L1: Questions and time in epidemiologic studies

EPID 722
Spring 2021
UNC – Chapel Hill
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Discuss questions

10 min

Roadmap

Chapter 1: 10 considerations when asking questions

Chapter 2: Risk

Chapter 3: Why learn methods for survival analysis?

Chapter 4: Line diagrams

Chapter 1: Asking questions

1. We have 100% missing data for all questions that are not asked

2. There are many routes to asking a question, and many sources of influence

How do we decide what to ask?

Who decides which questions we answer?

3. “Asking” a question is a 2-step process

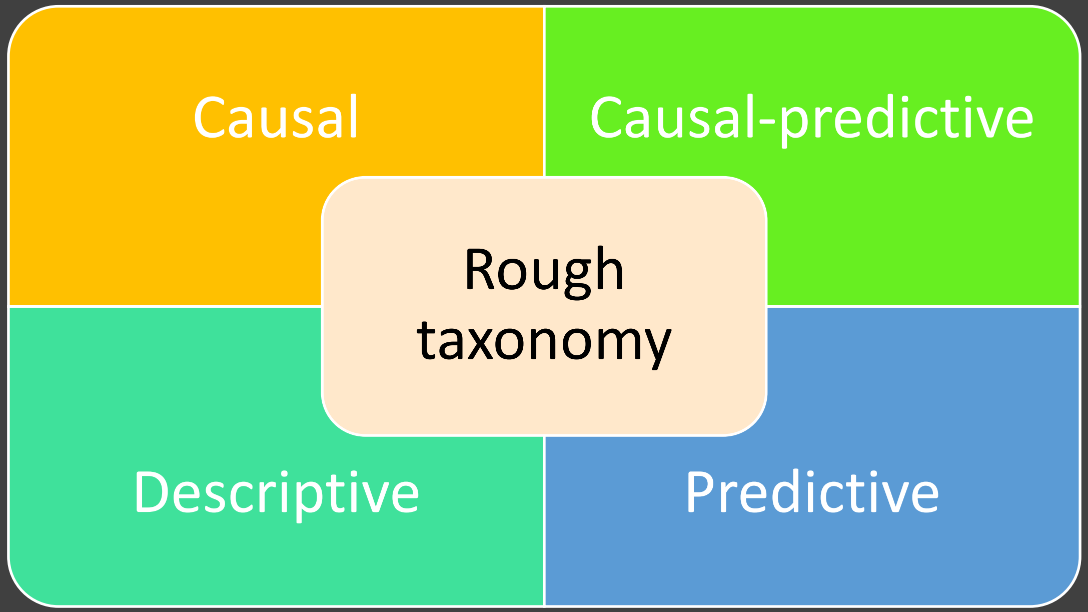
Idea

What problem needs to be addressed?

[Question]

Frame the question

4. Different types of questions can inform decisions



4. Different types of questions can inform decisions

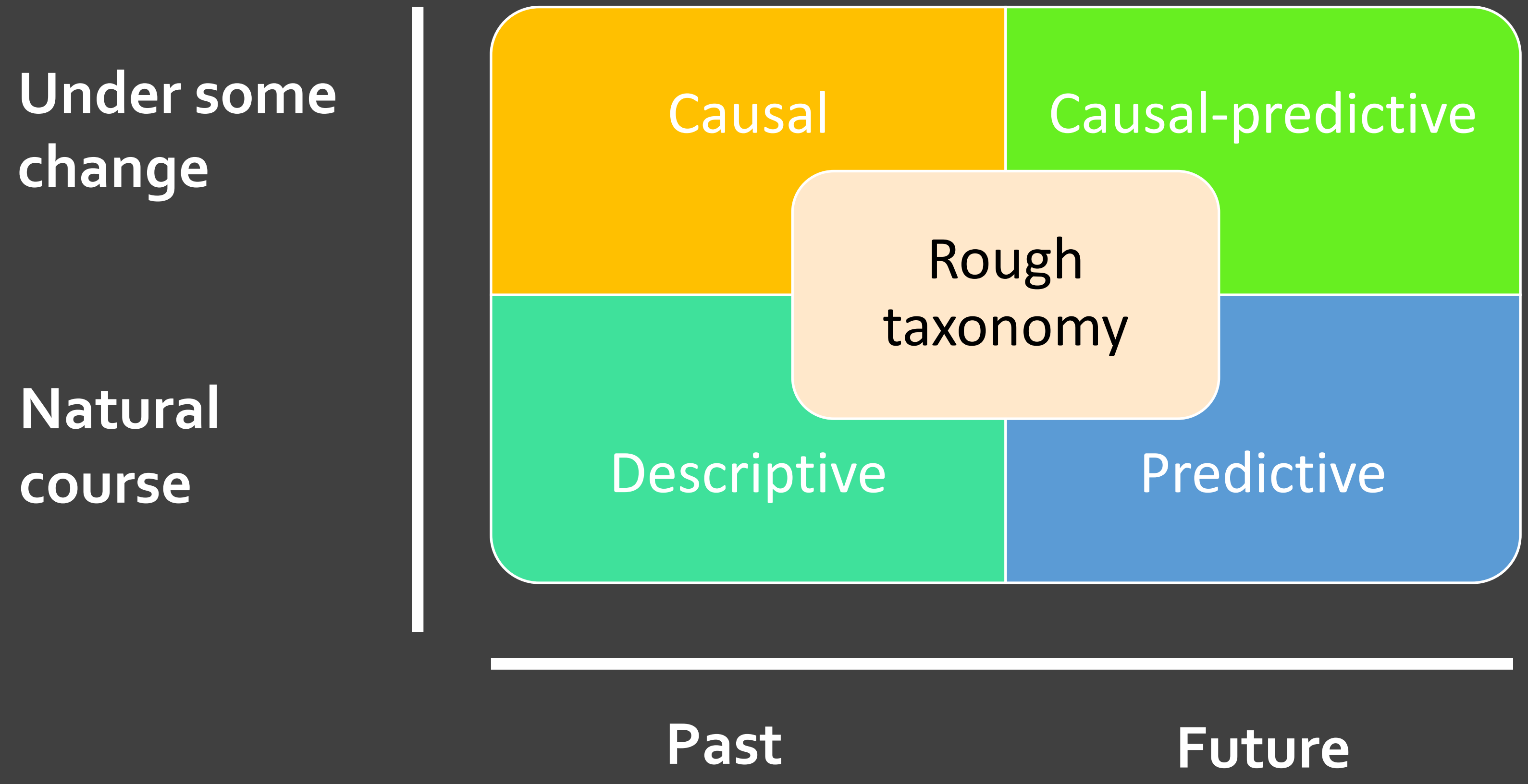
Descriptive: What happened?

Predictive: What will happen?

Causal: What would have happened had we done X?

Causal-predictive: What will happen if we do X in the future?

4. Different types of questions can inform decisions



5. Considering the use of the results is important to framing the question

Who will be acting on the results and Whom does the decision affect?

What actions are feasible, now or in the future?

What types of results would be compelling to decision makers?

6. To maximize utility of the answers, questions should have a set of components

1. Target population

2. Time period of interest (origin and timescale)

3. Outcome(s), including WHEN outcomes should be measured

4. If there are a set of **actions** that are being assessed, the set of candidate actions, including WHEN they would occur

5. If there is a **comparison** being drawn **between groups**, the set of groups compared, including WHEN groups are defined.

7. Consider the idealized cohort study to flesh out your question

A NEW APPROACH TO CAUSAL INFERENCE IN MORTALITY STUDIES WITH A SUSTAINED EXPOSURE PERIOD—APPLICATION TO CONTROL OF THE HEALTHY WORKER SURVIVOR EFFECT

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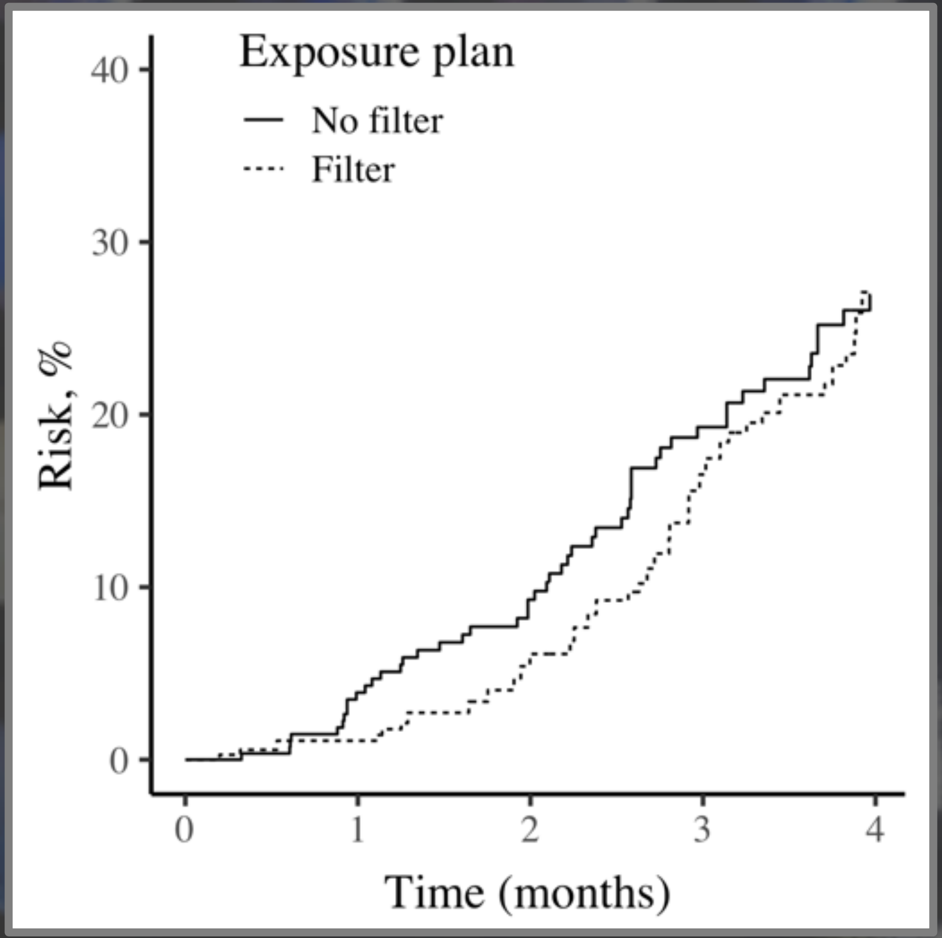
The answer to this question often not only is helpful in planning a retrospective study but also may be of assistance in determining

"Target trials" and beyond

2. OBSERVATIONAL STUDIES AS RANDOMIZED TRIALS MISSING DATA ON TREATMENT PROTOCOL

8. Frame the question without considering existing data or the logistics of data collection

9. Consider absolute measures in addition to contrasts



10. Always ask “compared to what”

WHAT IS A REALISTIC ALTERNATIVE TO ANY ACTION CONSIDERED?

ARE THERE COMPETING EVENTS OR OTHER RISKS/BENEFITS TO BE WEIGHED

IMPORTANT FOR METHODS, AS WELL AS SUBSTANTIVE QUESTIONS

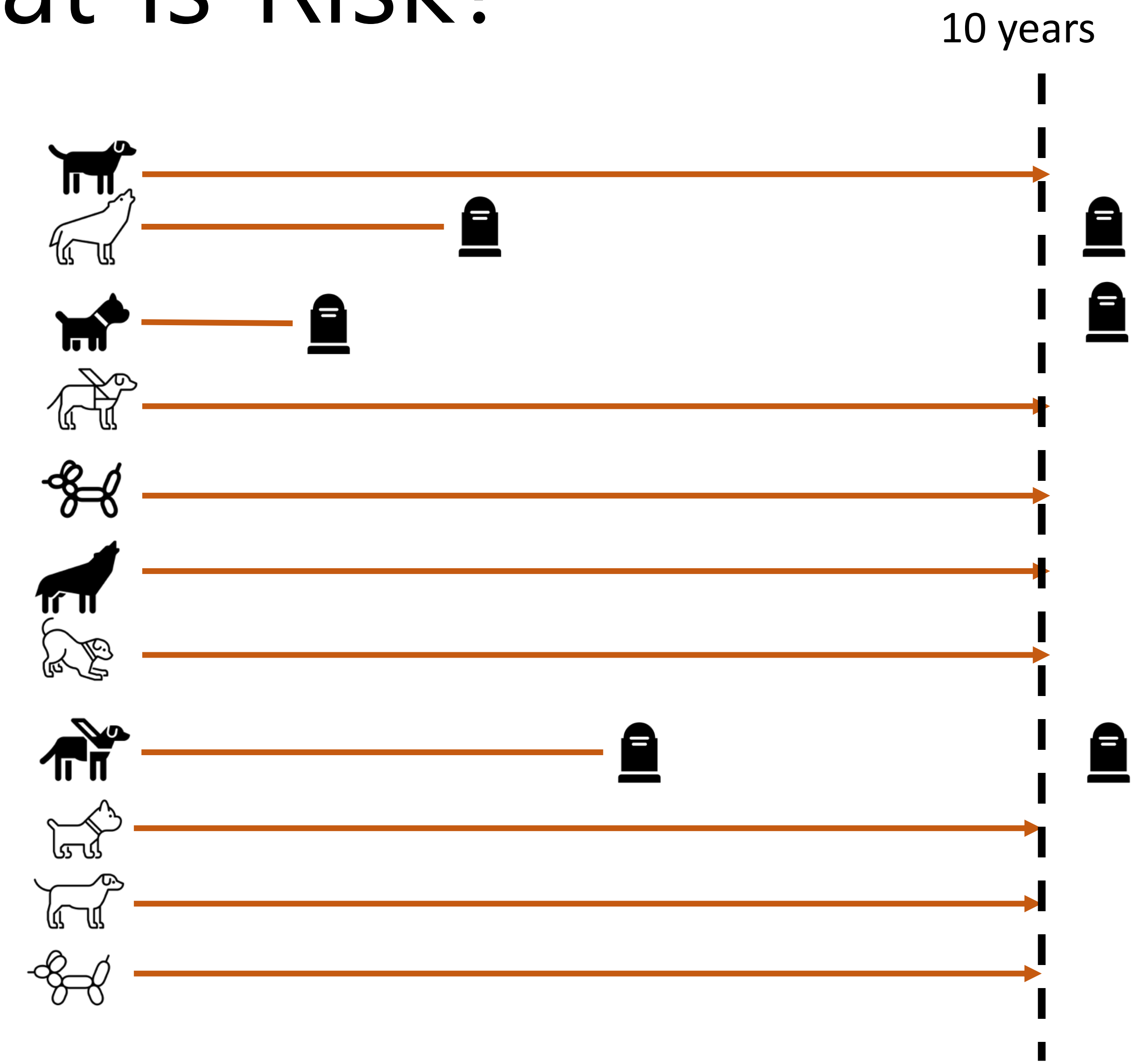
Chapter 2: Recipe for risk in closed cohorts

What is a cohort?

What is Risk?

In earlier courses, we defined risk as the proportion of units who experienced the outcome within a defined time period.

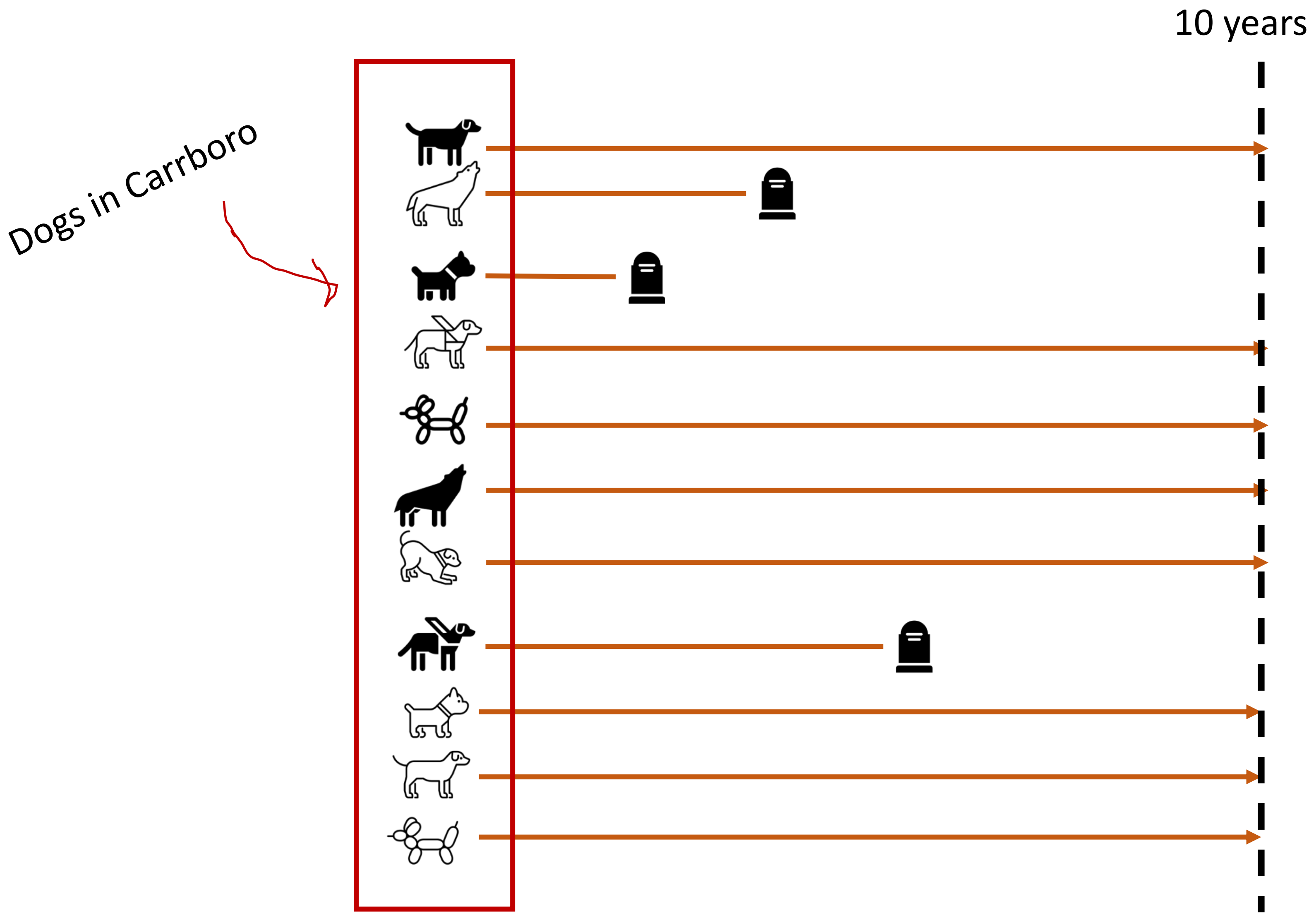
What is Risk?



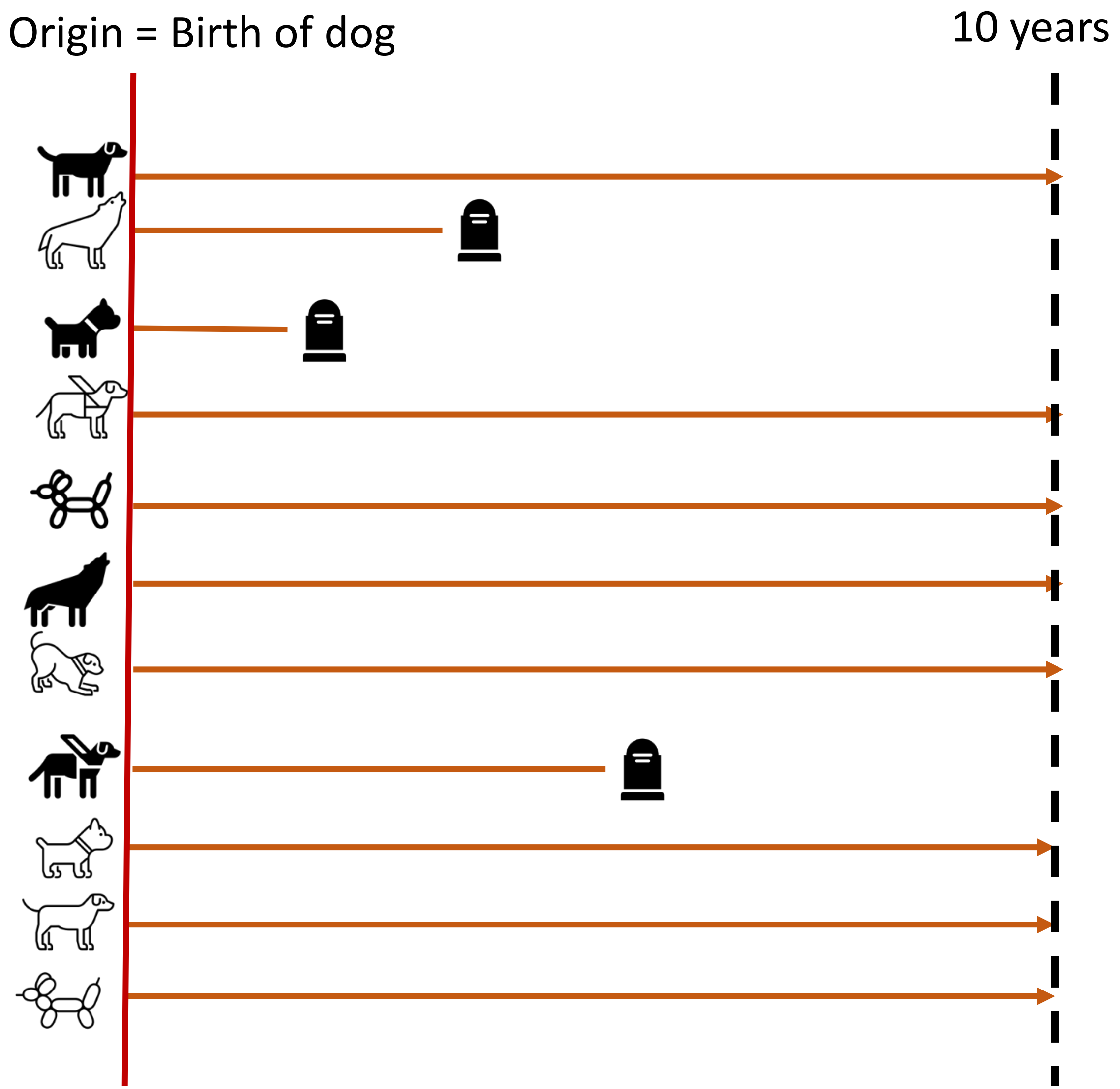
$$\frac{3 \text{ deaths}}{11 \text{ dogs}}$$

10-year risk = 27%

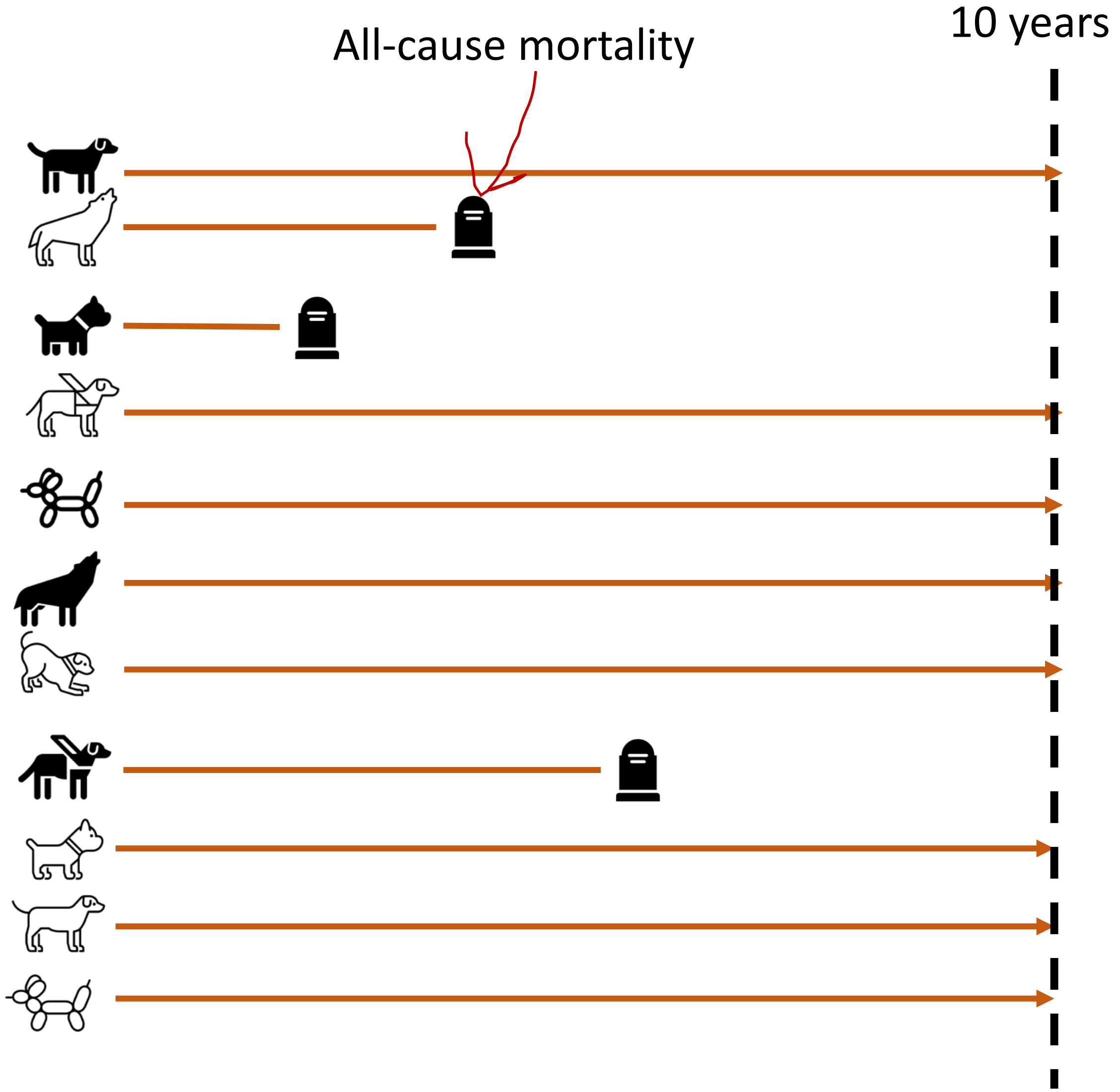
Refining the question: Target population



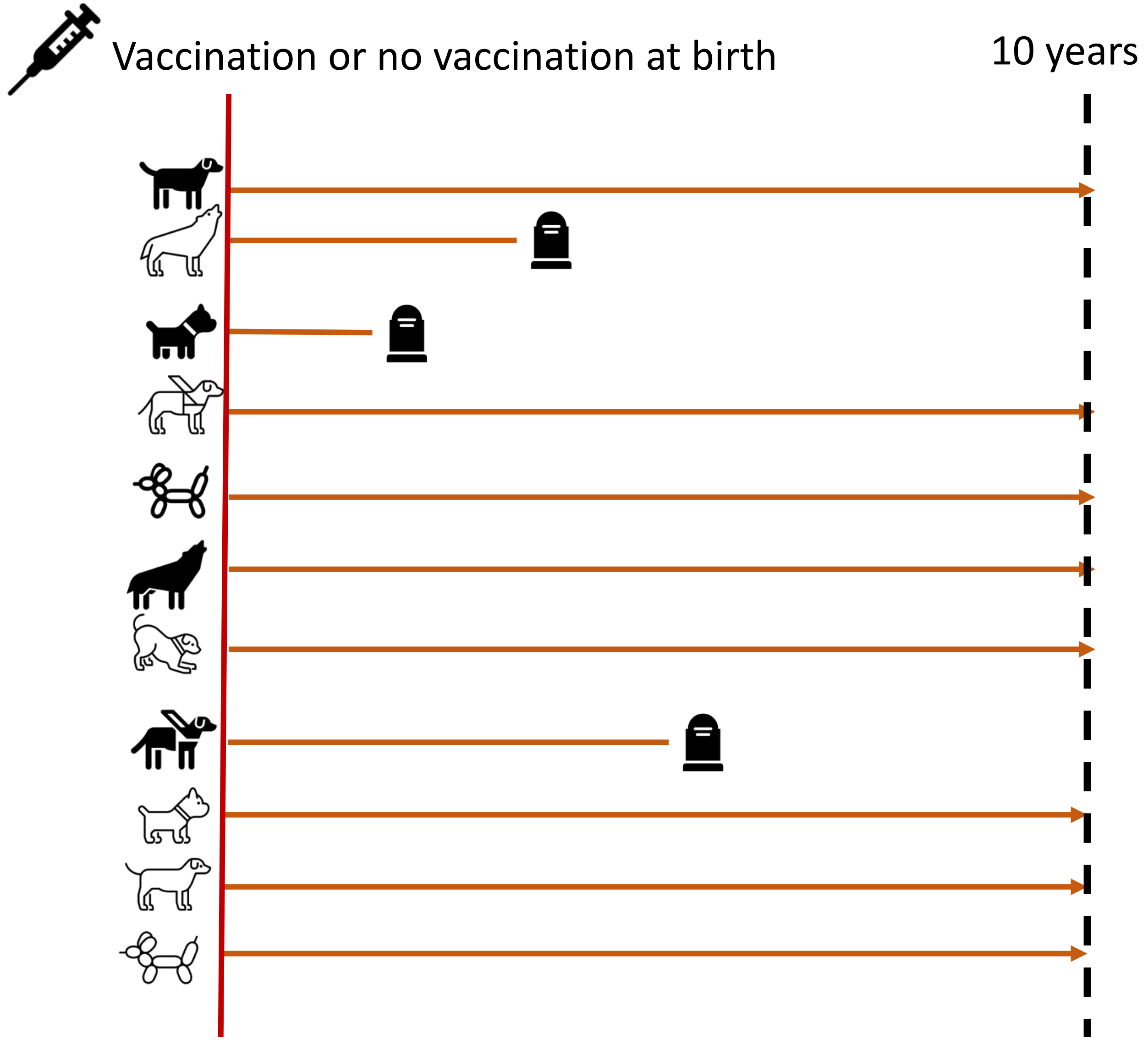
Refining the question: Time period



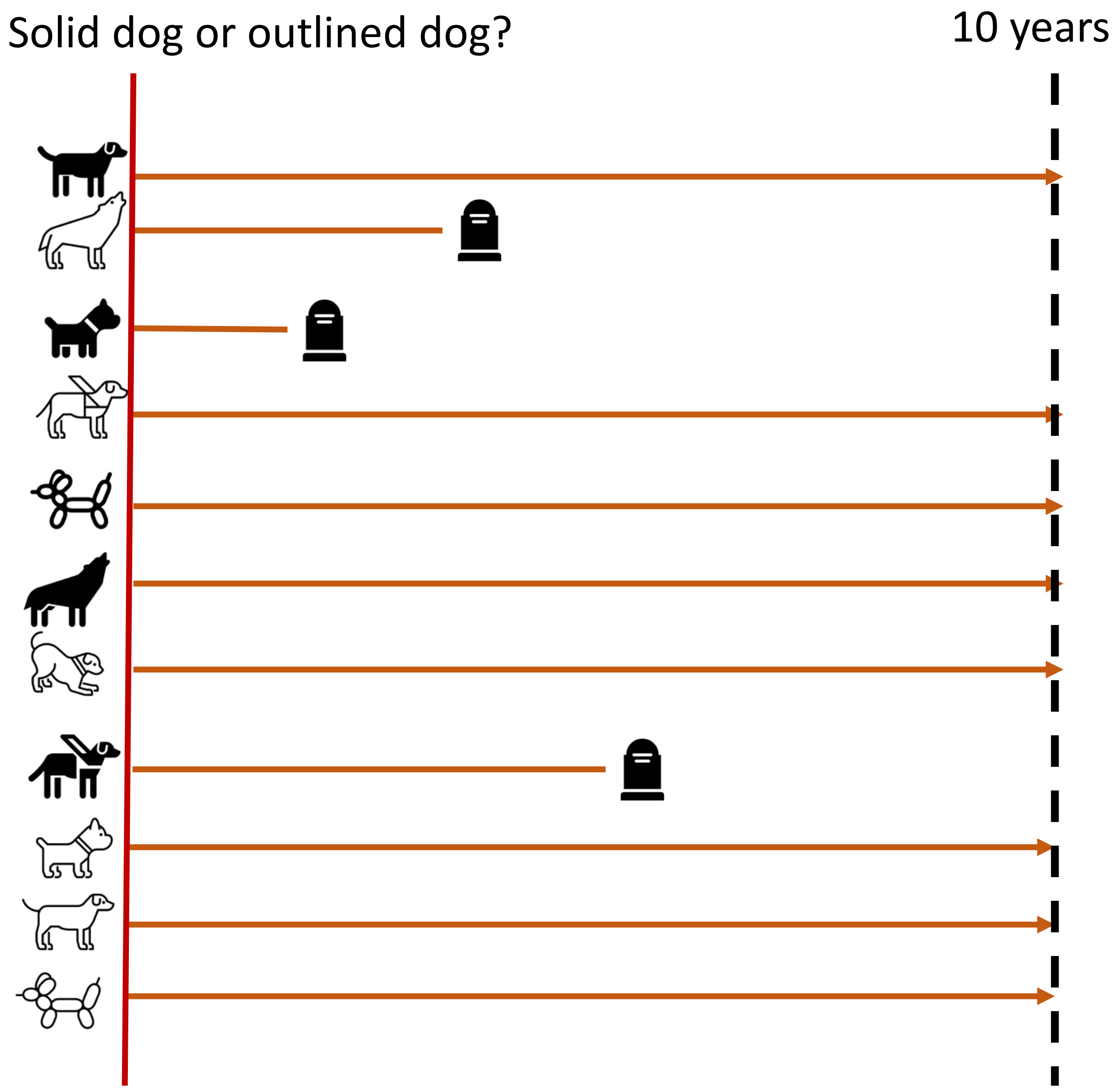
Refining the question: Outcome(s)



Refining the question: Actions



Refining the question: Groups



Chapter 3: Why learn survival analysis?

Risk as a function

First, some notation

Let T_i represent the time from the origin to death for each dog i

Risk as a scalar

Risk at 10 years = $P(T_i \leq 10)$ = 0.27

Risk as a function

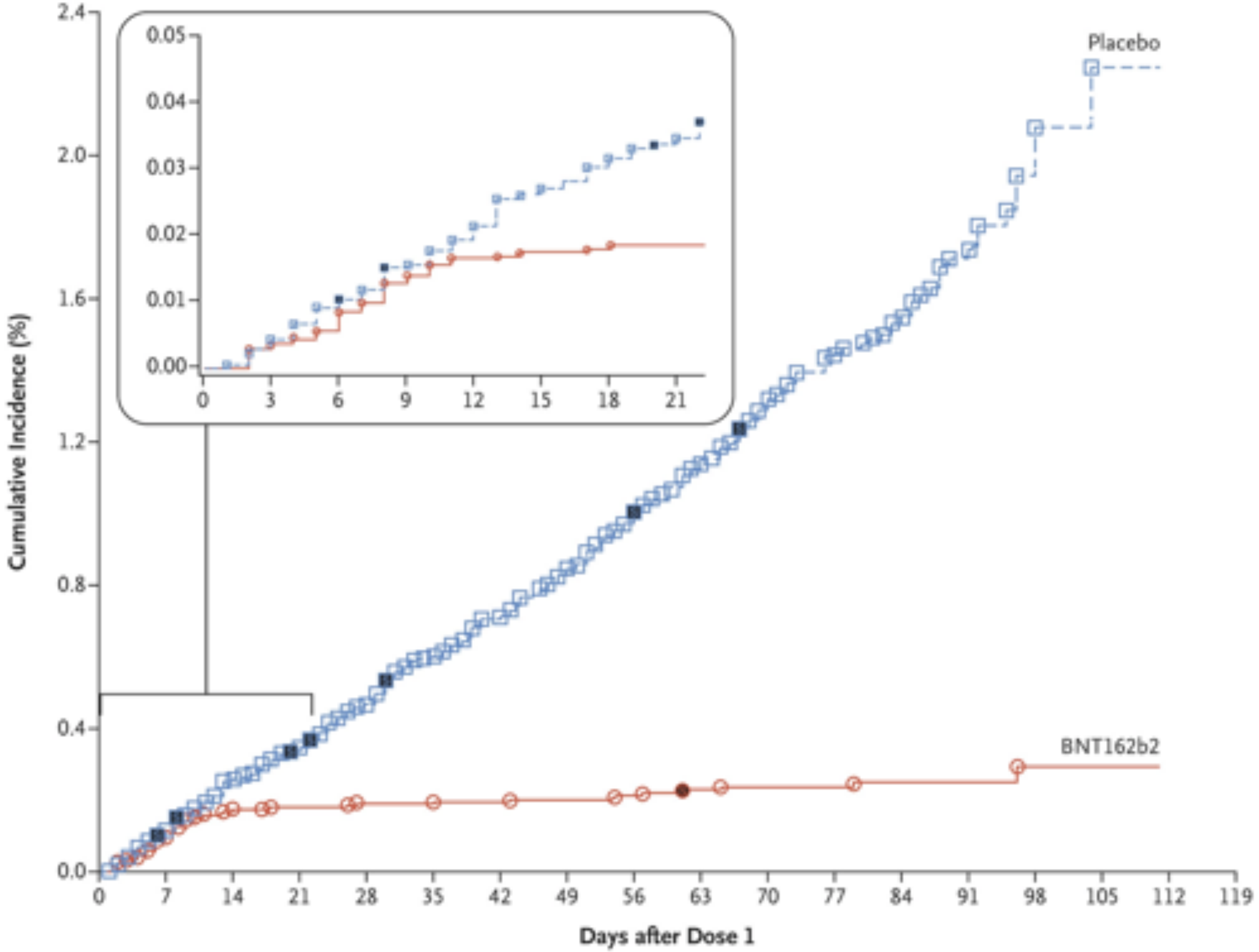
First, some notation

Let T_i represent the time from the origin to death for each dog i

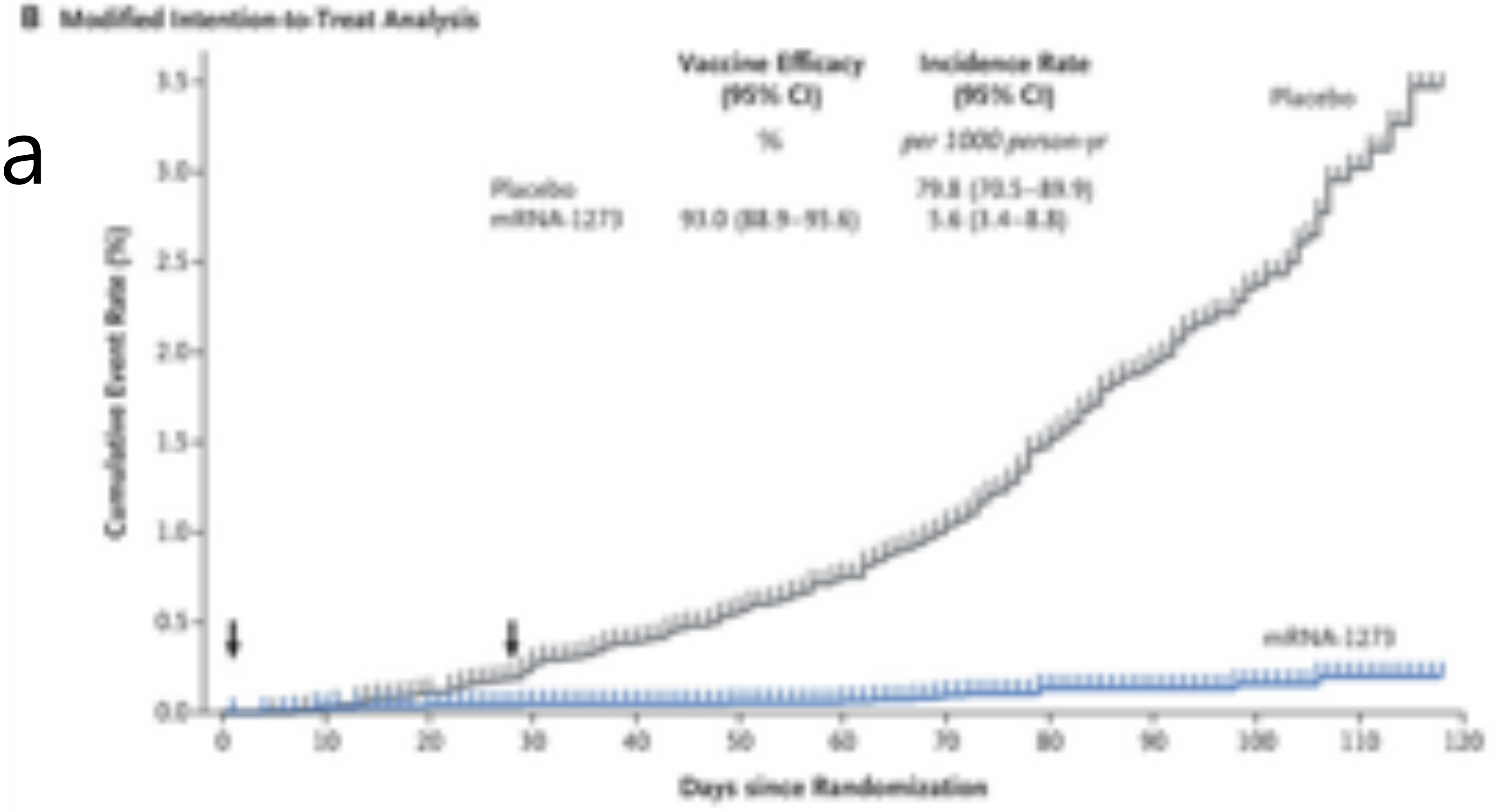
Risk as a function

Risk at t years = $P(T_i \leq t) = F(t)$

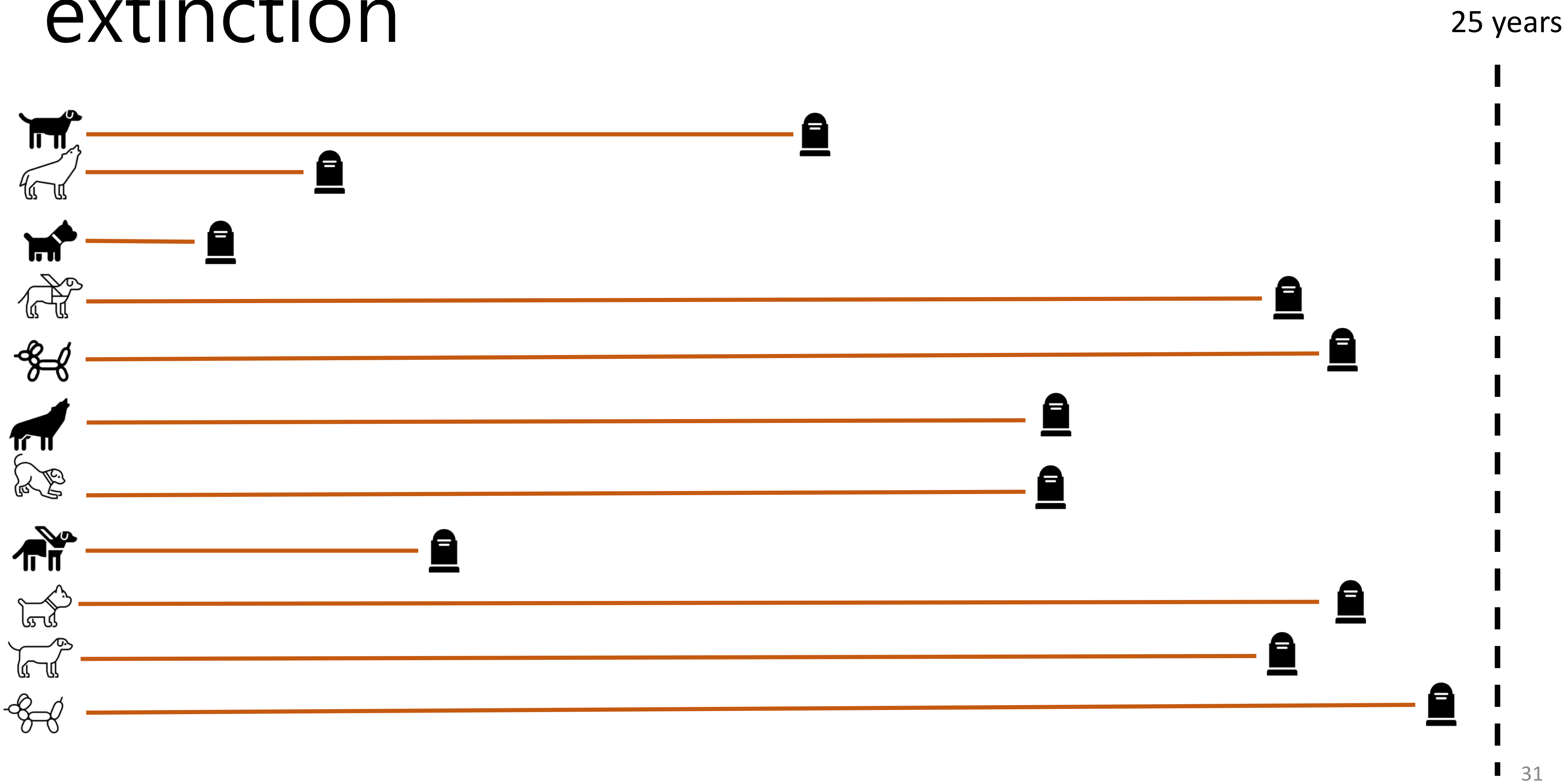
Risk as a picture



Risk as a picture



Learn from cohorts followed to extinction



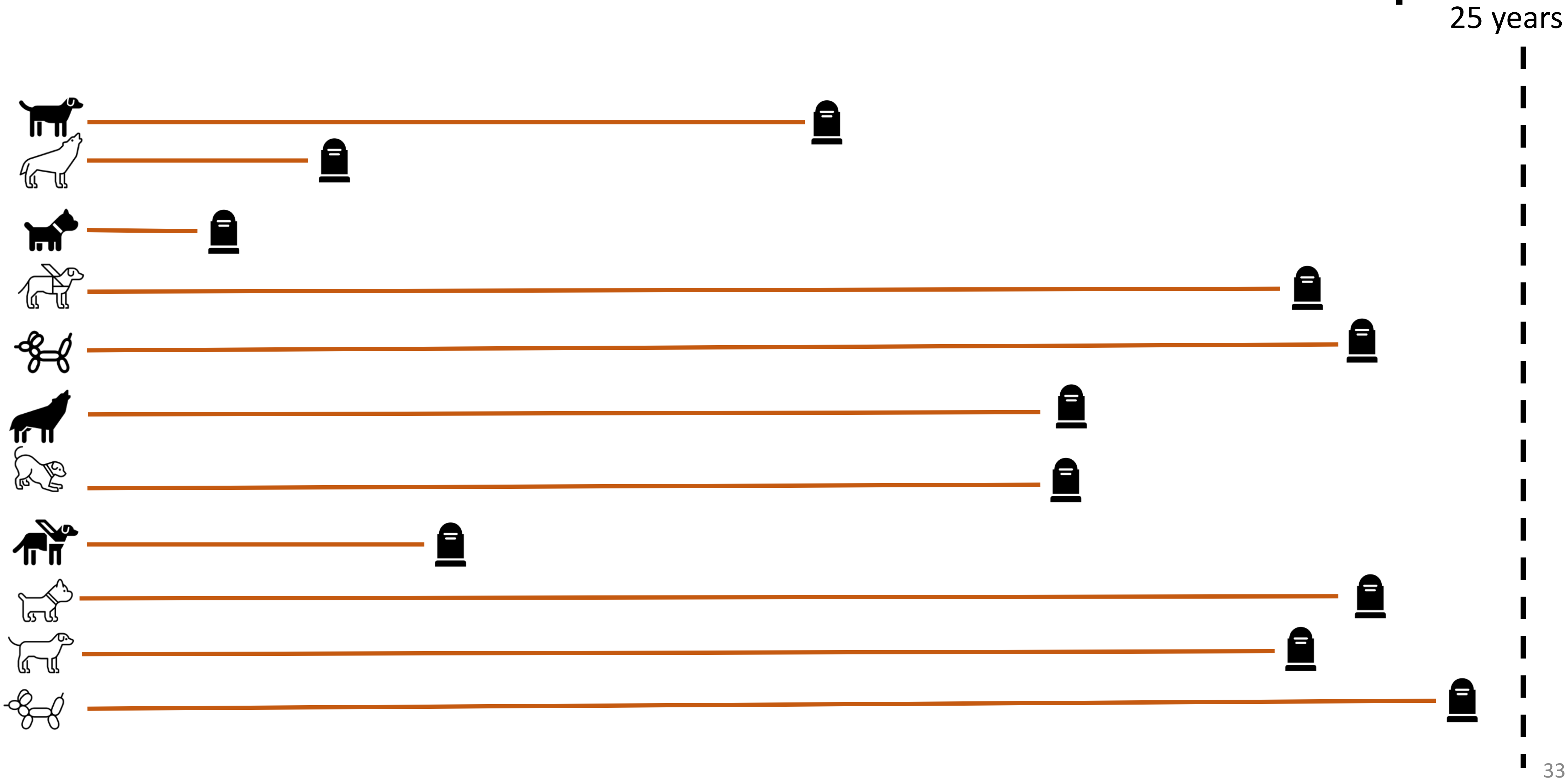
Learn from non-closed cohorts

Cohorts may be *open on the right* or *open on the left*

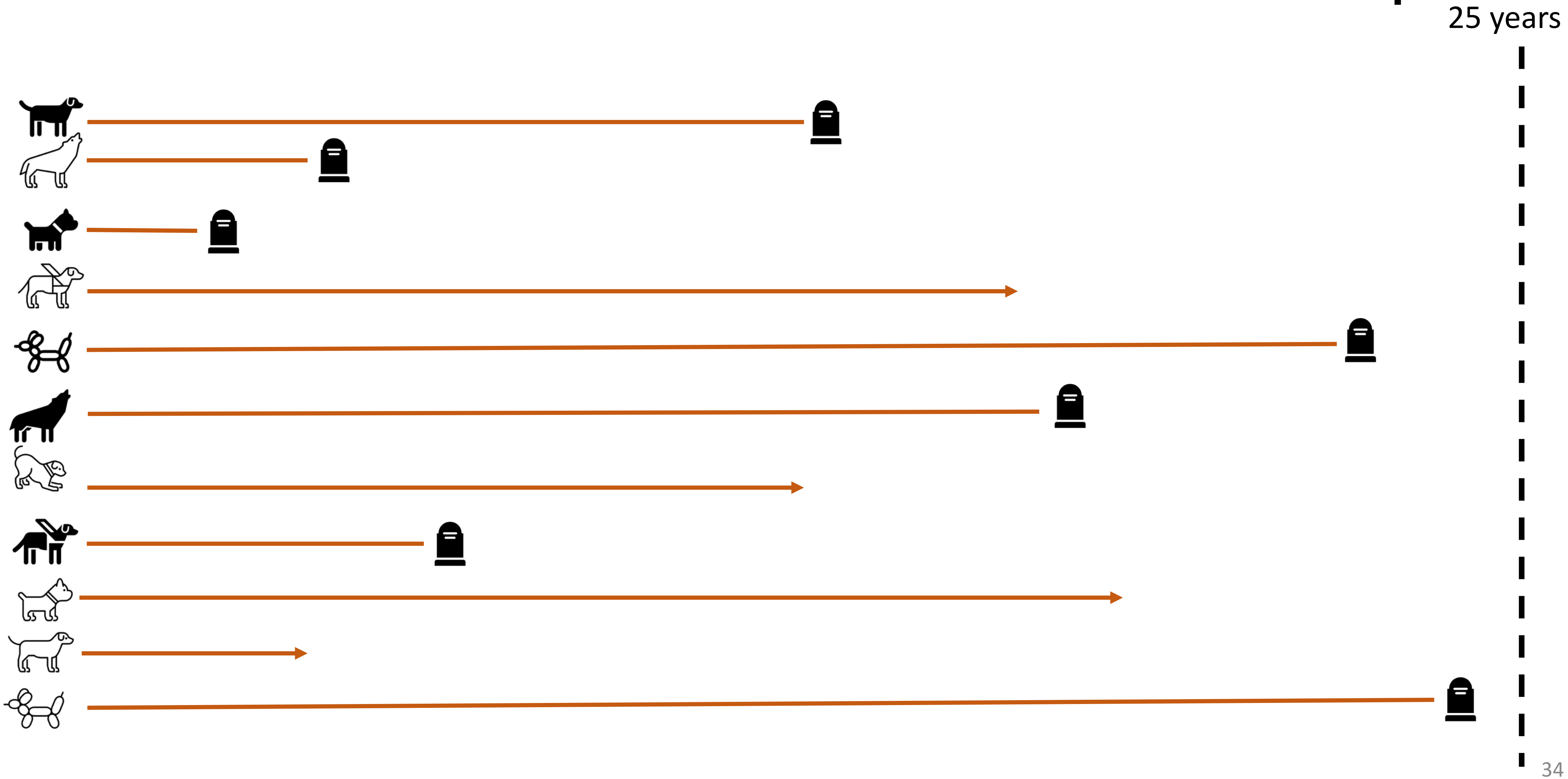
Open on the right: drop out, administrative censoring

Open on the left: late entry

Learn from non-closed cohorts: Dropout



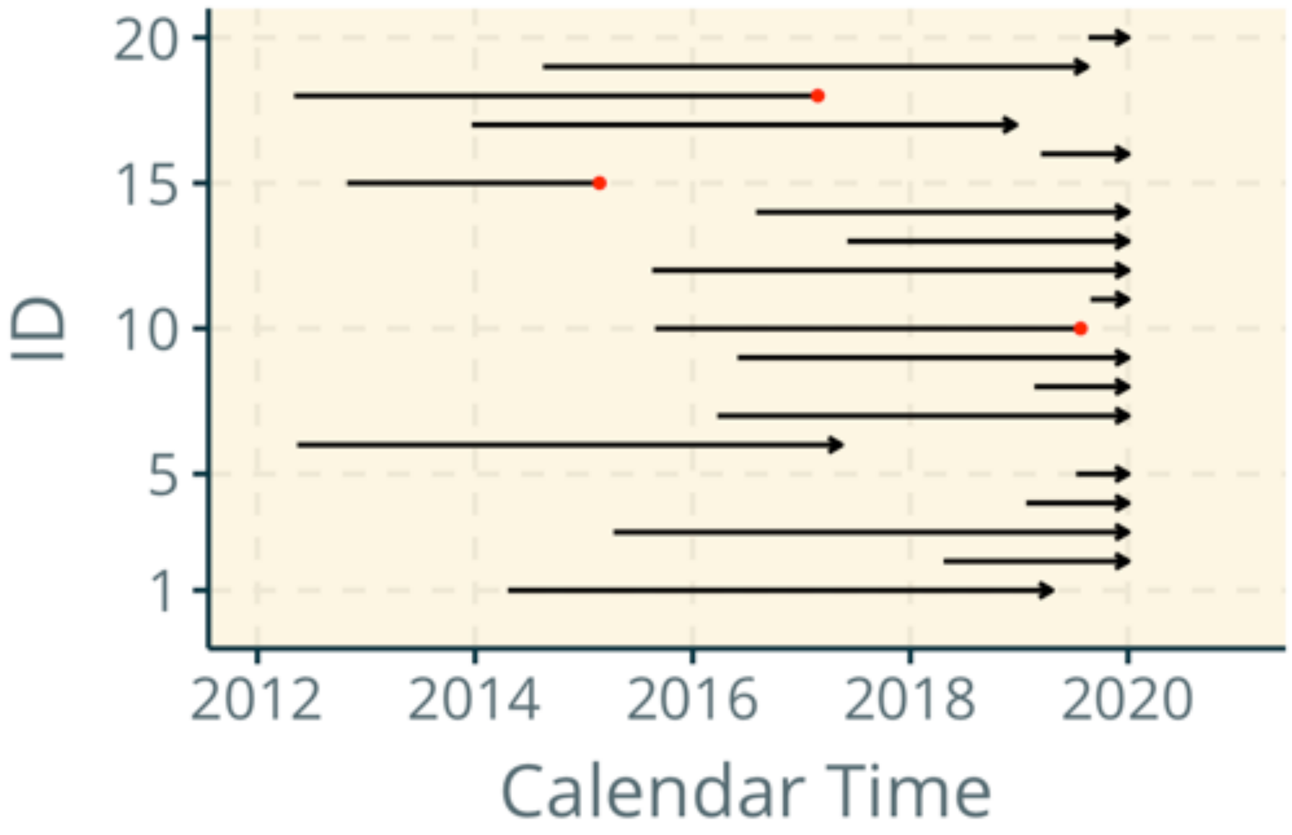
Learn from non-closed cohorts: Dropout



Cohorts can be open on the right even without dropout!

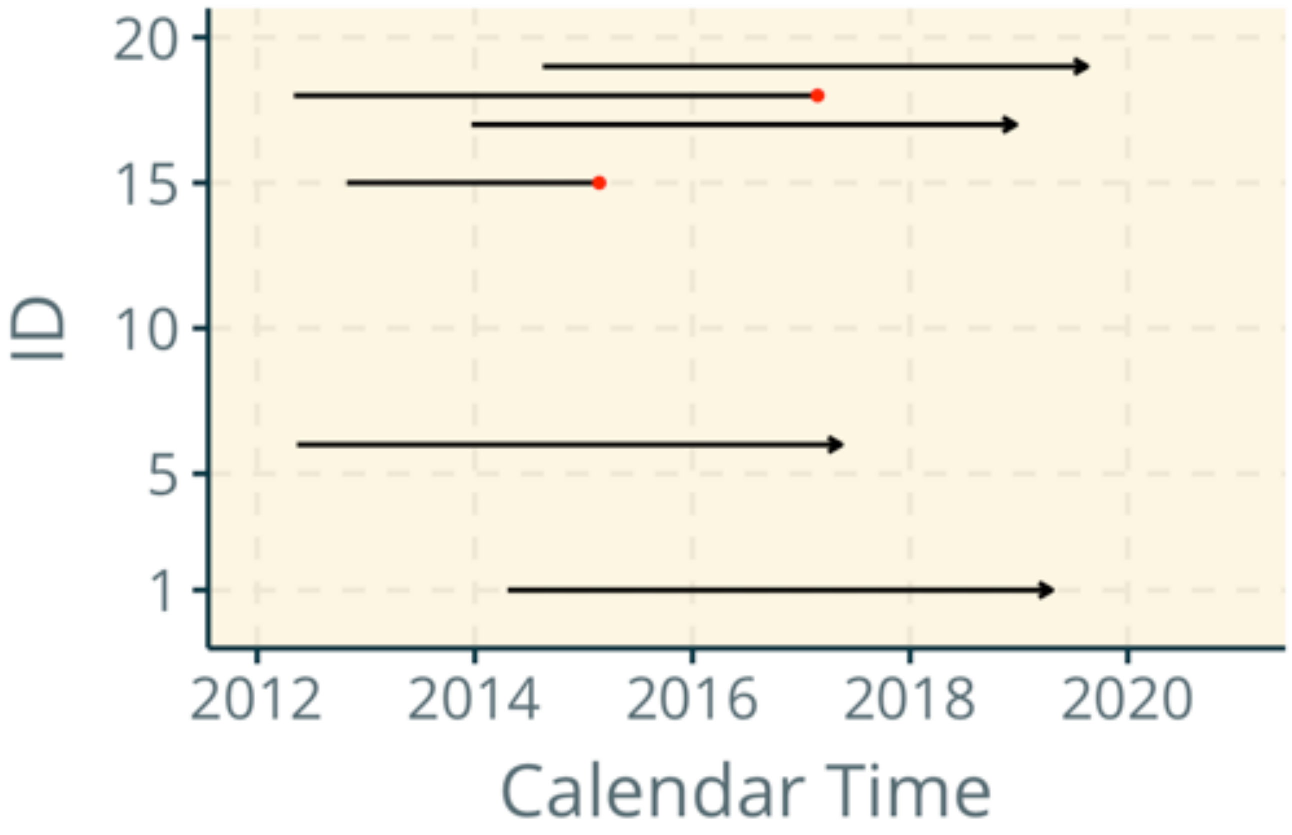
Say you wish to estimate the 5-year risk of death among people entering HIV care.

You have a database of people entering HIV care between 2012 and 2020.



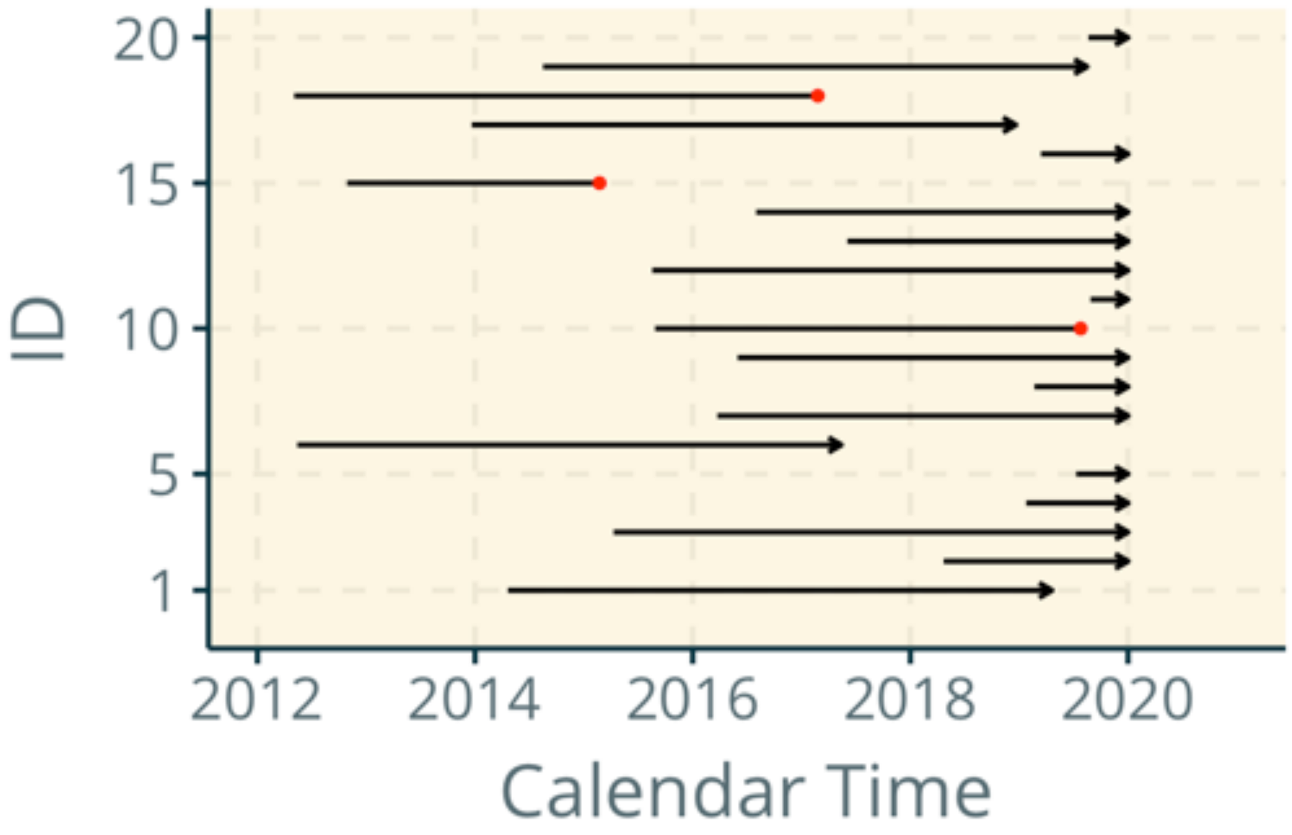
Cohorts can be open on the right even without dropout!

If your methods require a closed cohort, you require 5 full years of follow-up, so can only use data on those enrolled between 2012 and 2015, essentially throwing away 5 years of data.



Cohorts can be open on the right even without dropout!

But using time-to-event methods, the partially observed person time (and any events) among those enrolled between 2015 and 2020 also contribute to the study.



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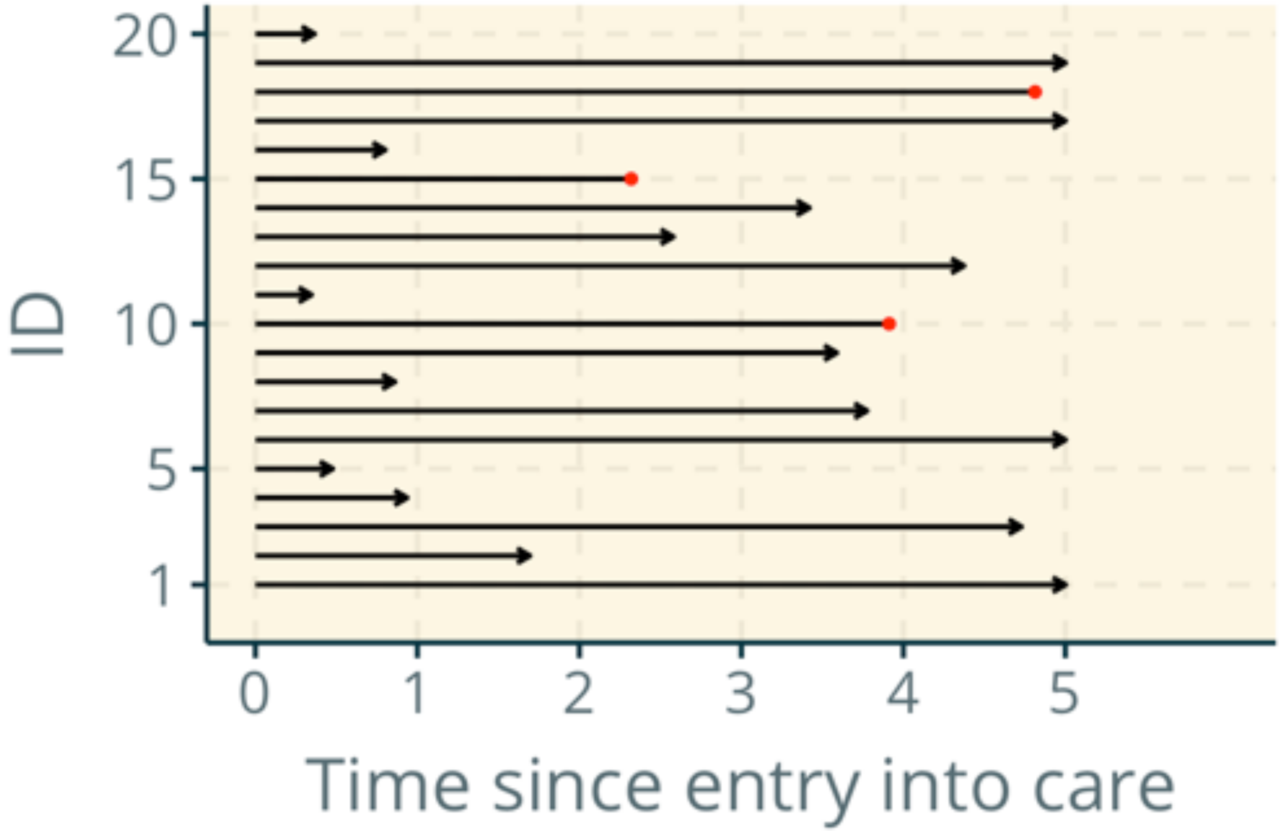

Consider time-varying exposures

- Nonadherence
- Policy changes

Critical to compare the right people at the right times!

Chapter 4: Line diagrams

Line diagrams

Visualize choices of origin and timescale

See which participants are being compared at a given point in time.

In next week's reading, we will see how choice of timescale results in very different line diagrams and very different risk functions.

Line diagrams, steps

1. Draw and label axes (y axis is usually study id, x axis is timescale, starting at the origin)
2. Calculate the amount of time after the origin that the first person enters the study. Place an open circle at this timepoint.
3. Draw a line from this open circle until the last available information for that participant.
4. If an event was observed, place a closed circle at that time
5. If no event was observed, place an arrow at that time
6. Repeat for remaining participants

An example, drawing line diagrams.

Say have a (small) cohort study of 5 soldiers selected at random from all people enlisting in the armed services between 2004 and 2014 and followed for mortality up to 10 years.

Complete line diagrams as described by the following 3 slides (we will do the first one together).

Example data

Draw a line diagram with the x axis as *age (starting at age 18)* and the y axis as soldier id number.

ID number	Age at enlistment	Enlistment date	Last date with available information	Vital status at last info
1	24	1 July 2008	Today()	Alive
2	18	1 July 2008	1 January 2011	Dead
3	21	1 January 2011	15 June 2016	Dead
4	35	1 January 2011	Today()	Alive
5	19	1 July 2013	Today()	Alive

Recall: Say we have a (small) cohort study of 5 soldiers selected at random from all people 18 and over enlisting in the armed services **between 2004 and 2014** and followed for mortality **up to 10 years**.

Example data

Draw a line diagram with the x axis as *calendar time (starting 1 Jan 08)* and the y axis as soldier id number.

ID number	Age at enlistment	Enlistment date	Last date with available information	Vital status at last info
1	24	1 July 2008	Today()	Alive
2	18	1 July 2008	1 January 2011	Dead
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Recall: Say we have a (small) cohort study of 5 soldiers selected at random from all people 18 and over enlisting in the armed services **between 2004 and 2014** and followed for mortality **up to 10 years**.

Example data

Draw a line diagram with the x axis as *time since enlistment* and the y axis as soldier id number.

ID number	Age at enlistment	Enlistment date	Last date with available information	Vital status at last info
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