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# **Methods in “Effect of Screening Mammography on Breast-Cancer Mortality in Norway”**

**Kalager M et al. N Engl J Med 2010;363:1203-1210**

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Kalager M et al. Ann Intern Med 2012;156:491-499

# NORWEGIAN BREAST CANCER SCREENING PROGRAM

- Started in 1996
  - ~40% of the eligible Norwegian population was invited
- Gradual implementation from 1996 to 2005
- Multidisciplinary teams
- Since 2005 all women aged 50-69 years are invited every second year

# AIM OF STUDY

Evaluate the effectiveness of the Norwegian Breast Cancer Screening Program

Challenge:

- Valid control group
    - Risk factors
    - Treatment
    - Awareness
  - Differences in incidence and mortality in the different counties
  - Account for these changes
- Changes with time

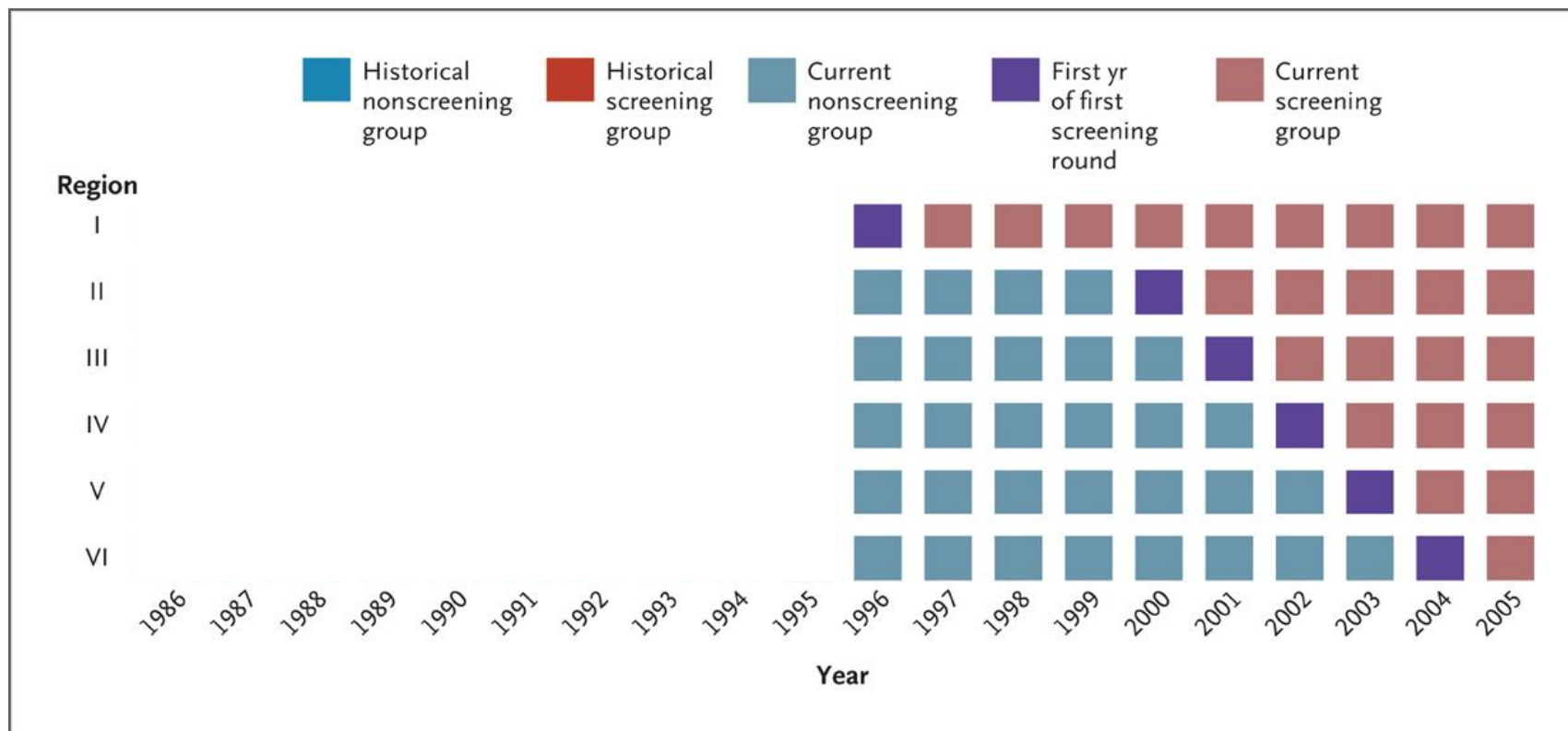
# Methods

- Individual data on all breast cancer patients from the Cancer Registry of Norway, Cause of Death Registry
- Data on person-years in all women from Statistics Norway
- 1986-2005
  - After 2005, all eligible women are invited
  - Difficult to establish valid control group
- 77% attendance in the screening program

# Methods

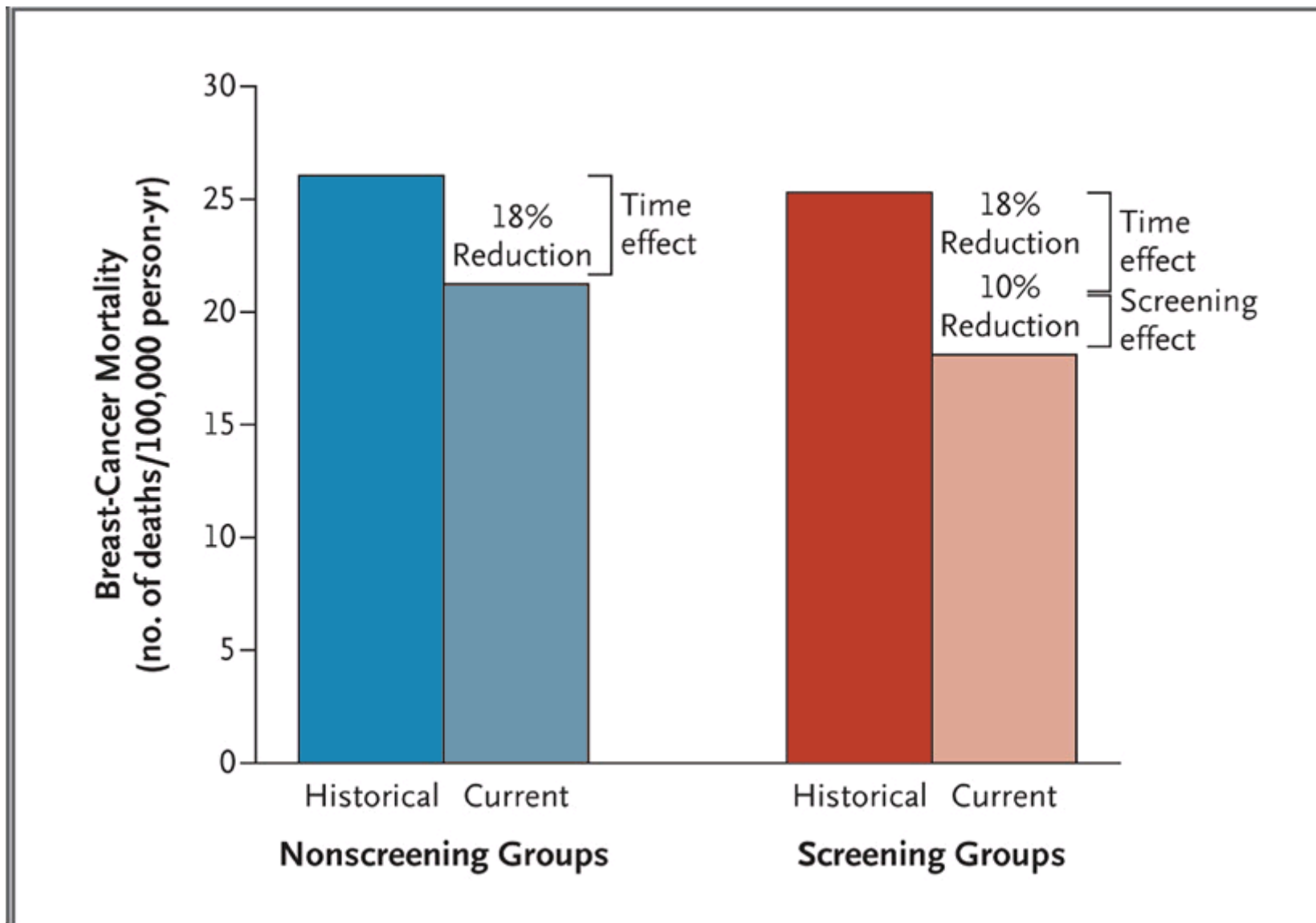
- Used incidence-based mortality (refined mortality):  
Counting the deaths only for women diagnosed after invitation to the program
- Non-constant hazard of breast cancer mortality with follow-up time:
  - Need equal follow-up in the comparison groups

## Implementation of the screening program establishing valid control groups



Incidence-based mortality

### Mortality from breast cancer women aged 50-69 years in the four groups



## Other age groups

- 20-49 years: Death from breast cancer reduced by 23 to 27%
- 70-84 years: Death from breast cancer reduced by 16 to 24%
- Can not be associated with screening



## Possible outcomes, age 50 to 69 years

- Pre- (historical data) and post screening comparison not valid:
  - If we did not account for time changes: 28% reduction in mortality
- Equal follow-up time in the comparison:
  - If the current screening group was followed for 9 years and the historical screening group was followed for 3 years a 63% reduction in mortality would be found (MRR 0.47)

# SUMMARY

- Four-group comparison eliminates biases
  - Changes over time (underlying risk, treatment, awareness)
  - Regional differences
  - Follow-up time
- Individual data for all cancer patients; county data for the rest (as “individual” as it gets)
  - Problem? I doubt it!
- Reduction in death from breast cancer from 1986 to 2005
  - Overall: 28%; Associated with screening: 10%

## Benefit and Harm with Screening Mammography and Aspirin

10-year risk of death from breast cancer (bars above 0) and 10-year risk of diagnosis of breast cancer (bars below 0) with and without mammography screening/Aspirin use. Difference between the percentages represented by the bars shows the absolute benefit or (background data from literature)

