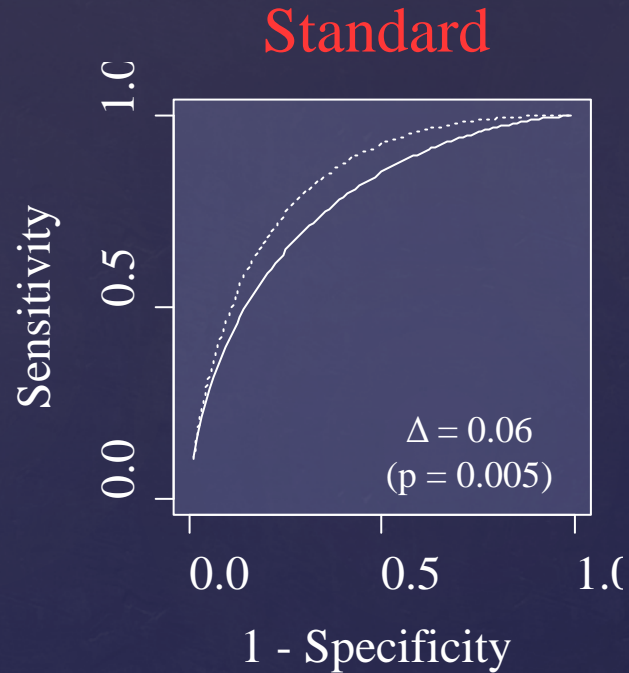
Type I Error



Wrong Rejection



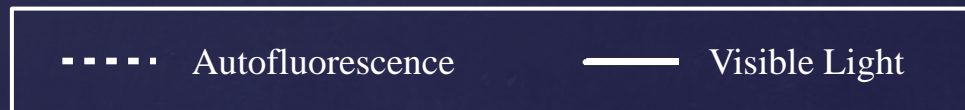
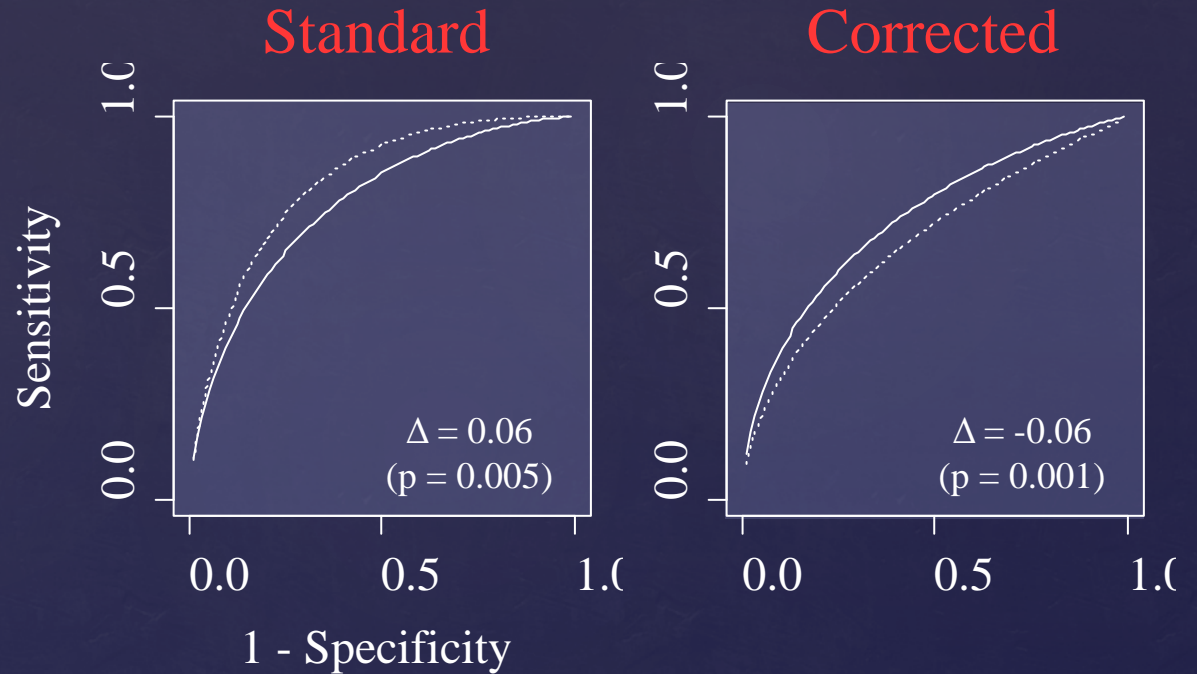
Oral Cancer Screening Analysis



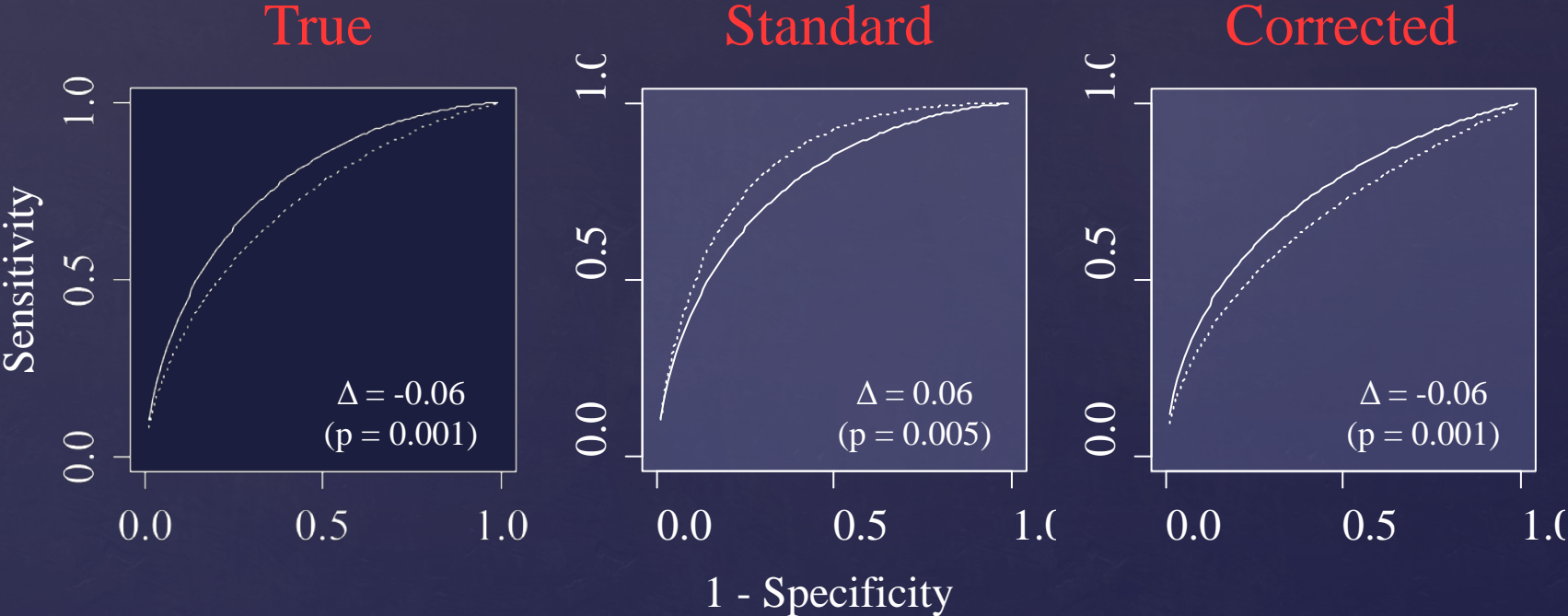
----- Autofluorescence

— Visible Light

Oral Cancer Screening Analysis



Oral Cancer Screening Analysis



References

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