

# Breast cancer screening- how does it work and how can it be improved?

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# Mammographic screening

- Screening for breast cancer generally uses mammography (X-ray of the breasts)
- The aim is to find cancers which are too small to be felt and are at an early and readily treatable stage
- How do we know it works?

# Randomised Trials

- One group of healthy women is allocated at random to be invited to screening (study group) or not (control group)
- The women are followed up for death from breast cancer
- If the screening works, there will be fewer breast cancer deaths in the study group

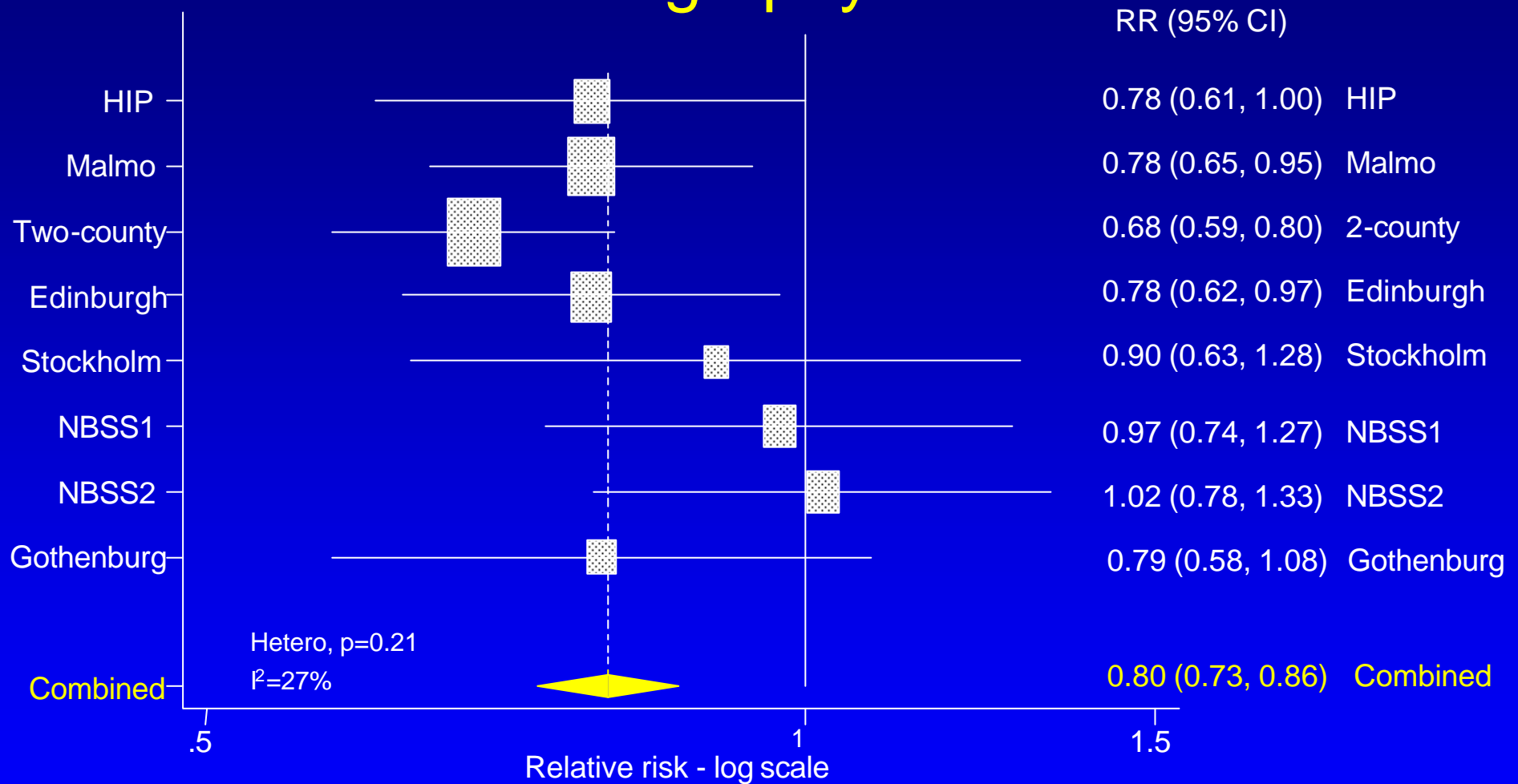
# Example- Swedish Two-County Trial

| Group   | Number of women | Breast cancer deaths | Rate/1000 |
|---------|-----------------|----------------------|-----------|
| Study   | 77080           | 319                  | 4.14      |
| Control | 55985           | 334                  | 5.97      |

Rate/1000 (study group) =  $1000 \times 319/77080 = 4.14$

Relative risk =  $4.14/5.97 = 0.69$ , a 31% mortality reduction

# RR's breast cancer mortality, Mammography RCT's



**Overall, 20% reduction in breast cancer mortality  
associated with invitation to screening mammography**

# What is the effect of being screened?

- 20% is the intention to treat result
  - Women who do not attend screening are included in the study group
  - Women who obtain screening outside of the study are included in the control group
- The International Agency for Research on Cancer concluded that the effect of actually receiving screening was closer to a 35-40% breast cancer mortality reduction

# Absolute benefit

- In the Swedish Two-County Trial, 141 breast cancer deaths were prevented by the 3-4 rounds of screening in the study group
- Of the 77080 women, on average 65518 (85%) attended for screening
- Thus we need to screen  $65518/141 = 465$  women to save one life

# How does screening work?

- In principle breast screening works by detecting the cancer while it is still
  - small
  - confined to the breast, i.e. has not invaded the regional lymph nodes
- Does this hold in practice?



# RR (mortality) and RR (node positive cancer)

| Study      | RR (mortality) | RR (node positive) |
|------------|----------------|--------------------|
| HIP        | 0.78           | 0.85               |
| Malmo      | 0.78           | 0.83               |
| 2-county   | 0.69           | 0.73               |
| Edinburgh  | 0.78           | 0.81               |
| Stockholm  | 0.90           | 0.82               |
| NBSS-1     | 0.97           | 1.20               |
| NBSS-2     | 1.02           | 1.09               |
| Gothenburg | 0.79           | 0.80               |

## How *CAN* screening work?

- Presumably, screening can only prevent deaths from cancers detected by the screening
- In principle it does not prevent deaths from cancers diagnosed between screens or in women who do not attend for screening
- Cancers detected by screening may well be a minority

# Very large effect on screen-detected tumours

- In the two-county study for screen-detected vs clinical tumours, there was a 68% reduction in fatality, adjusted for lead time
- In the UK screening programme, around 40% of tumours are screen-detected, 30% occur between screens and 30% in non-attenders
- Thus one would expect a mortality reduction of 68% of 40%, i.e. 27%

# Possible improvements

- Use of ultrasound and other imaging technologies
- Digital mammography
- Computer-Aided Detection
- Individually-tailored screening based on
  - Breast density
  - Risk
- One day there will be a blood test

# Evaluating improvements

- Two-county result based on screening for 6-7 years and 20-year follow-up
- With the pace of technology, we need more rapid evaluation
- We need a more flexible ethical and governance environment