

**The Problem
with
Individual Risk**

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Primary Prevention of Disease

- **Mass diseases and mass exposures require mass remedies--Geoffrey Rose**
- **Environmental, behavioral, and medical interventions should, and will, be targeted to each person's genetic susceptibility--Muin Khoury**

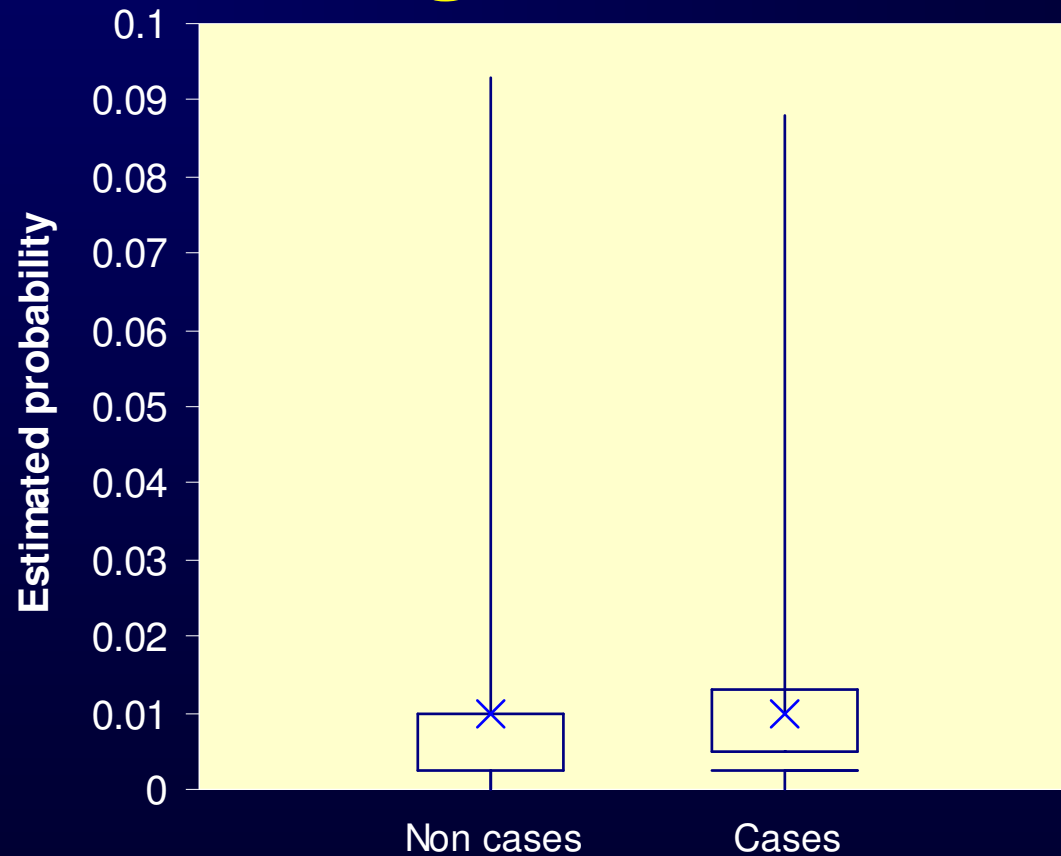
How to identify high-risk individuals?

- Most identified chronic disease risk factors have only modest associations with disease—RRs 1.5-3.0

How to identify high-risk individuals?

- For most diseases, large majority of individuals will remain disease-free over considered time period, and “individual” risk estimates will tend to cluster at low end
- Bulk of disease cases will arise from mass of population with risk factor values (“individual risk”) around average

Boxplots of 14-year estimated risk of lung cancer, according to baseline smoking status (NHS)



Assessing accuracy of prediction at individual level

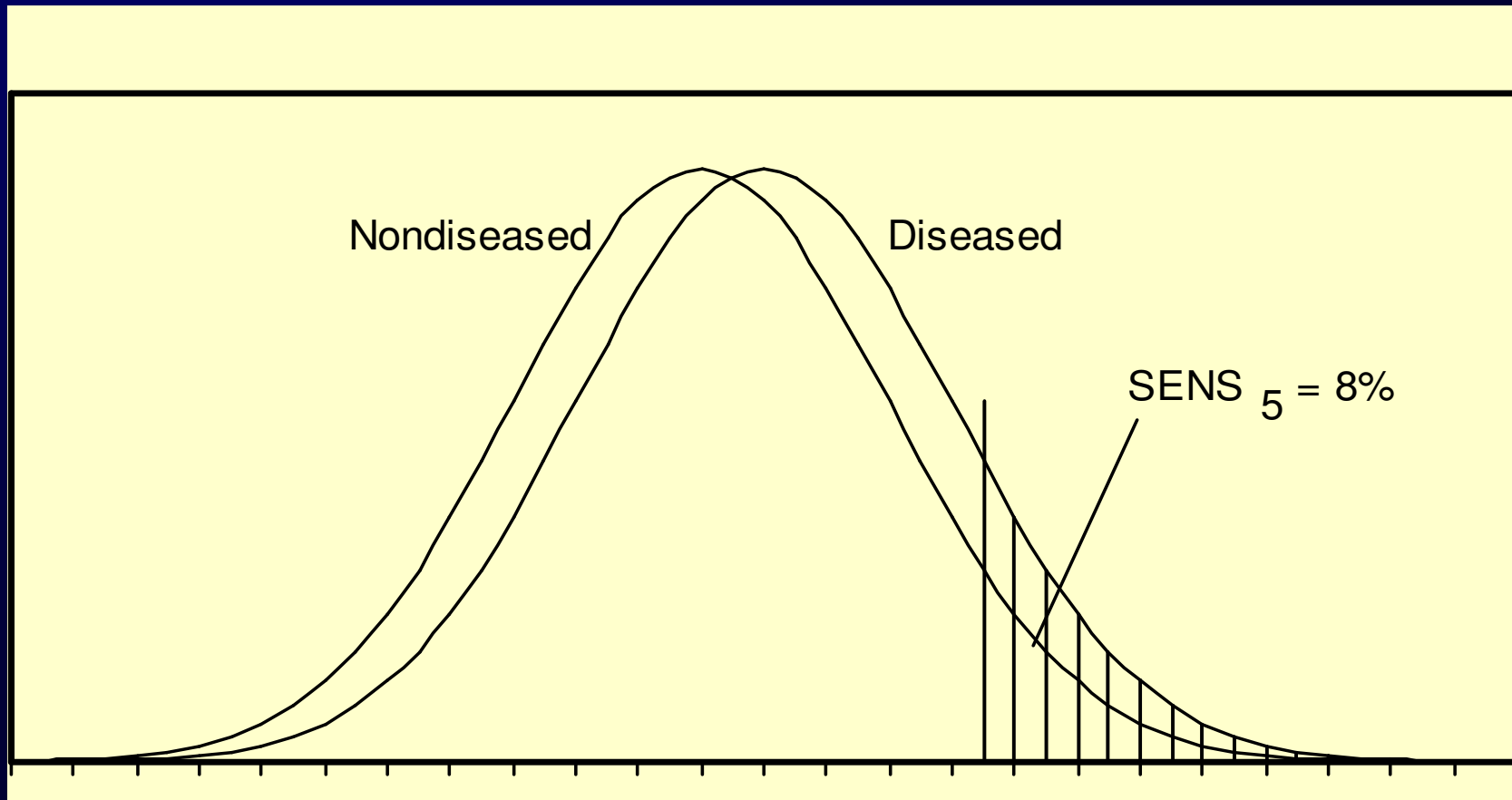
Calibration vs. discriminatory accuracy

- Calibration=goodness of fit; extent of bias in model estimation. E.g., if average predicted risk for group of individuals is 0.10, and 10% of persons develop disease over time interval, model well-calibrated.
- Discrimination: ability to separate individuals with different outcomes.

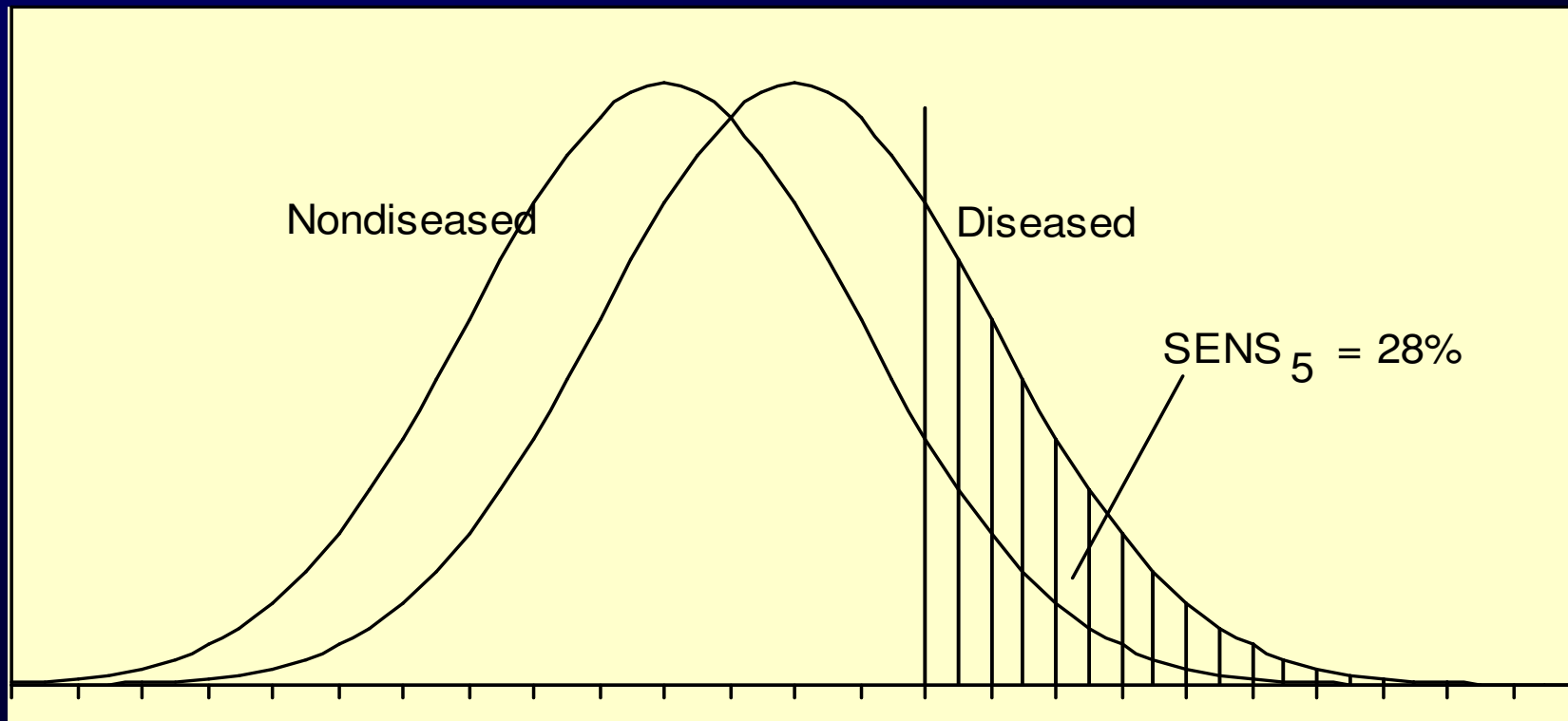
Risk factors as screening tools

Risk prediction tool must have large associated relative risk ($\gg 20$) comparing extremes of exposure or predicted risk in order to serve as useful screening tool at individual level

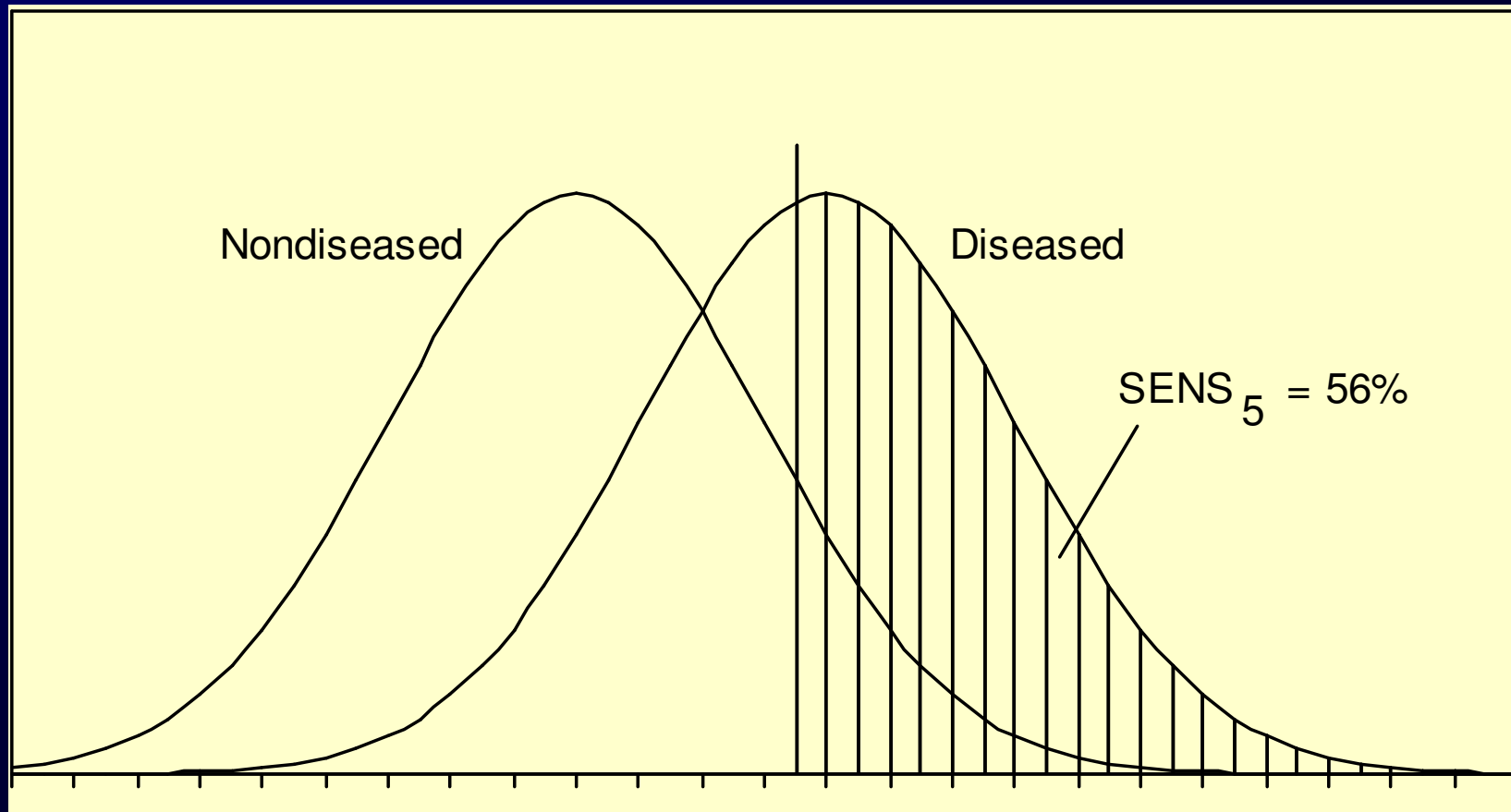
$$RR_{q1-5} = 2$$



$$RR_{q1-5} = 20$$



$$RR_{q1-5} = 200$$



Main points

- Sensitivity and specificity, and resulting positive predictive value, of most risk factors/risk models are poor. NPV higher, obviously, but key question is “how much is gained, given knowledge of risk factors, above and beyond knowledge of average risk/incidence in population?”
- Individuals concerned with these quantities, since they address question “what does this information mean for ME?”, rather than with good calibration, statistically significant predictors, etc.

Critical questions

- Is there a systematic “rational” way that individuals should act on “individual risk” information? Would a “rational” individual make a change in diet to lower 5-year risk of colon cancer from 15/10,000 to 8/10,000? Take a drug to lower risk of breast cancer from 2% to 1% in 5 years?
- Where does education end, and persuasion begin?
- Do communicators have full understanding of what they are communicating?

General conclusions

- As long as poor ability to single out small minority of individuals who will develop disease remains, a prevention strategy built upon idea of individual risk prediction and communication will have to affect many (i.e., persuade many to change or act) in order to prevent disease in a few

General conclusions

- “Mass remedies” needed; which are socially, ethically acceptable, and logically supportable?