IN THE NAME OF GOD

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Breast-Cancer Tumor Size, Overdiagnosis, and Mammography Screening Effectiveness

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BACKGROUND

- The goal of screening mammography is to detect small malignant tumors before they grow large enough to cause symptoms

INTRODUCTION

- After the advent of screening mammography:

  detected breast tumors that were small increased from ٣٦% to ٦٨%

  detected tumors that were large decreased from ٦٤% to ٣٢%.

INTRODUCTION

- the decline in the size-specific case fatality rate :

improved treatment was responsible for at least two thirds of the reduction in breast cancer mortality.

- the efficacy of screening mammography in reducing cancer-specific mortality in the relatively controlled setting of randomized trials:

- those trials may not accurately reflect the actual effectiveness of screening when it is used in clinical practice.

- trial data
- an assessment of some negative consequences of screening, such as false positive results and associated diagnostic procedures
- such assessments may understate what actually occurs when screening is implemented in the general community.

- One response to these challenges :
  microsimulation modeling.

- The output of statistical models :
  the appeal of quantitative precision
  more apparent than real

- the biologic characteristics of tumors:

  more relevant to breast cancer prognosis than the size of the tumor

- tumor size is more relevant to the assessment of the proximate effect of screening.

- In this analysis:
- trends in malignant breast tumor size to approximate the contribution of screening mammography to
- reduction in breast-cancer mortality and
- estimate the magnitude of overdiagnosis.

METHOD

- calculate the tumor-size distribution and size-specific incidence of breast cancer among women ٤٠ years of age or older.

- calculated the size-specific cancer case fatality rate for two time periods:
- a baseline period before the implementation of widespread screening mammography (١٩٧٥ through ١٩٧٩)
- a period encompassing the most recent years for which ١٠ years of follow-up data were available (٢٠٠٠ through ٢٠٠٢).

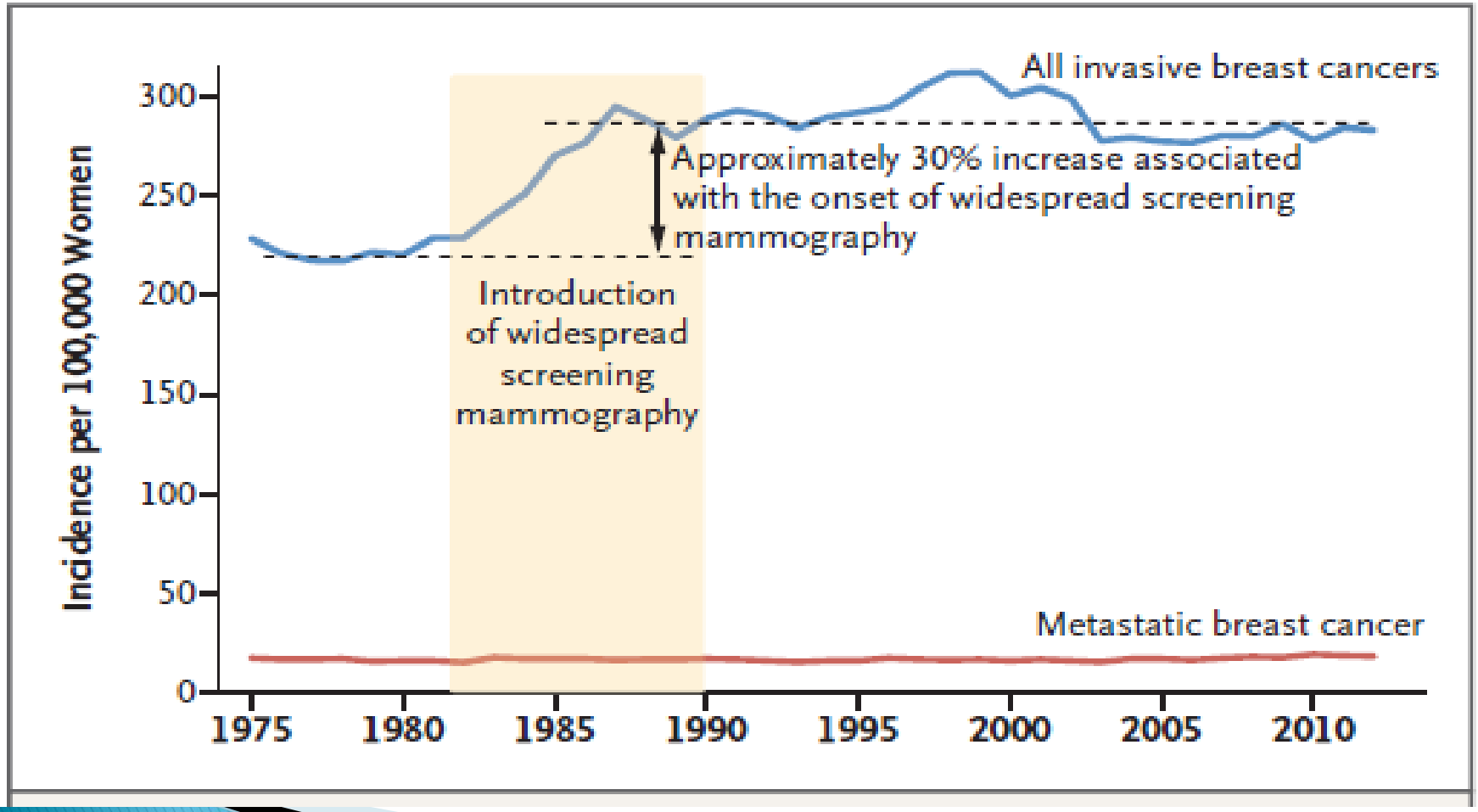
MEASURES:

- *Tumor-Size Distribution and Size-Specific Incidence*
- *Ten-Year Risk of Death from Breast Cancer*

Approximations:

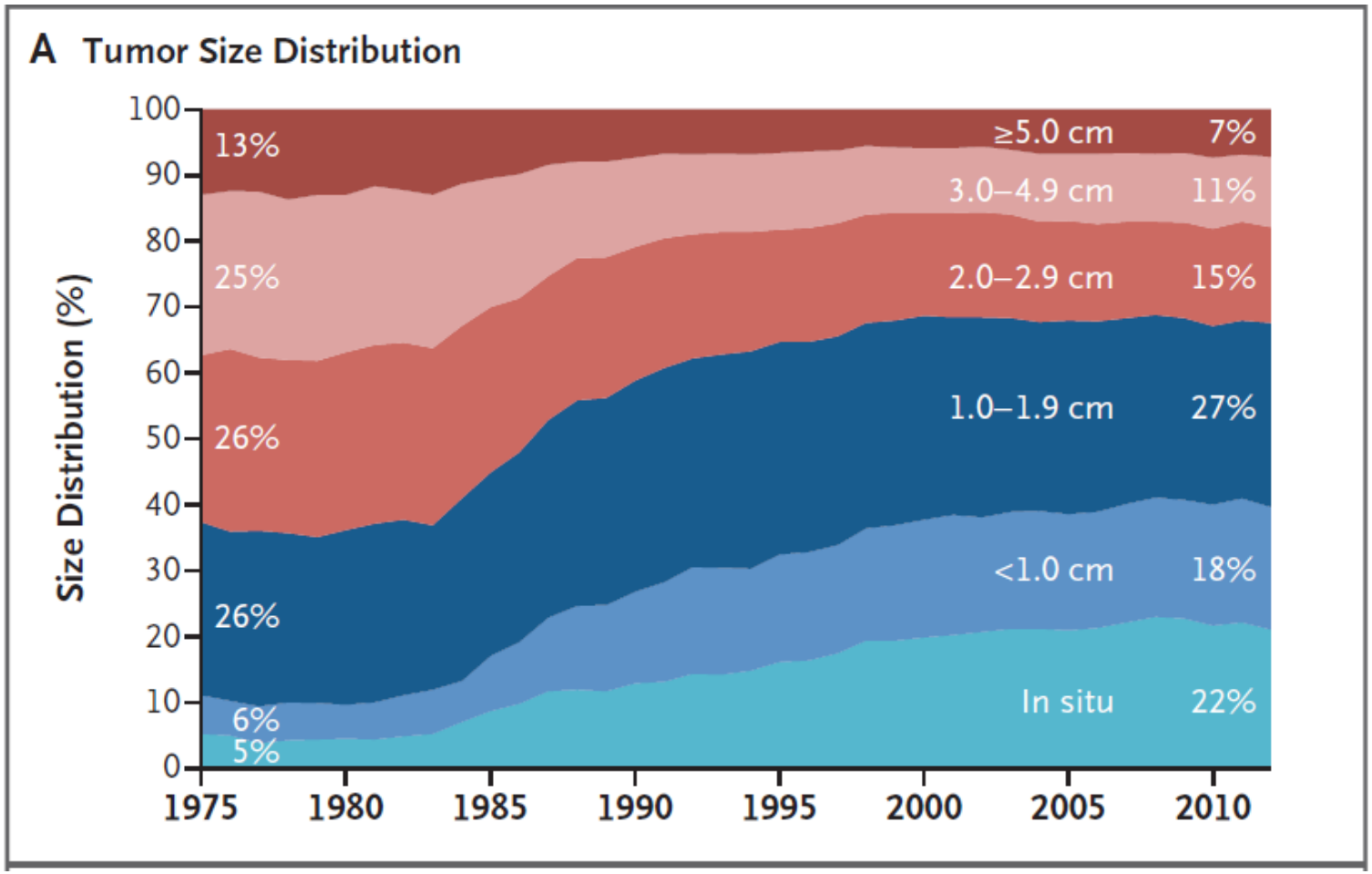
- *Magnitude of Overdiagnosis*
- *Relative Contribution of Improved Cancer Treatment versus Screening*

Temporal Relationship between the Introduction of Screening Mammography and Increased Incidence of Invasive Breast Cancer.



RESULT

- **Breast-Cancer Tumor-Size Distribution and Size-Specific Incidence among Women ٤٠ Years of Age or Older in the United States, ١٩٧٥–٢٠١٢.**


A Tumor Size Distribution
Size Distribution (%)
100
90
80
70
60
50
40
30
20
10
0
1975
1980
1985
1990
1995
2000
2005
2010
13%
25%
26%
26%
6%
5%
≥5.0 cm 7%
3.0–4.9 cm 11%
2.0–2.9 cm 15%
1.0–1.9 cm 27%
<1.0 cm 18%
In situ 22%

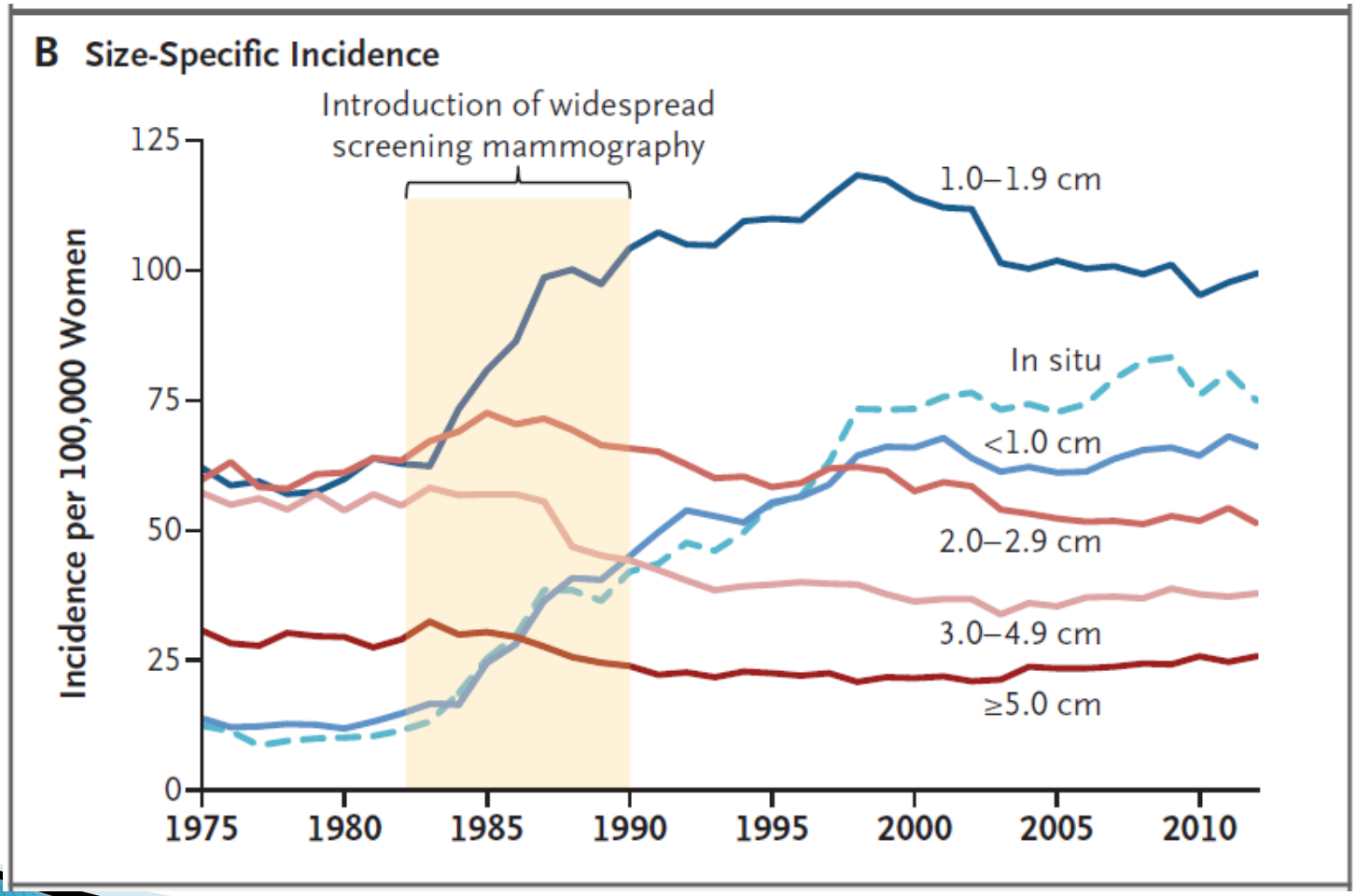

B Size-Specific Incidence
Introduction of widespread screening mammography
Incidence per 100,000 Women
125
100
75
50
25
0
1975
1980
1985
1990
1995
2000
2005
2010
1.0–1.9 cm
In situ
<1.0 cm
2.0–2.9 cm
3.0–4.9 cm
≥5.0 cm

Table 1. Change in Size-Specific Incidence of Breast Cancer among Women 40 Years of Age or Older after the Introduction of Screening Mammography.*

Tumor Size	Size-Specific Incidence per 100,000 Women†		
	1975–1979	2008–2012	Change
Large tumors			
≥5.0 cm	29	25	–4
3.0 to 4.9 cm	56	38	–18
2.0 to 2.9 cm	60	52	–8
Total (95% CI)	145 (144 to 147)	115 (114 to 116)	–30 (–28 to –33)
Small tumors			
1.0 to 1.9 cm	59	99	40
<1.0 cm	13	66	53
In situ	10	79	69
Total (95% CI)	82 (81 to 83)	244 (243 to 245)	162 (160 to 164)

Change in Size-Specific Case Fatality Rate.

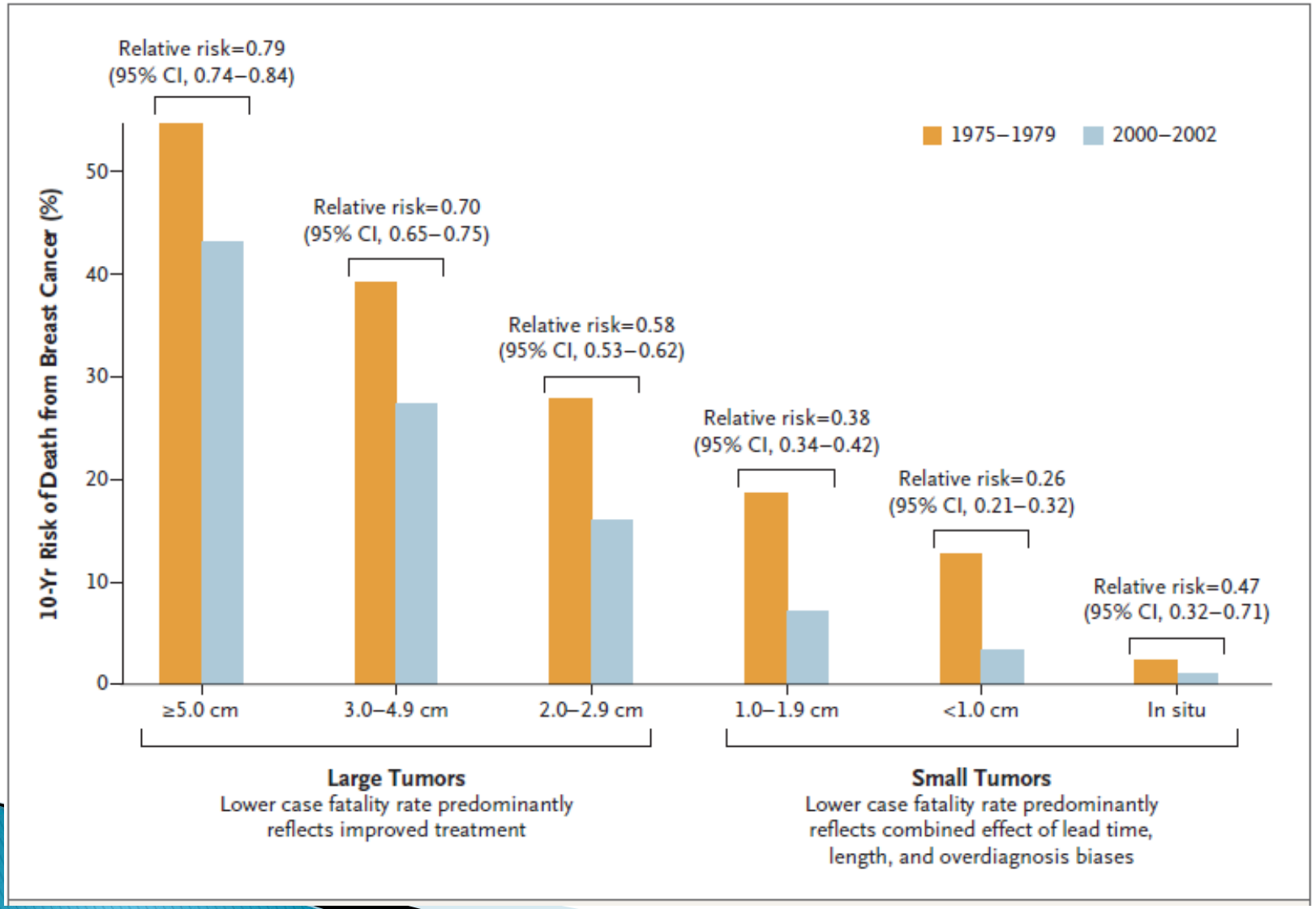


Table 2. Approximations of the Effects of Improved Breast-Cancer Treatment and Screening Mammography on Breast-Cancer Mortality among Women 40 Years of Age or Older.*

Effect	Tumor Size			Total
	≥5.0 cm	3.0–4.9 cm	2.0–2.9 cm	
Approximate effect of improved treatment had screening not occurred				
Size-specific case fatality rate				
Baseline	55%	39%	28%	
Recent	43%	27%	16%	
Absolute reduction from baseline (percentage points)	12	12	12	
Baseline size-specific incidence of breast cancer per 100,000 women	29	56	60	
Mortality reduction per 100,000 women, calculated as absolute reduction from baseline × baseline size-specific incidence (95% CI)	3 (2–4)	7 (6–8)	7 (6–8)	17 (15–19)
Approximate effect of screening				
Size-specific incidence of breast cancer per 100,000 women				
Baseline	29	56	60	
Recent	25	38	52	
Absolute reduction from baseline	4	18	8	
Effect given previously available therapy				
Baseline case fatality rate	55%	39%	28%	
Mortality reduction per 100,000 women, calculated as absolute reduction from baseline × baseline case fatality rate (95% CI)	2 (2–3)	7 (7–8)	2 (2–3)	12 (11–13)†
Effect given more recent therapy				
Recent case fatality rate	43%	27%	16%	
Mortality reduction per 100,000 women, calculated as absolute reduction from baseline × recent case fatality rate (95% CI)	2 (1–2)	5 (5–6)	1 (1–1)	8 (7–9)

DISCISSION

- clear that the biologic characteristics of the tumor are more relevant to breast-cancer prognosis than the size of the tumor
- Tumor size is, at best, a very crude manifestation of underlying biologic characteristics.

DISCISSION

- Our analysis of size-specific incidence highlights the fact that the introduction of screening mammography :

  produced a mixture of effects.

DISCISSION

- Screening can result :

  the harm of overdiagnosis yet simultaneously result in the benefit of lower breast-cancer mortality.

DISCISSION

- earlier detection at a smaller size would not translate into a mortality reduction
- shift in tumor-size distribution to screening mammography:

did not take into consideration the possibility that women may have sought care earlier in the course of their disease.

DISCISSION

- We assumed that the underlying incidence of breast cancer was unchanged and that the observed increase reflected the increased observational intensity associated with screening

DISCISSION

- We do not pretend to present a precise estimate of either the amount of overdiagnosis or the contribution of screening mammography to the reduction in breast-cancer mortality.

CONCLUSIONS

- The data regarding size-specific incidence:
- make clear that the magnitude of overdiagnosis is larger than is generally recognized
- the data regarding size-specific case fatality rate clarify that decreasing breast-cancer mortality largely reflects improved cancer treatment.

Thanks for your attention