



Probability of entering and remaining in disability after breast cancer treatment: evidence from France

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Context : Residential Mortgage in France



47% of households have at least one loan currently being repaid



Mortgage loans

- 3 out of 10 households
- up to 5 out of 10 in 30–49 age band



Consumer Credit*

- 3 out of 10 households

*consumption, Student loan, Installment payments for a car or household appliances

Share of indebted households at the beginning of 2024 among those living in ordinary housing in France, excluding Mayotte

Source : INSEE, Enquête Histoire de vie et Patrimoine 2024



Creditor Protection market figures

A key market that protects households
and supports financial stability



25 MILLION

INSURED LOANS CURRENTLY IN FORCE



€7 BILLION

IN ANNUAL PREMIUMS
FROM MORTGAGE ADE INSURANCE



THE LARGEST

INDIVIDUAL PERSONAL PROTECTION
INSURANCE MARKET



2.5 TO 4 MILLION

NEW SUBSCRIPTION APPLICATIONS
PER YEAR



25% TO 30%

INCLUDE A MEDICAL DECLARATION AND 15%
INCLUDE A RISK ASSESSMENT (EXCLUSIONS
AND PREMIUM LOADINGS), I.E. BETWEEN
400,000 AND 550,000 PER YEAR
(BEFORE THE LEMOINE LAW)

Source : INSEE, Enquête Histoire de vie et Patrimoine 2024



Context : Right to be Forgotten



- **Right to be forgotten** (adopted in 2016, amended in 2022)
For residential mortgage cover only : People who **had cancer** are **allowed not to declare it** after the end of therapeutic protocol. : **Waiting period: 10 years** (2016), then reduced to **5 years** (2022)
*France, 2016: 17% of former cancer patients **apply for a loan** (business or mortgage) within five years of diagnosis (VICAN 5 survey)*
- **Lemoine Law** (2022)
Removing health questionnaires (conditions : Max €200,000 loan amount / loan maturity before 60)
- **Reference Grids** when RTBF or Lemoine Law do not apply allowing access to insurance :
 - **Current limitation:** These grids are mainly based on survival data, not on post-cancer professional consequences (disabilities).

Context : From survival to disability data



- **Survival data** : Time-to-cure and cure proportion in solid cancers in France. A population based study
- **TTC is the time at which the probability of belonging to the cured group reaches 25%**

Cancer Epidemiology
Volume 60, June 2019, Pages 93-10

Table 4

Estimated values of the cure proportion (P) and time-to-cure (TTC) in **women** by cancer site and age at diagnosis.

Cancer site	P (95% CI)	TTC (95% CI)	P (95% CI)	TTC (95% CI)	P (95% CI)	TTC (95% CI)
	15-44 years		45-54 years		55-64 years	
Breast	72 (71-74)	12.1 (11.5-12.7)	80 (80-81)	10.6 (10.0-11.1)	79 (78-79)	11.2 (10.6-11.8)
Central nervous system	38 (33-42)	10.4 (6.2-14.5)	19 (15-23)	10.8 (3.3-18.3)	NC	NC
Cervix uteri	77 (75-79)	6.5 (4.3-8.7)	63 (60-67)	8.5 (4.6-12.5)	49 (45-53)	11.0 (7.6-14.5)

- **Current limitation:**
 - TTC considers the return to mortality of the general population, when insurance prices are based on selected population
 - This study is based on survival data, no information on post-cancer professional consequences (disabilities).

Context : cancer and sequelae



France, 2023: **433,000** new cancer cases (including 61,000 cases of breast cancer)

Cancer and its treatments can lead to long-term consequences:

- **Temporary incapacity of work**, with sick leave (work stoppages) that can sometimes be prolonged and recurrent
 - **Sick leave** (up to max. of 3 years) and **therapeutic part-time work** (up to max. of 1 year)
- A potential transition to **permanent incapacity (disability)**

➤ For actuaries:

There is a need for **specific data** to enable proper analysis of risks related to **borrower insurance claims**, particularly for **work incapacity coverage**.

WHY DO WE LEARN FROM INTERNATIONAL LITERATURE?

Cancer survivors face higher employment vulnerability



Working-age survivors

~50%

**of adult cancer survivors are
younger than 65 years**



**Breast cancer and employment
A meta-analysis**

+28%

**higher unemployment risk
compared with healthy controls**



**However, meta analysis integrates multiples social security schemes.
There is need for country-specific data for actuarial analysis.**

Source: de Boer et al., JAMA 2009

WHY THIS STUDY

Survival is not enough for actuarial risk



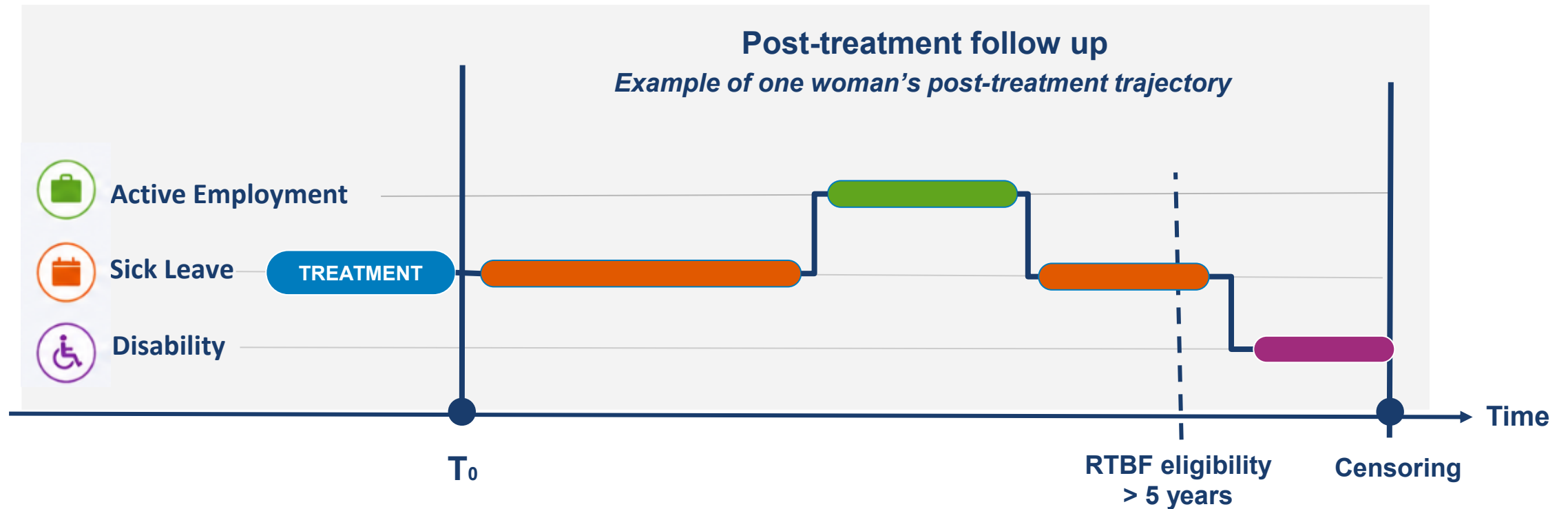
Clinical lens

Is the person alive and in remission?



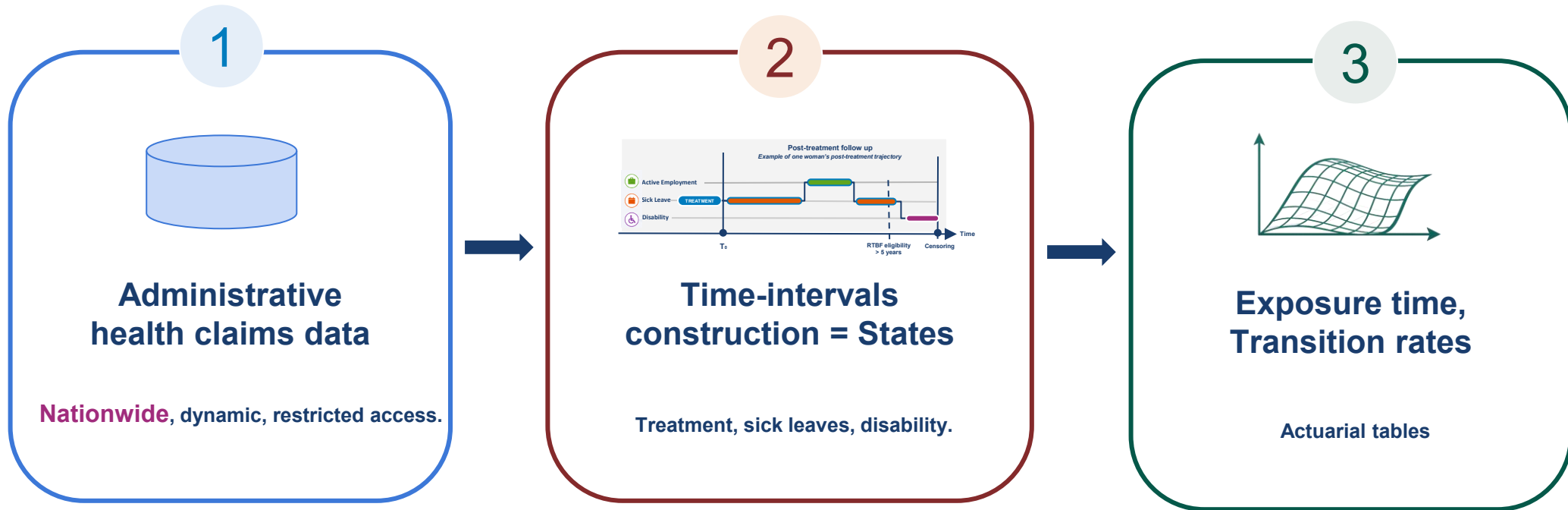
Actuarial lens

Transition rates:
Active employment - SL - DISAB



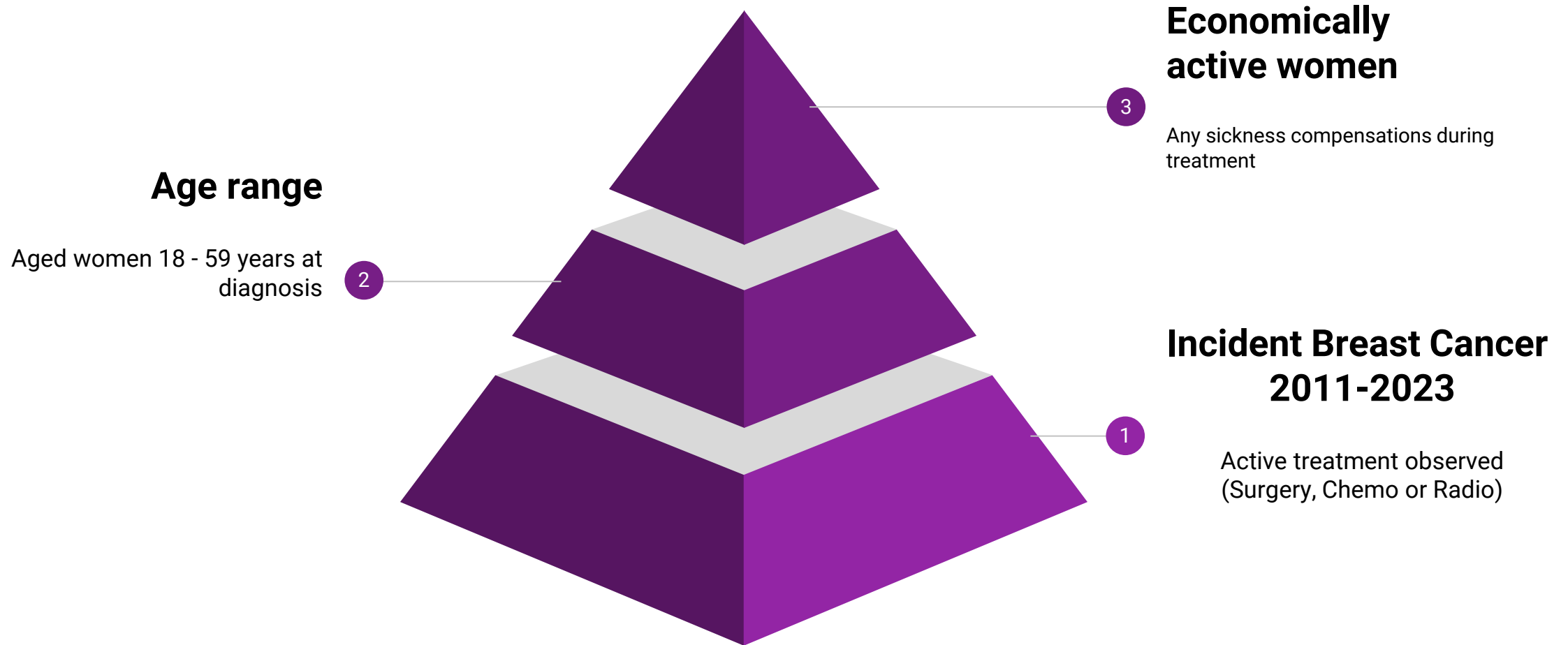
METHOD

From claims records to actuarial transition rates



About 99% of breast cancer cases can be found in administrative databases

1 Administrative health claims extraction for Breast cancer



States definition: Time intervals

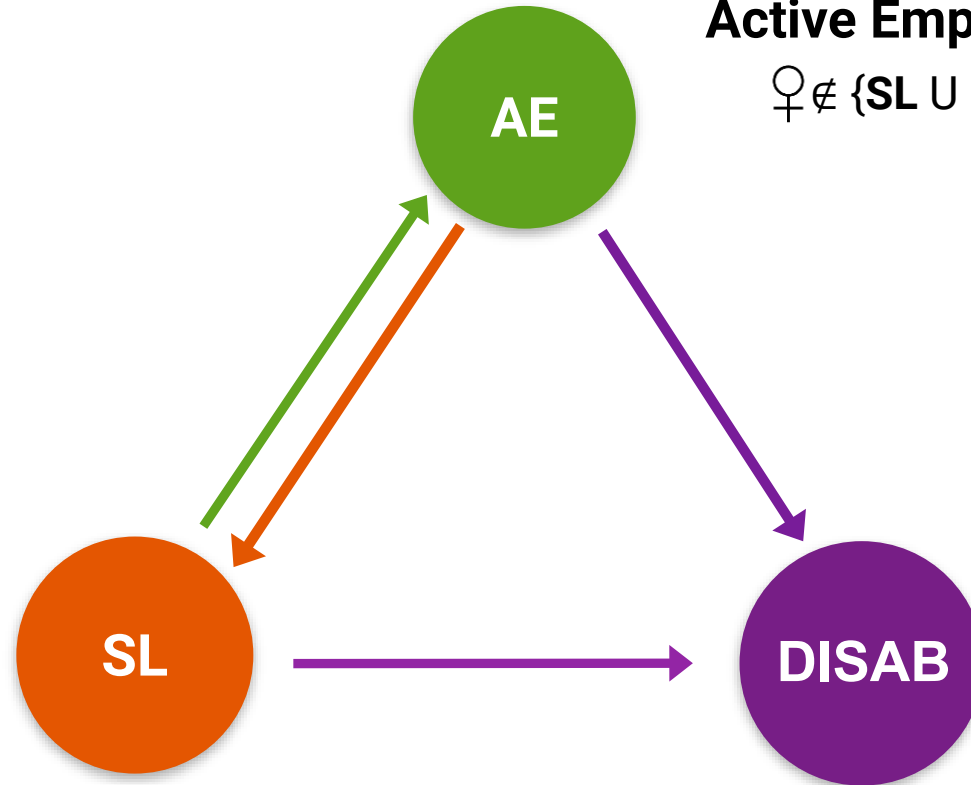


Active Employment

$\neg \{SL \cup DISAB\}$

Sick Leave or Temporary Disability

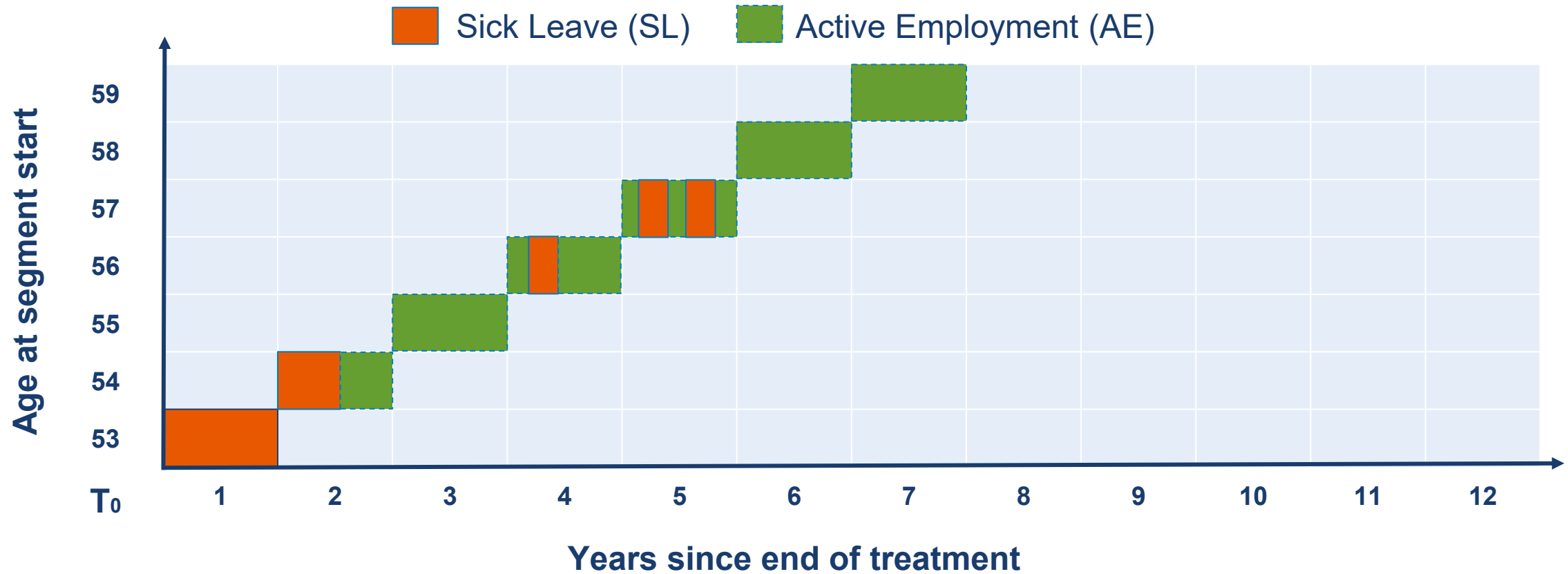
- Through sickness-benefit reimbursements
- All-cause burden
- 60-days gap = one SL



Permanent Work Disability

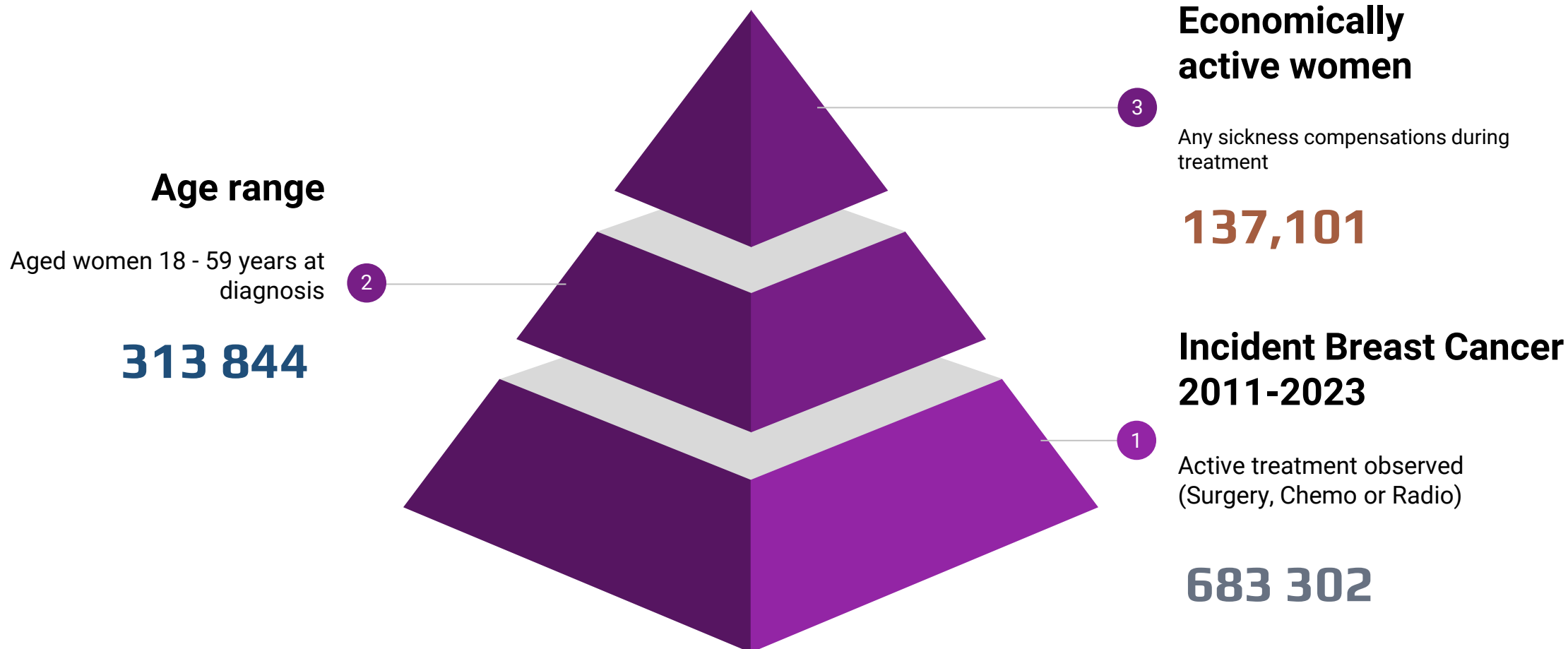
Through disability-pension records
Absorbing state

Exposition times and transitions rates



RESULTS

Analytical cohort



Analytical cohort Breast Cancer



137,101

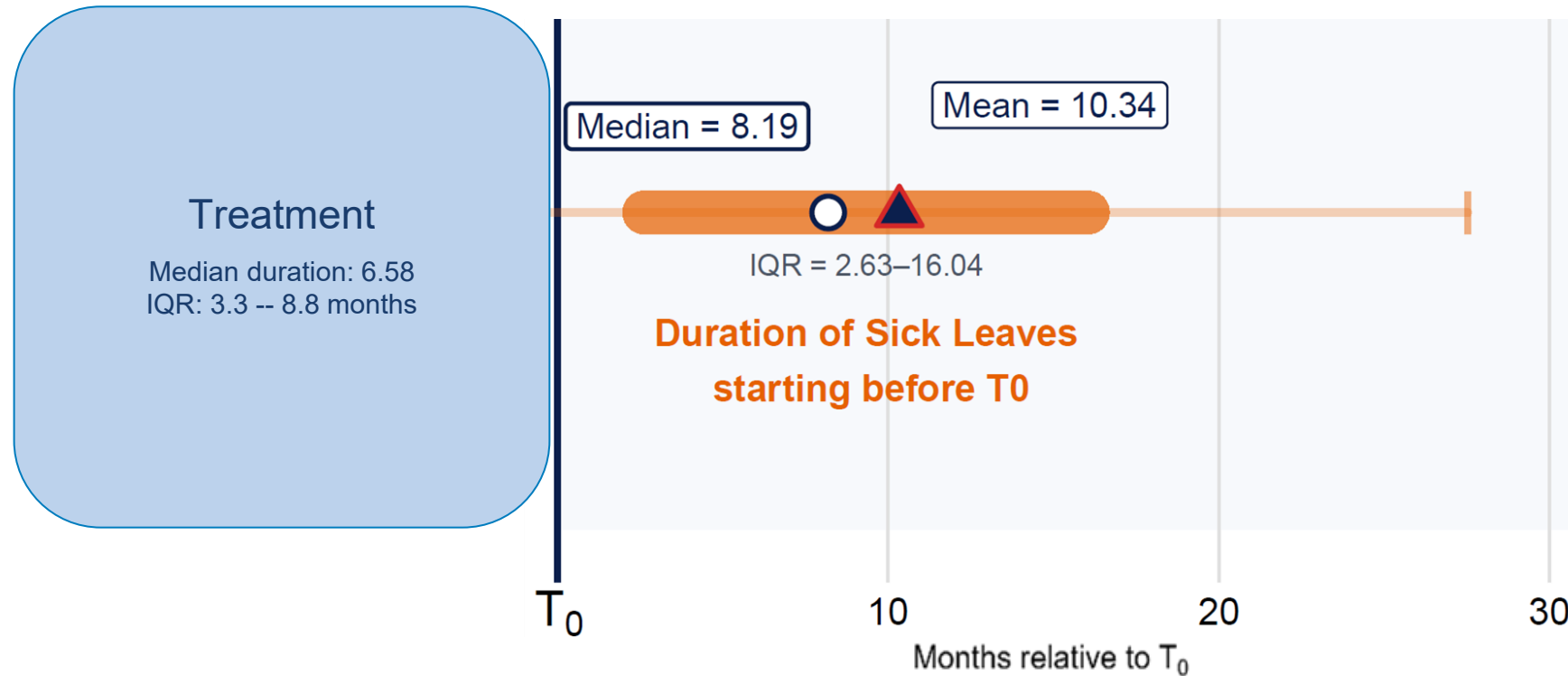
women in the final analytic cohort

Working-age women with incident breast cancer and observable sickness-benefit records.

49.7 years	Median age at treatment completion
4.4 years	Median follow-up (before RTBF eligibility)
667,703	Person-years of observation
6.6 months	Median active treatment duration

RESULTS

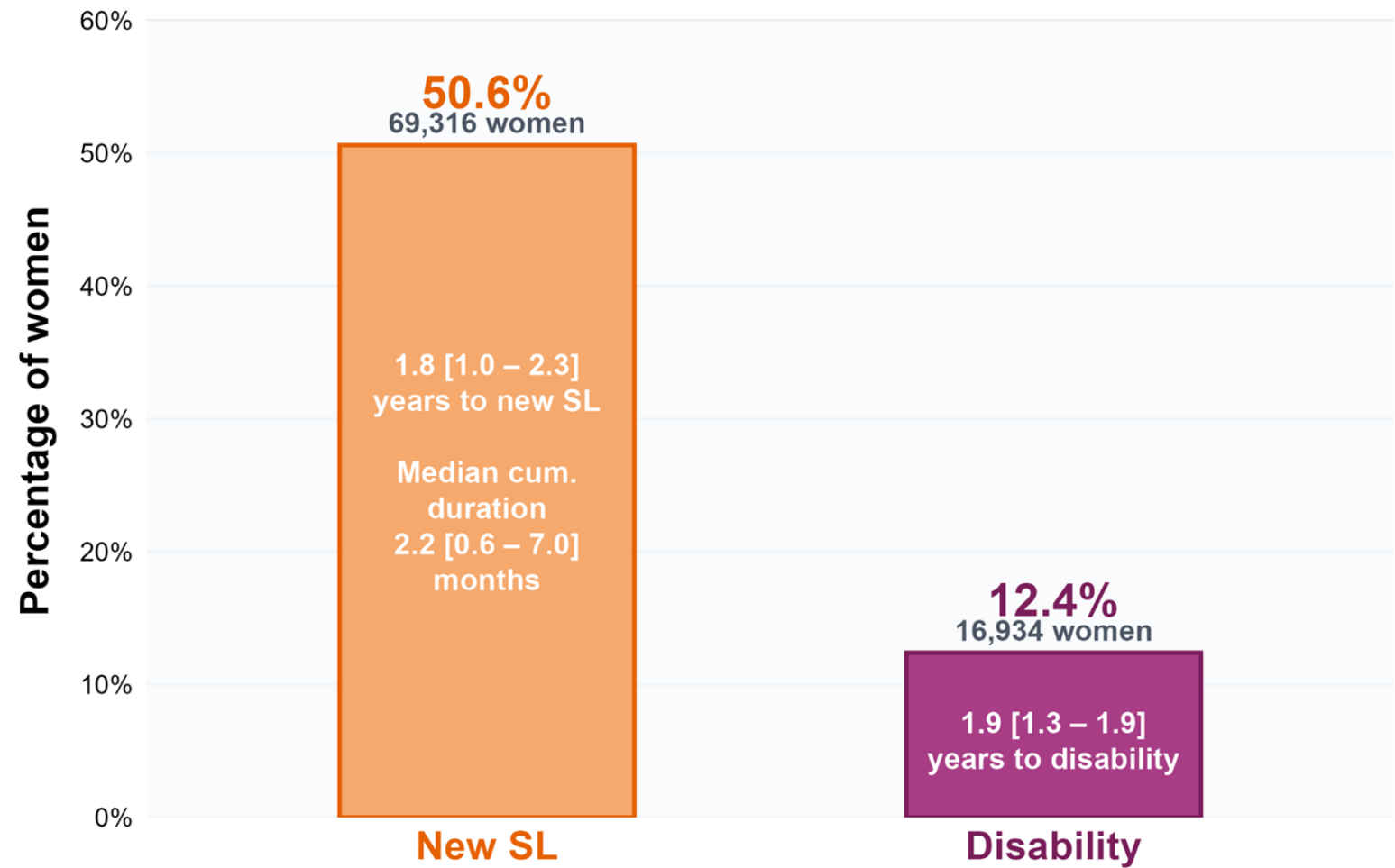
Treatment completion $\neq$ *Work-capacity recovery*



84% of women remain on SL for an average of 10.34 months after treatment

RESULTS

New SL episodes and disability



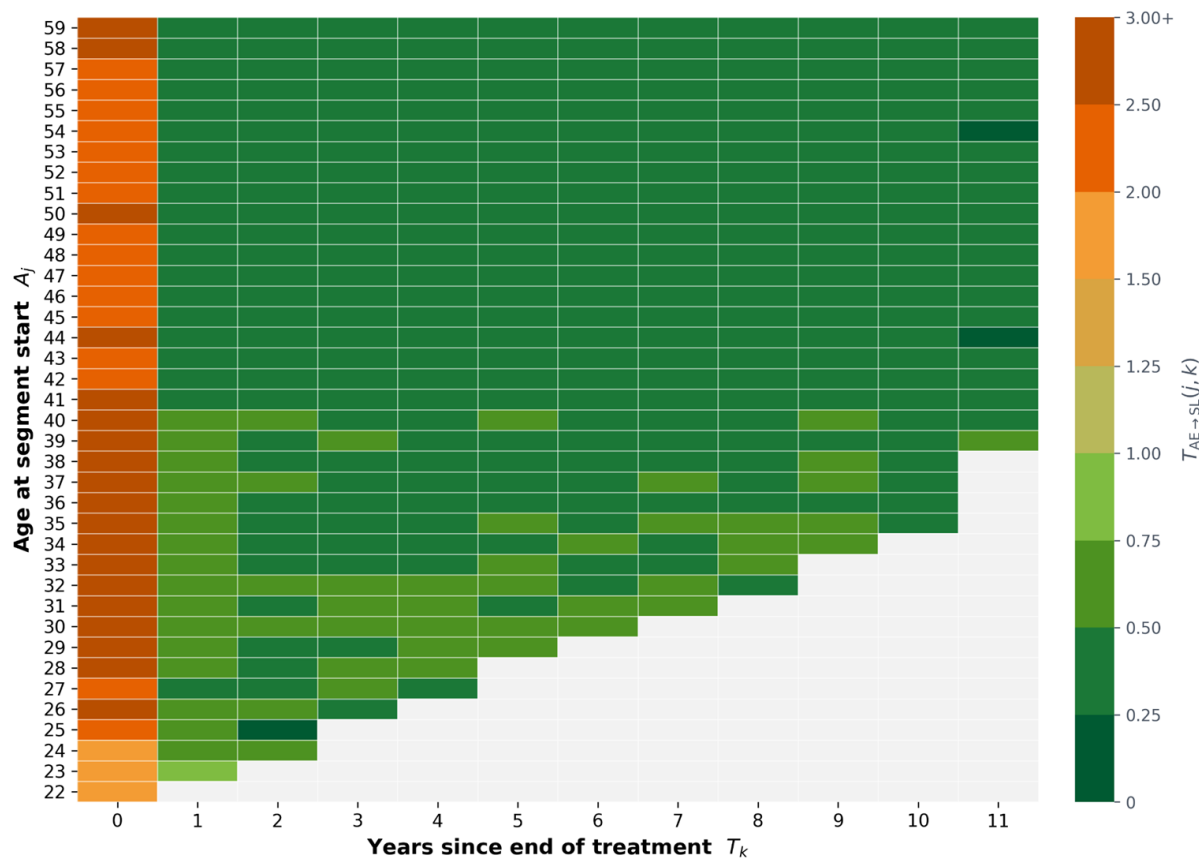
Values inside bars are median [IQR] time in years from T₀

RESULTS

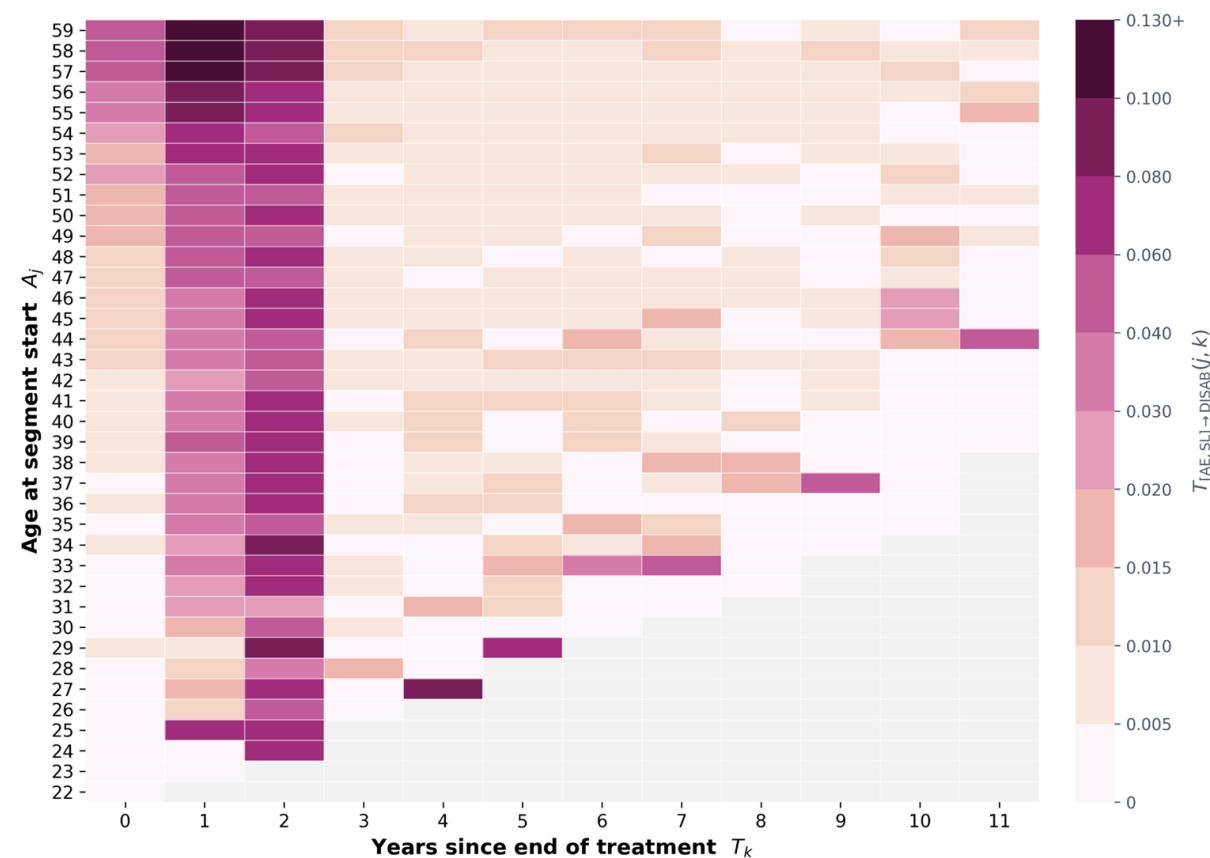
However, work-disability risks follow different age–time patterns



Transition rates
 $AE \rightarrow SL$



Transition rates
 $\{AE \cup SL\} \rightarrow DISAB$



Limitations

- Certain specific groups such as civil servants are excluded of the study
- General population $\neq$ Insured population

Next steps

- Actuarial studies and incidence rates and duration - actuarial tables vs current tables.
- Other cancers

Thank You

- **Questions & Discussion**
- Happy to discuss: methodology, actuarial applications, next steps.
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I am a statistician and data scientist with over 10 years of experience in public policy evaluation and predictive modeling. I currently work at SESSTIM, where my research focuses on disability and return-to-work trajectories after breast cancer. My broader research interests include the external validation, fairness, and safe deployment of AI systems in high-stakes contexts.



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I have been working for Swiss Re in L&H in a commercial role on the French market for over 20 years. I am actively involved in the AERAS convention, contributing to improve fair access to insurance for applicants. Ensuring the use of reliable and robust data is at the core of my professional commitment.



- Swiss Re is one of the world's leading providers of reinsurance, insurance and other forms of insurance-based risk transfer. Through our work with clients, we fulfil our vision of helping to make the world more resilient.
- 74% of risks – from natural catastrophes and extreme weather events, to ageing populations and cybercrime – remain uninsured. We aim to change that.

