

Insurability of cancer survivors: conditional survival of breast cancer patients

An online model predicting the excess mortality of individual (ex-)breast cancer patients

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Conflicts of interest

- R.F. Kneepkens: president of the local organising committee of ICLAM 2016, board member of the ICLAM
- De Hoop Life Reinsurance: sponsor of ICLAM 2016
- This project is conducted for the Dutch Association of Insurers and the Dutch federation of cancer patient organisations levenmetkanker
- My work for this project is paid by the Dutch Association of Insurers.

Introduction

- Cancer patients and survivors often experience problems in getting a life insurance
- Ten-year survival rates calculated from diagnosis: clients of insurers perceive the data to be outdated
- Survival rates will change as time passes
- Insurers underwriting decision: evidence-based

- To determine 10-year conditional relative survival of breast cancer patients in specific age groups, for different stages.
 - Output: prediction model that estimates extra death rates for individual patients

Netherlands Cancer Registry

- Large, population-based, including all Dutch cancer patients, from 1989
- Pathologic Anatomic National Automated Archive (PALGA) → signal to iKNL
- Trained registration clerks
- Primary registration: data on patient and tumour characteristics, primary treatment + vital status (Municipal Personal Records Database)
- Follow-up registration: actively go back to patient files → registration of all recurrences

Study population

- Inclusion criteria
 - Women
 - Breast cancer
 - Diagnosed 2000-2008
 - Stage I-III
 - Received surgery

Methods

- Relative survival: observed survival / expected survival
- Conditional (x year survived) relative survival:
 - Cohort 2000-2004: without HER2 status
 - Cohort 2005-2008: with HER2 status
- Conditional relative survival for patients without recurrences:
 - Cohort 2005: active follow-up
- Life tables of general population

Methods

- Prediction model
 - Predictive factors from literature
 - General linear models with Poisson distribution
 - Reference population
- Still in progress

Results: numbers

- Total cohort: n=103,375
 - 2000-2004: n=55,238 (without HER2 status)
 - 2005-2008: n=48,137 (including HER2 status)
- 2005 cohort: n=10,261 (including HER2 status)
- Median follow-up: 9.5 years
 - 2000-2004: 12.2 years
 - 2005-2008: 8.4 years

Results: characteristics

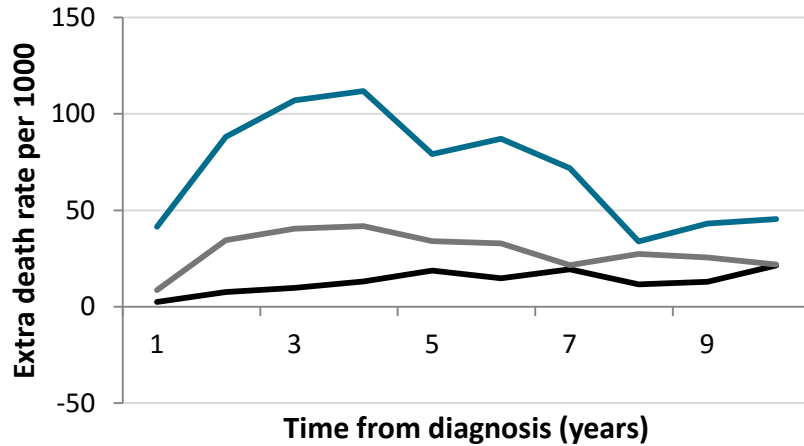
• Age <40	±6%	• Stage I	±43%
Age 40-64	±58%	Stage II	±45%
Age >64	±36%	Stage III	±12%

- From 2005 on
 - More targeted therapy
 - HER2 status determined
 - More often breast conserving surgery
 - Less often axillary lymph node dissection

Results: extra death rates

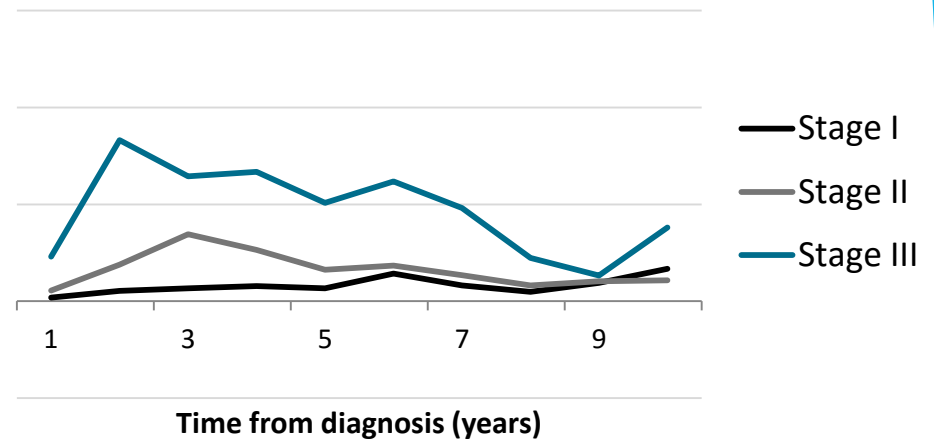
2000-2004

Age <40



2005-2008

Age <40



- Stage I
- Stage II
- Stage III

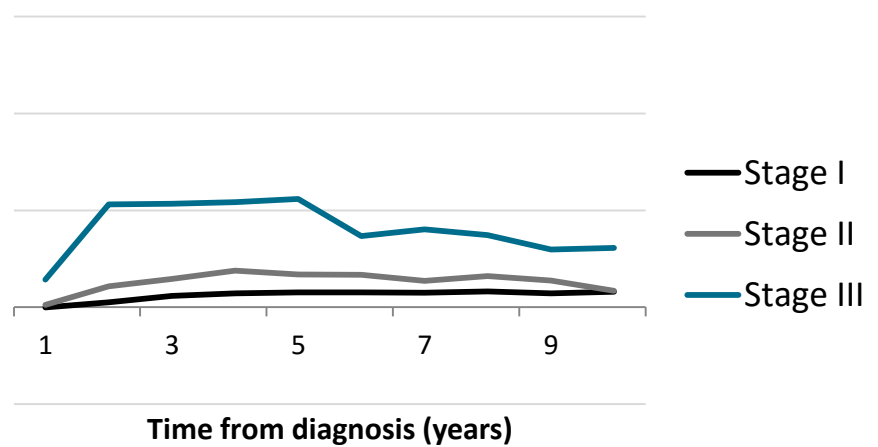
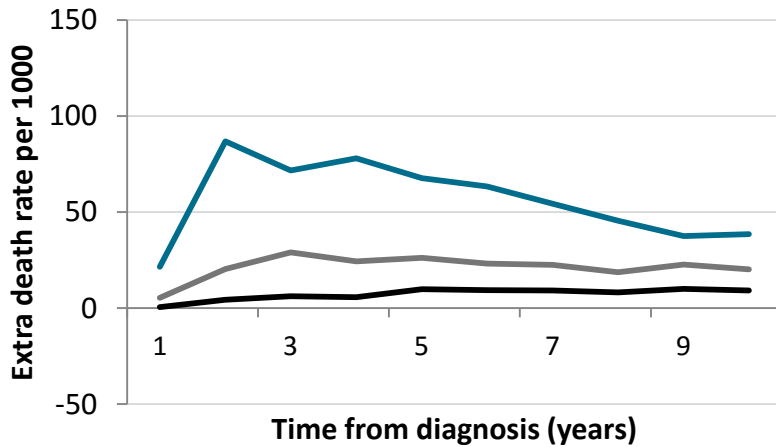
Results: extra death rates

2000-2004

2005-2008

Age 40-64

Age 40-64



- Stage I
- Stage II
- Stage III

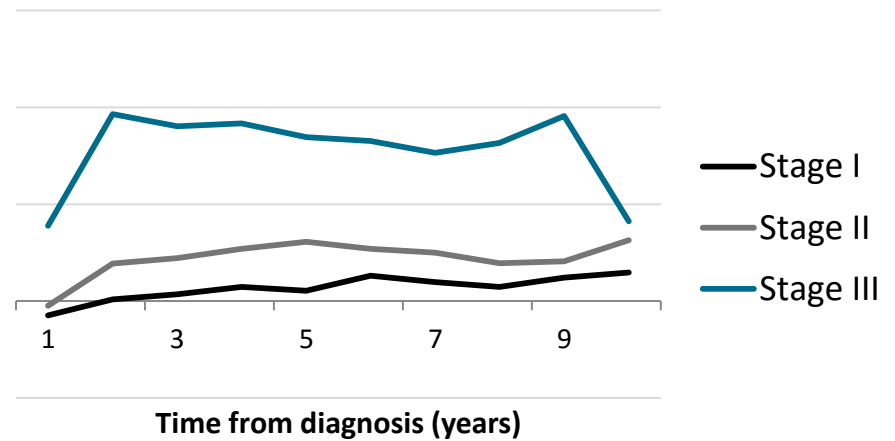
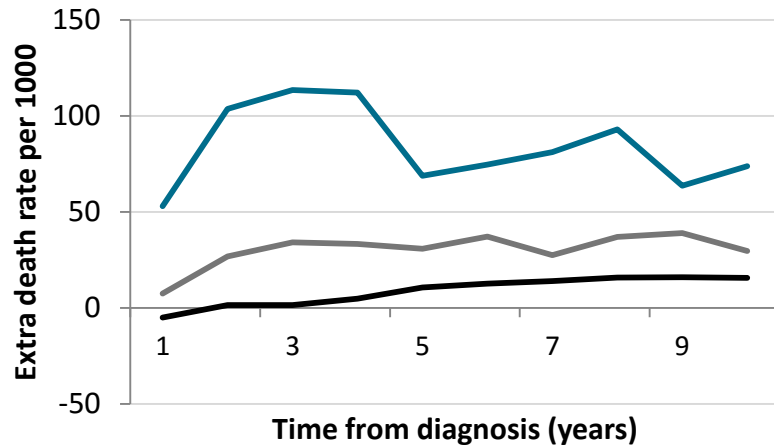
Results: extra death rates

2000-2004

2005-2008

Age >64

Age >64



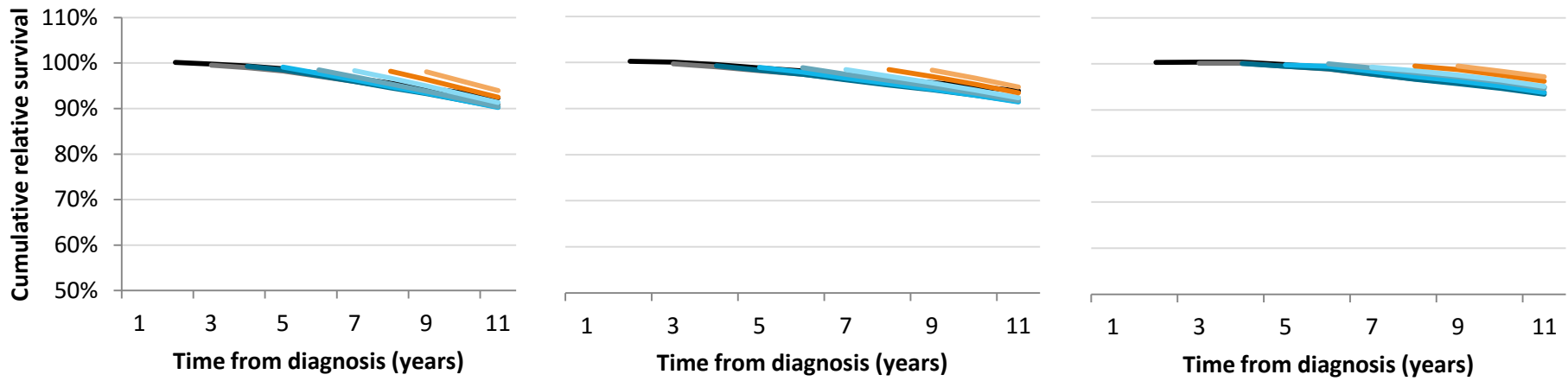
- Stage I
- Stage II
- Stage III

Results: conditional relative survival

2000-2004: Stage I

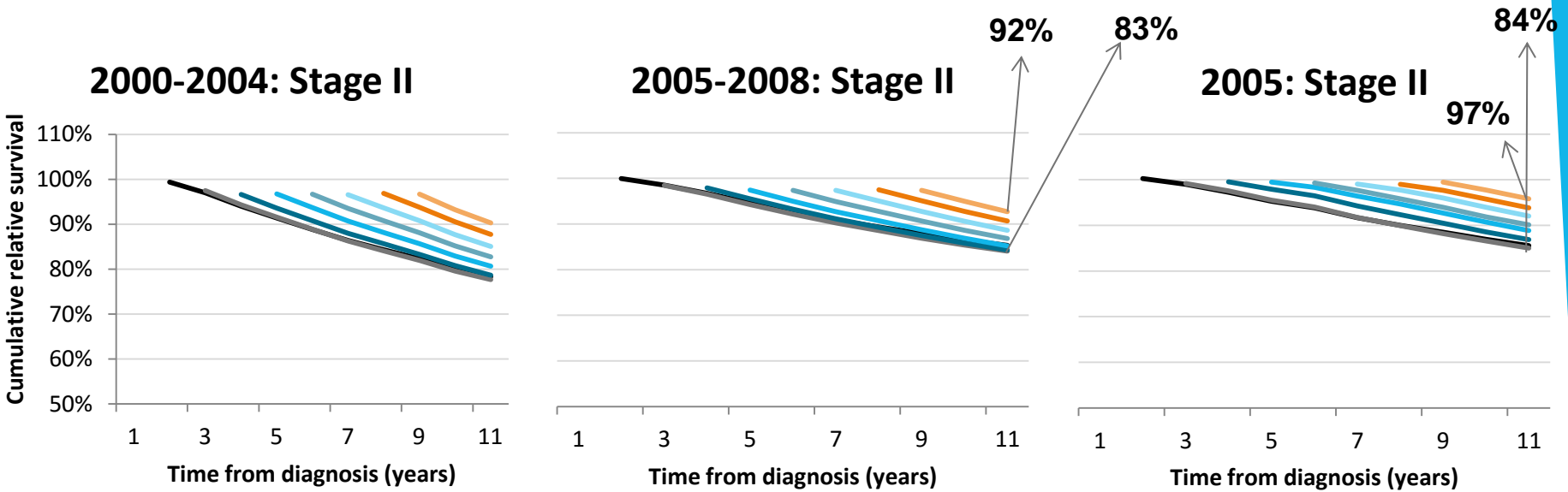
2005-2008: Stage I

2005: Stage I



- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

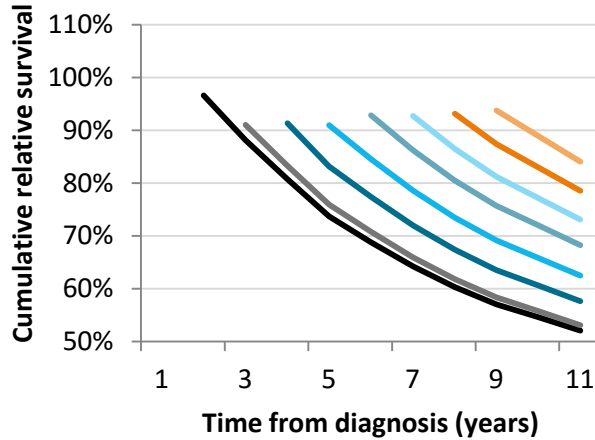
Results: conditional relative survival



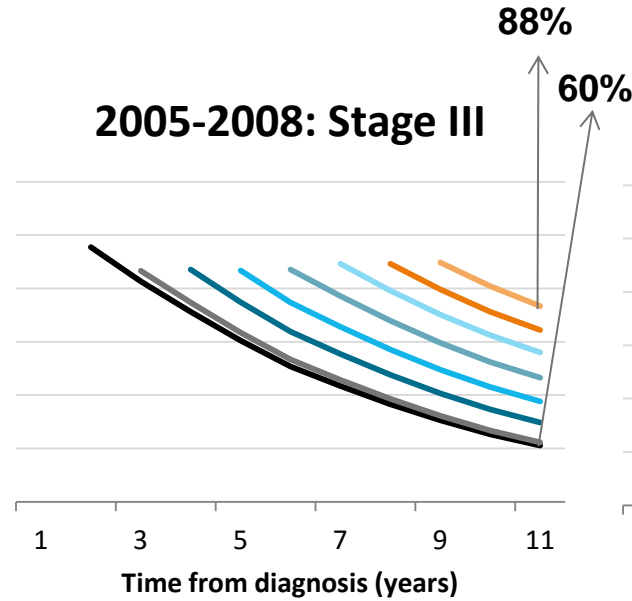
- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

Results: conditional relative survival

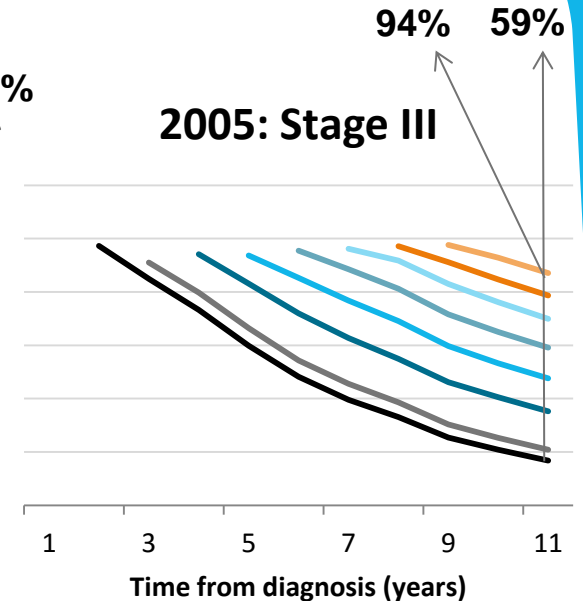
2000-2004: Stage III



2005-2008: Stage III



2005: Stage III



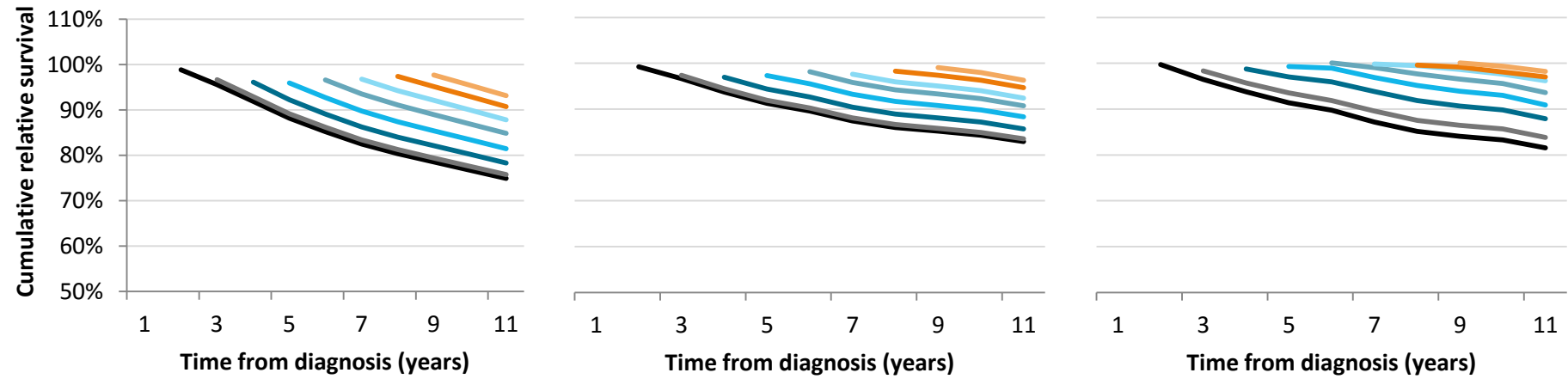
- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

Results: conditional relative survival

2000-2004: Age <40

2005-2008: Age <40

2005: Age <40



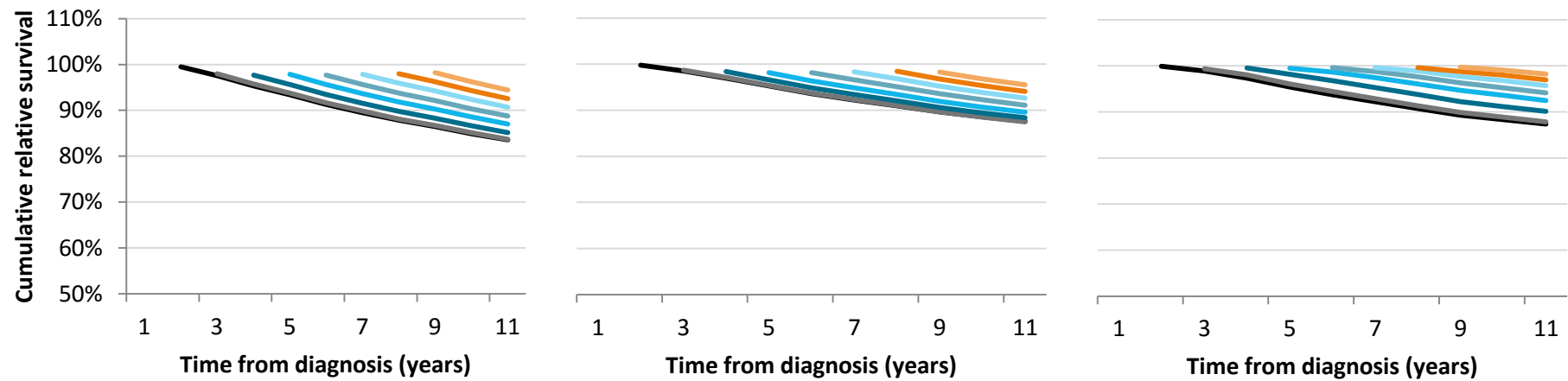
- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

Results: conditional relative survival

2000-2004: Age 40-64

2005-2008: Age 40-64

2005: Age 40-64



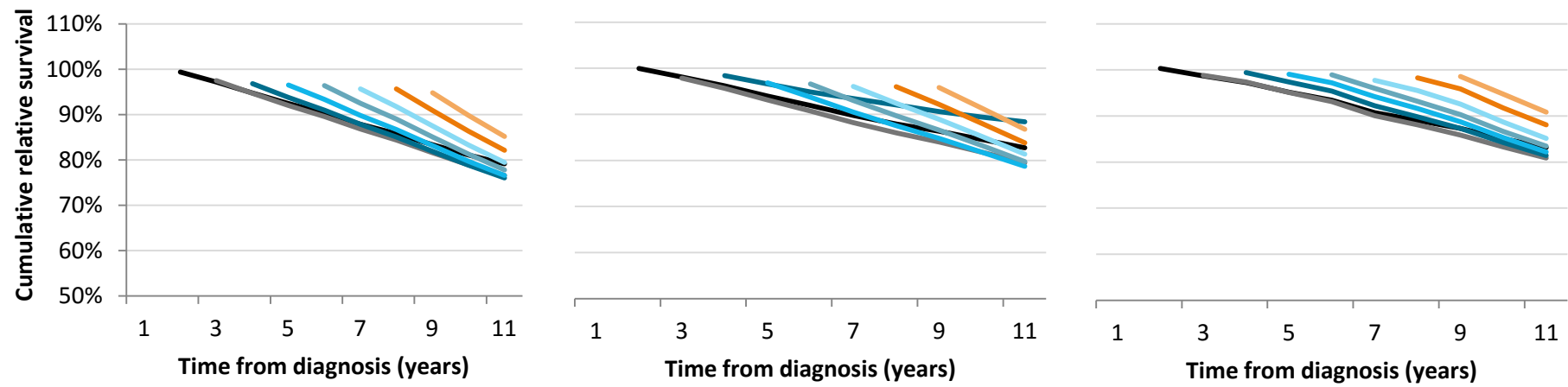
- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

Results: conditional relative survival

2000-2004: Age >64

2005-2008: Age >64

2005: Age >64

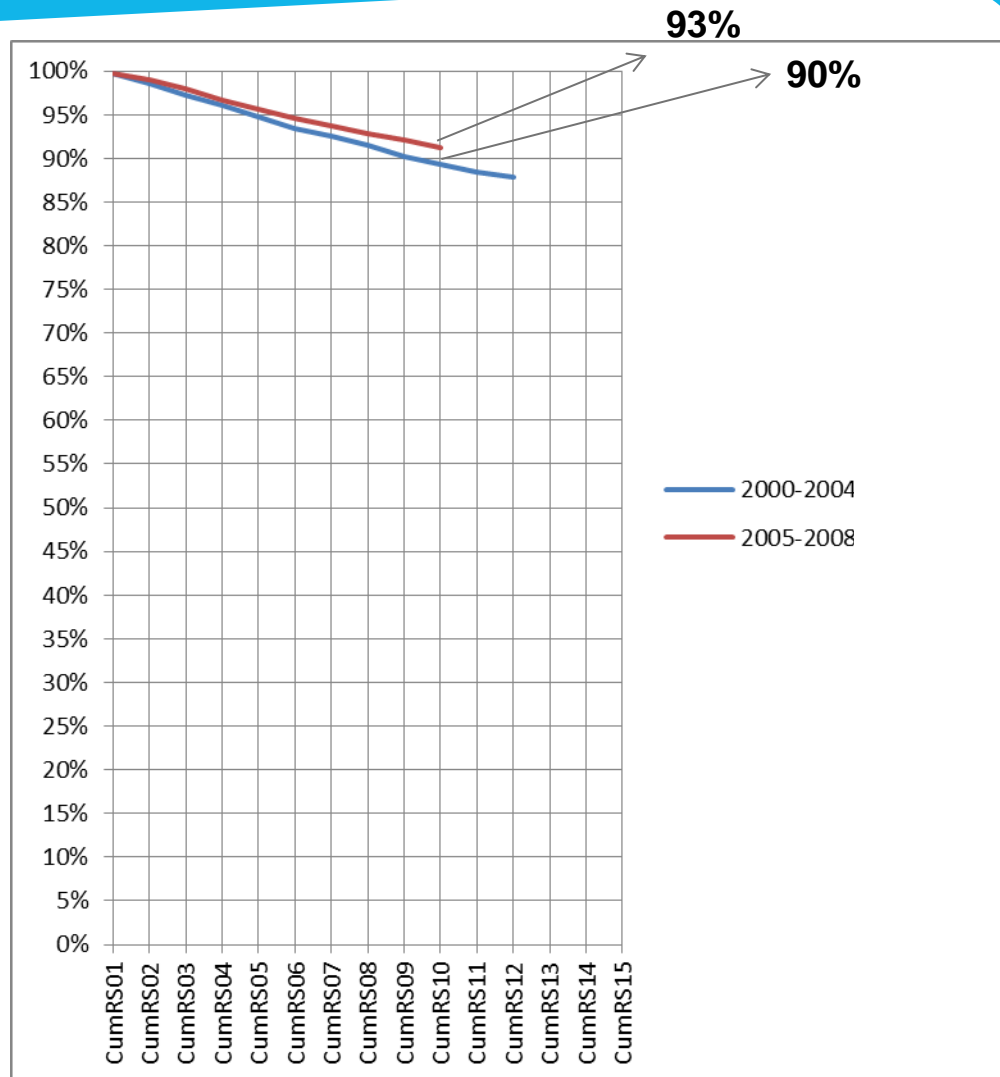


- at diagnosis
- after 1 year
- after 2 years
- after 3 years
- after 4 years
- after 5 years
- after 6 years
- after 7 years

Results: prediction model

- Example I:

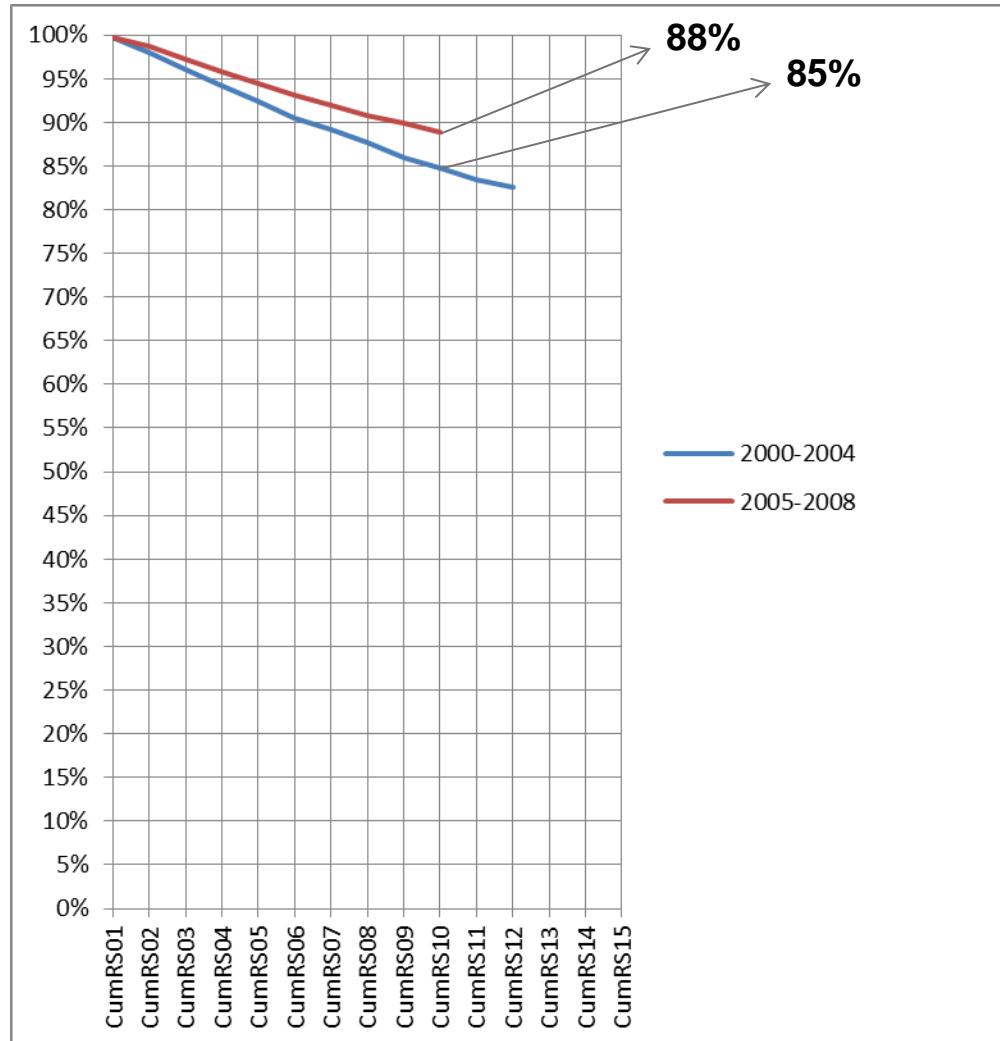
- <40 years
- Stage I
- Right, inner quadrants
- Grade II
- Lobular
- Unifocal
- ER/PR+
- BCS + RT
- Adjuvant hormonal therapy



Results: prediction model

- **Example II**

- <40 years
- **Stage II**
- Right, inner quadrants
- Grade II
- Lobular
- Unifocal
- ER/PR+
- BCS + RT
- **Adjuvant hormonal and chemotherapy**



Discussion

- Evidence-based underwriting decisions for (ex-)cancer patients
- Patients get more insight in their prognosis
- Survival estimates may differ when a different reference population is used
- 2005 cohort: local / regional recurrence vs distant metastasis

In progress

- Prediction model + validation
- 2005 cohort: separate any recurrence to
 - Distant metastasis
 - Locoregional recurrence
- Life tables: insurance population
- Other types of cancer (melanoma)



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