Are Biases in Longevity Beliefs an Artifact?

Eliciting Full Distribution with Visual Support Reduces Biases

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Eliciting longevity beliefs

Many economic **institutions** depend on longevity: **good aggregate data**

- Pensions

- Insurances

Individual decisions depend on **subjective** expected longevity: **little data**

- Saving for retirement

- Investing in life insurance

Are subjective longevity belief consistent with aggregate data?
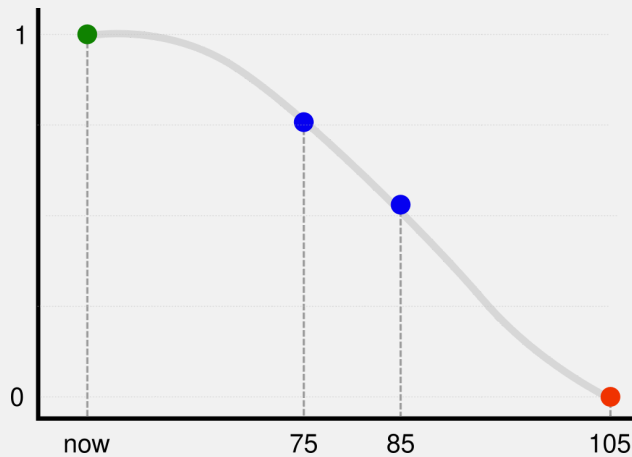
Are there biases?

- Hamermesh 1985, QJE custom survey, US, 370 subjects
  - *What is your subjective probability of living to at least age **[60; 80]***?

- Healt and Retirement Study, US, ~12k subjects
  - *What are the chances you will live to be **[75; 85]** or more?*

- Survey of Health, Ageing and Retirement in Europe, EU11, ~9k subjects
  - *What are the chances that you will live to be age **[~age+5]** or more?"*

- English Longitudinal Study of Ageing, UK, ~16k subjects
  - *What are the chances that you will live to be age **[75; 85]** or more?*

- Wu et al. 2014, JEDynCon, Australia, 920 subjects
  - *What are the chances that you will live to be age **[seq(75,120,5)]***?
- Lot 2024, WP, Switzerland, 1400 subjects
  - *What are your chances of being alive at age **[seq(50,105,5)]***
- Heimer et al. 2019, JoFin, US, ~4500 subjects
  - *What are the chances that you will live till **[age + 1,2,5,10]** years*

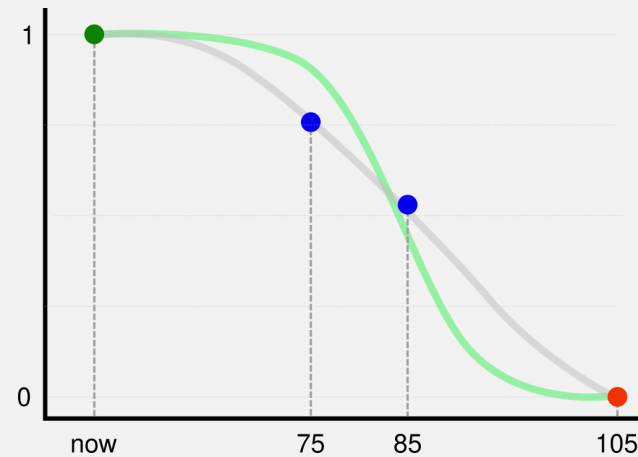**Building survival curves...**

Fitting a Weibull distribution

1. **Aggregating** data, or
2. **Individually**, over few points

...yields clear biases

Subjects, on average & individually

1. **Overestimate** death at young age
2. **Underestimate** death at old age

Wide implications: young undersave; old draw down assets slower
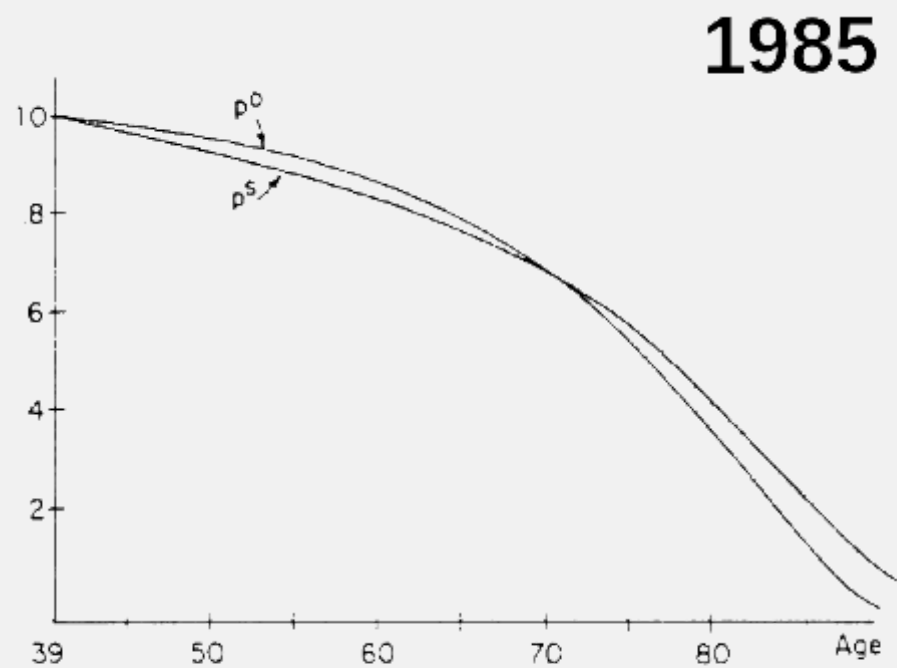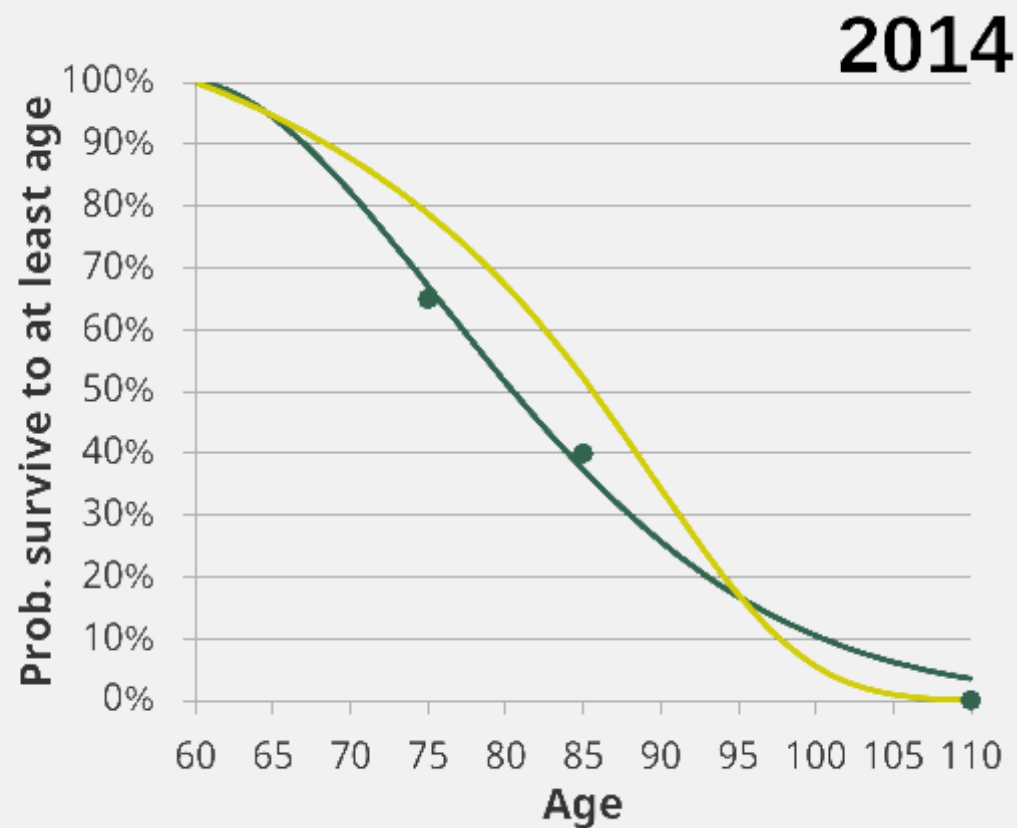
1985

2014

FIGURE 1

Actuarial and Subjective Survival Functions

usual explanations: **overweight** of rare events; **overconfidence**.

- **few** points + **aggregation**
- **parametric** assumptions (Weibull)
  - Data **loss** (if Weibull "unrealistic")
  - Data **imputation** (e.g. $p_{105} = 0$)

- **CDF-like** questions
  "Probability still alive at X"

  Are those biases *real*, or are they *artifacts* of the method?

A new method.
Can we do better?

We elicit full distributions

- visually
- intuitively
- individually

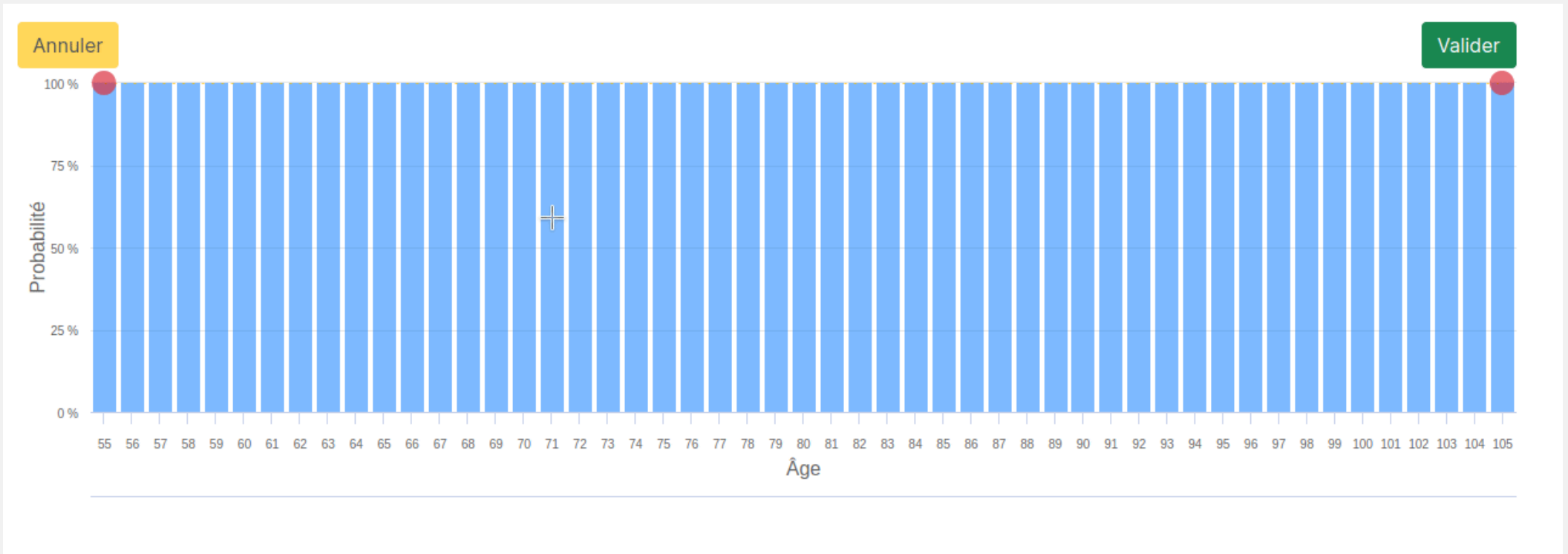## Click'n'Drag (Crosetto & De Haan 2024)
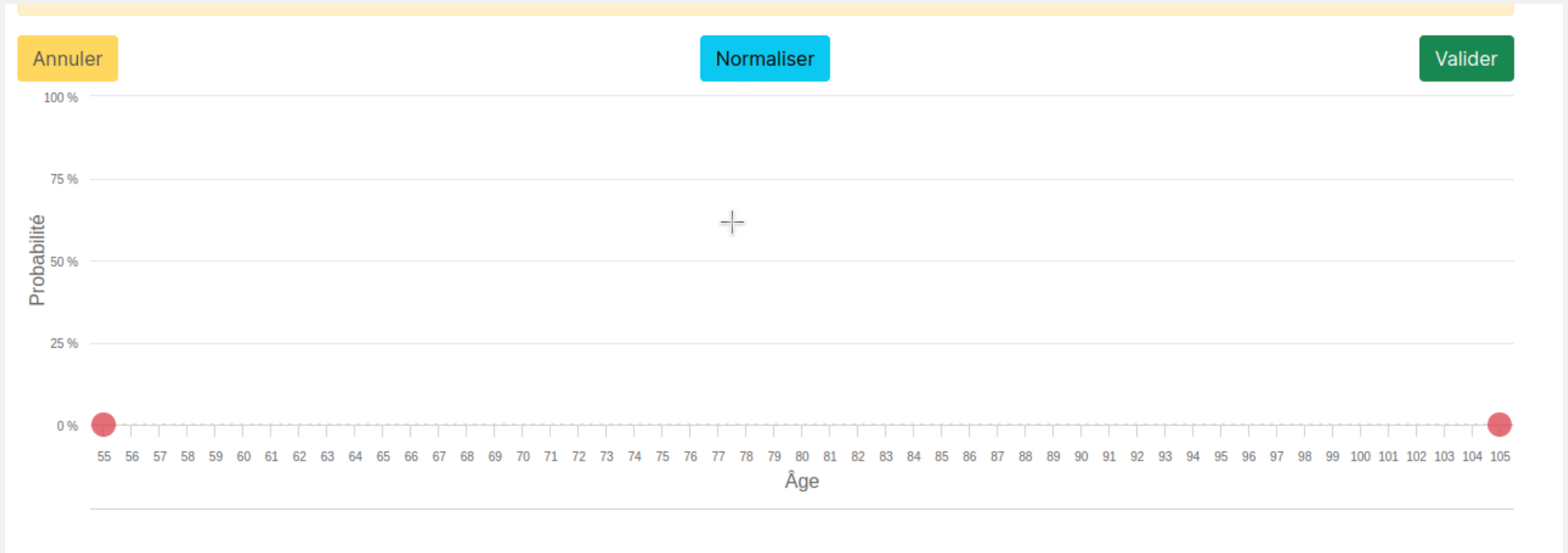
- no Weibull fitting
- endogenous N points

Using both CDF & PDF questions

- *"Probability still alive at X"*
- *"Probability to pass away at X*

*"how likely is a typical **your_age** year old **your_gender** person **to be still alive** at each of the future ages given on the plot?"*

_"how likely is a typical **your_gender** year old **your_age** person **to pass away** at each of the future ages given on the plot?"_
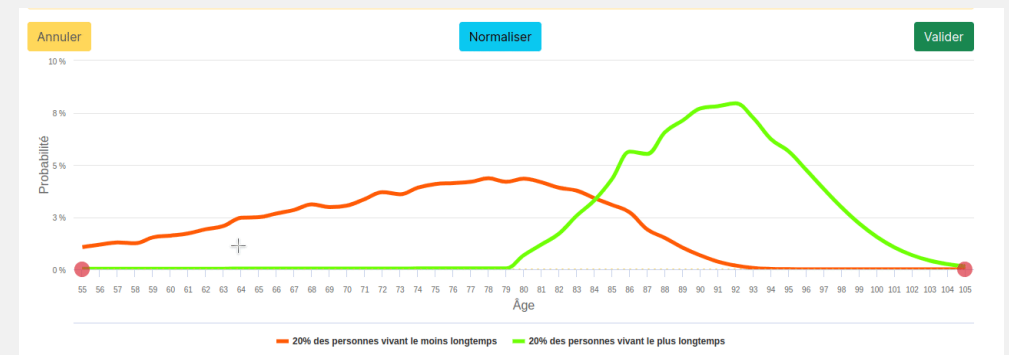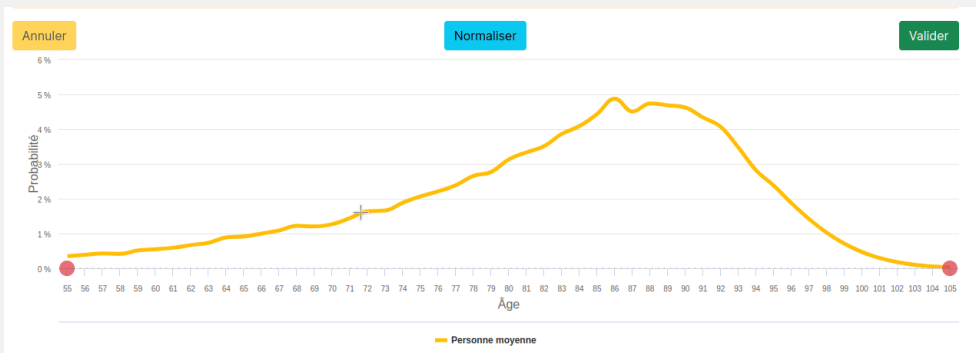
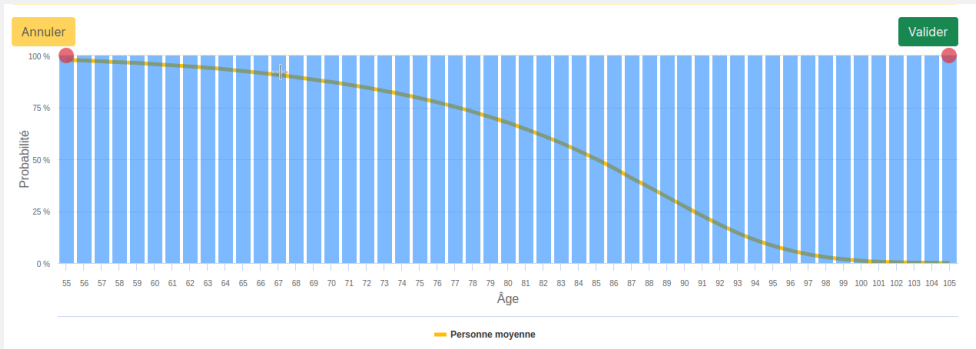# Asking self survival is tricky

- Subjects have private information

- Self-image concerns play a role

- Emotionally sensitive

We use **archetypes** · an "average" person with *your* age and gender

Does **providing information** in the form of reference curves help?

Mean person survival

20% least · 20% most healthy

Health condition	Suffered
Hypertension	Yes/No
Diabetes	Yes/No
Cancer	Yes/No
Heart attack	Yes/No
Stroke	Yes/No
Lung illness	Yes/No
Parkinson	Yes/No
Alzheimer or dementia	Yes/No
Other long-term chronical illness	Yes/No

- **Healty**: no condition
- **Hypertension**: hypertension only
- **Chronic**: other chronic only
- **1 Condition**: 1 from the list
- **2 Conditions**: 2 from the list
- **3 Conditions**: 3 from the list
- **4 Conditions**: 4 from the list

Longevity expectations

1. New methods exploration

2. Collect data on earlier age

3. Archetype *vs* Self

4. Data on health scenarios

Experimental & Behavioral

1. Bias *vs* artifact

2. PDF *vs* CDF

3. Info and debiasing

Experimental details

Between subjects

- Interface [CDF · PDF]
- Support [none · 20/80 · mean]

Within subjects

- Archetype
- Health scenarios
- Self [for CDF only]

- **3105** swiss, ~75% DE, ~25% FR

- **~55%** Female · mean age **~40**

- Recrutiment via Bilendi · oTree

- Incentives:

  - Self · Archetype: none

  - Health scenarios: **incentives** for accuracy

- mean duration **~12'** · mean payoff **~5CHF**
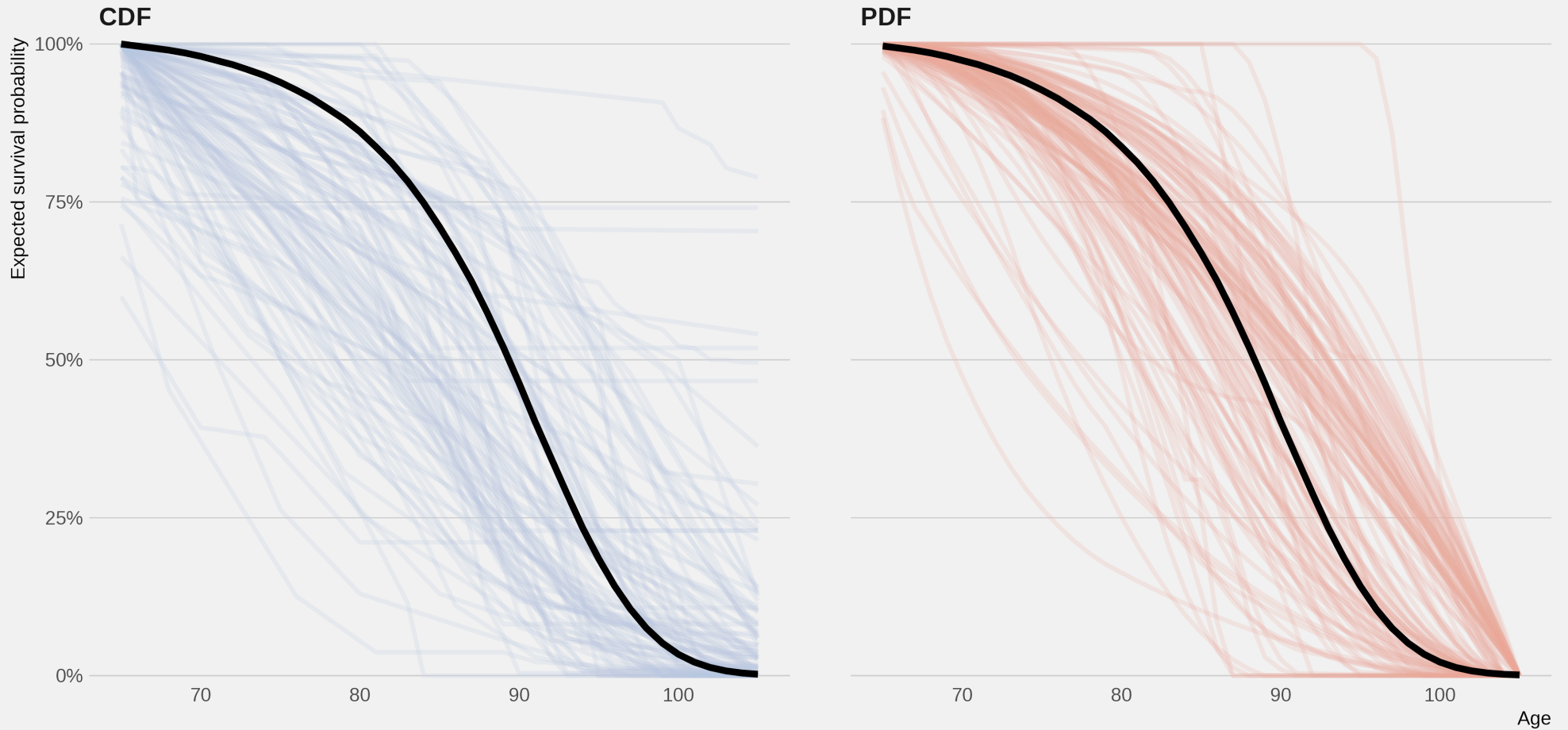
- December '23 (main) + May '24 (robustness)

Results

- **transform** PDF into CDF to make comparable
- compare with Swiss **actuarial tables** for the relative cohort
- only provide expectations for **own gender**
- different measures of distance
  - **euclidean** distance from target
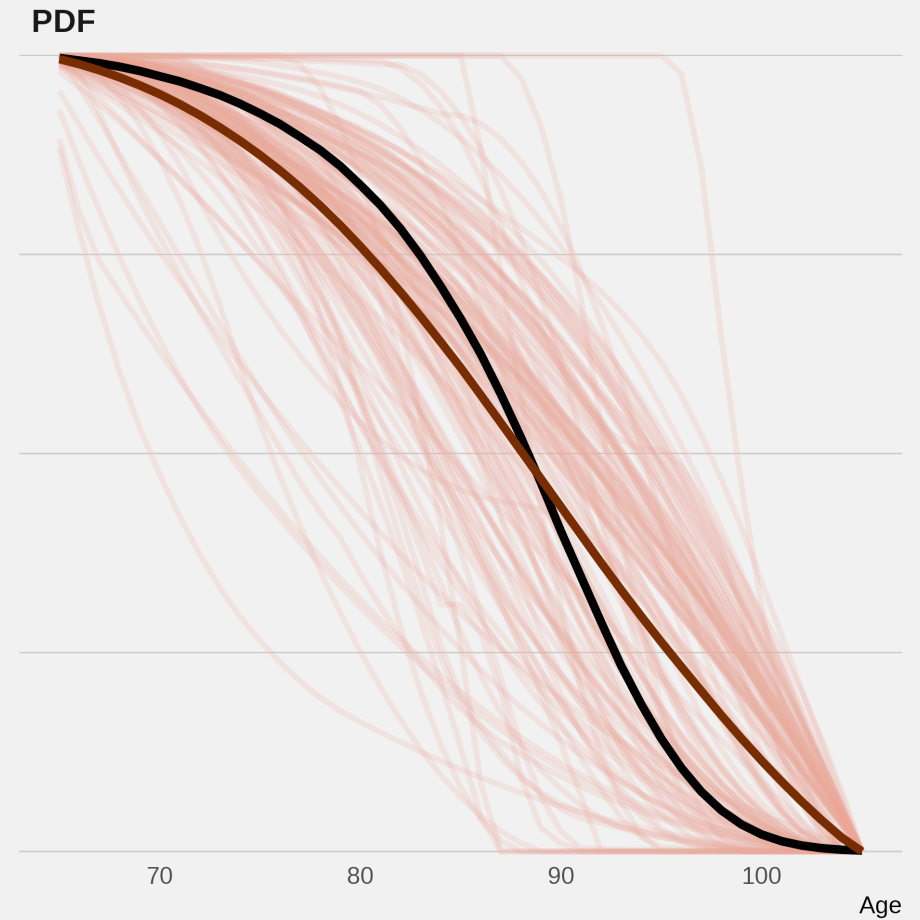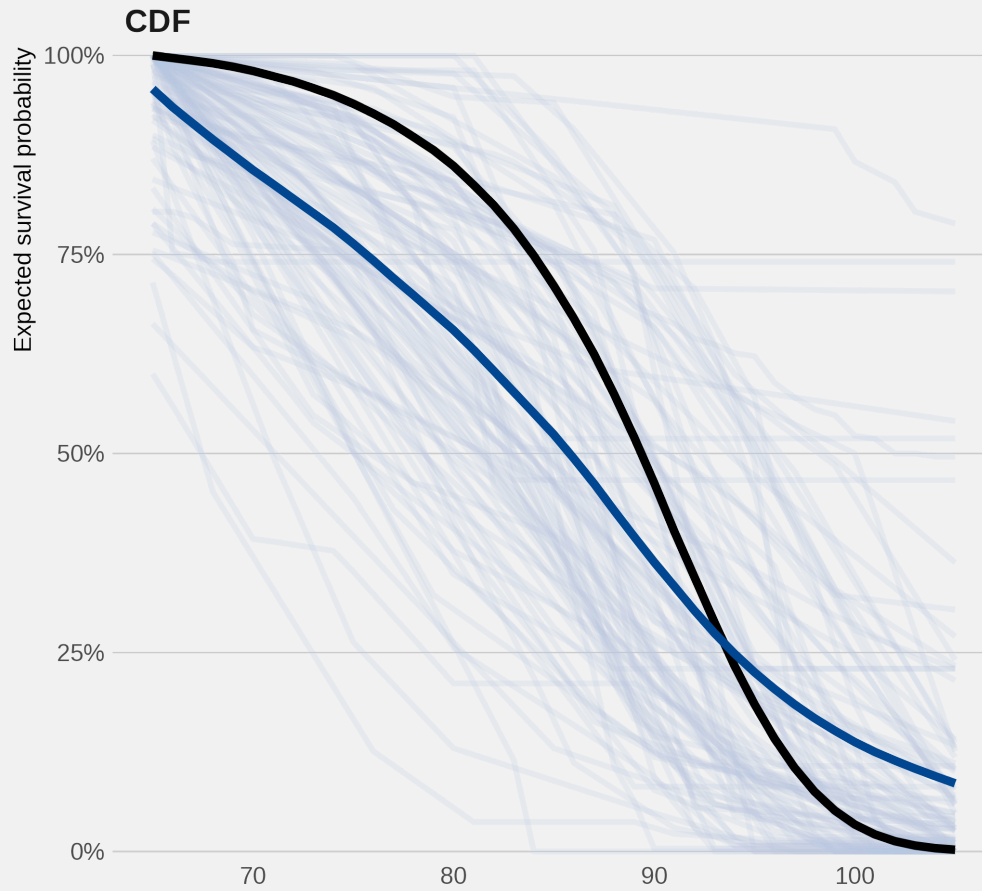 - implied average **time of death**

CDF vs PDF

Individual estimations · females · healthy scenario · no support

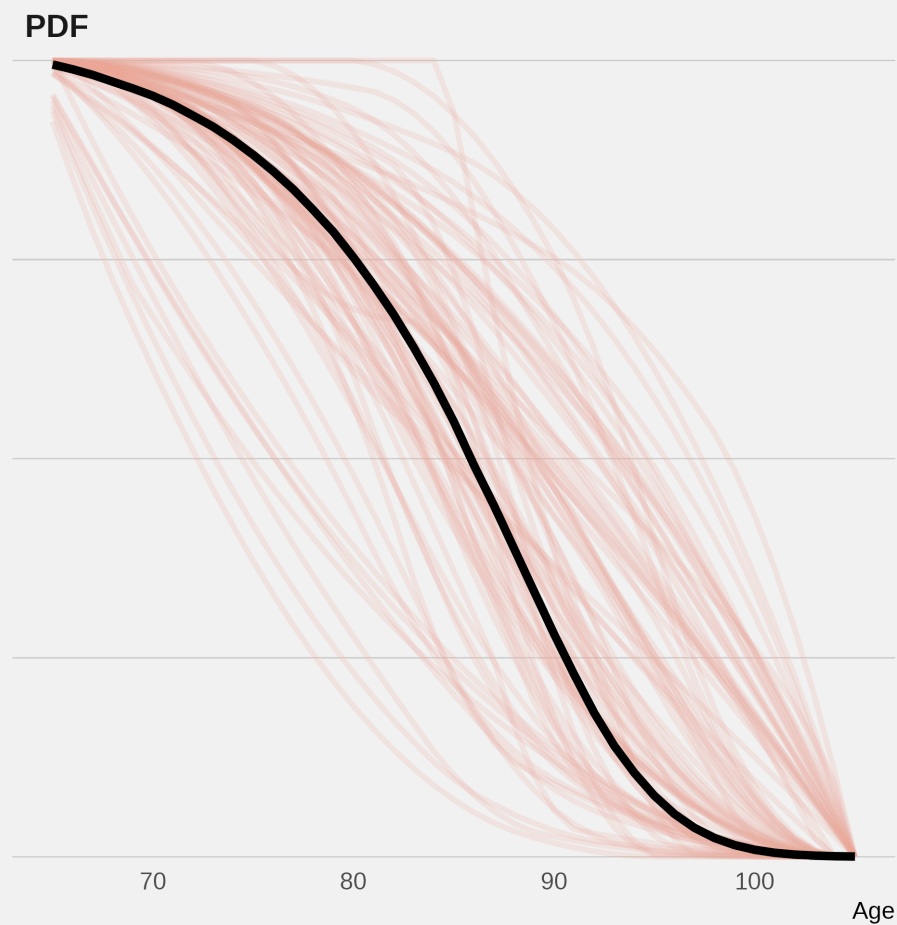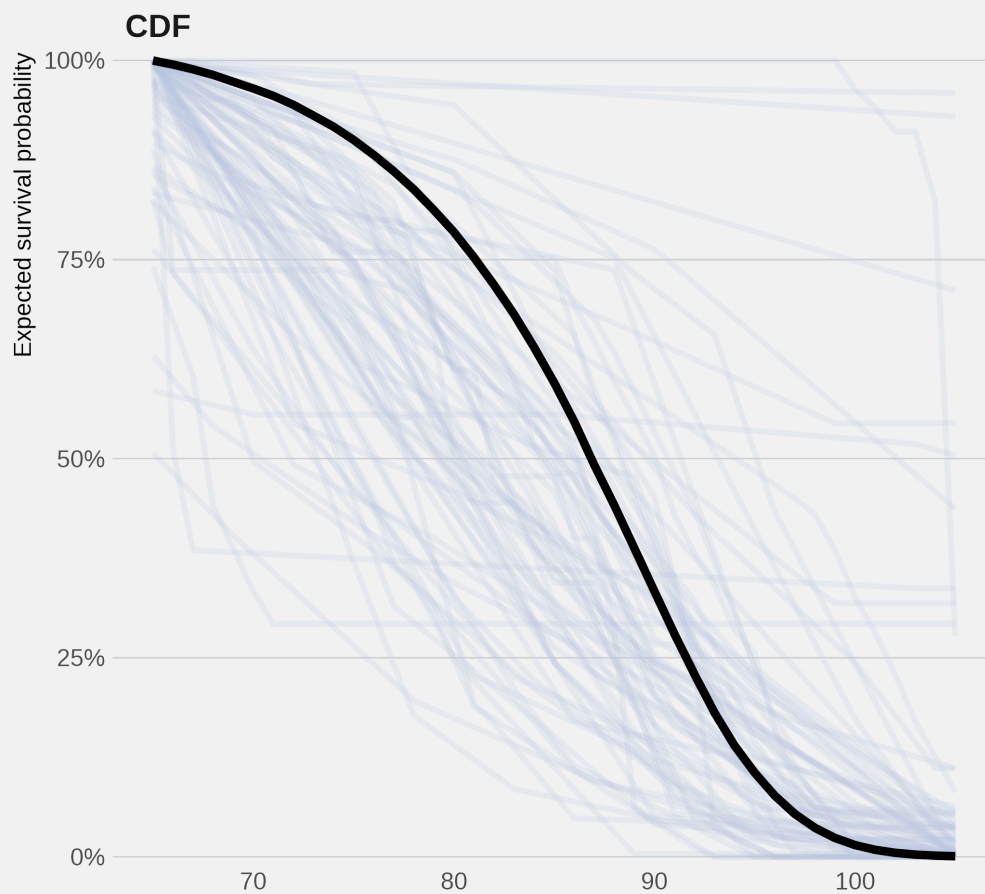Each line is an estimation · target as solid black line

Individual estimations · females · healthy scenario · no support

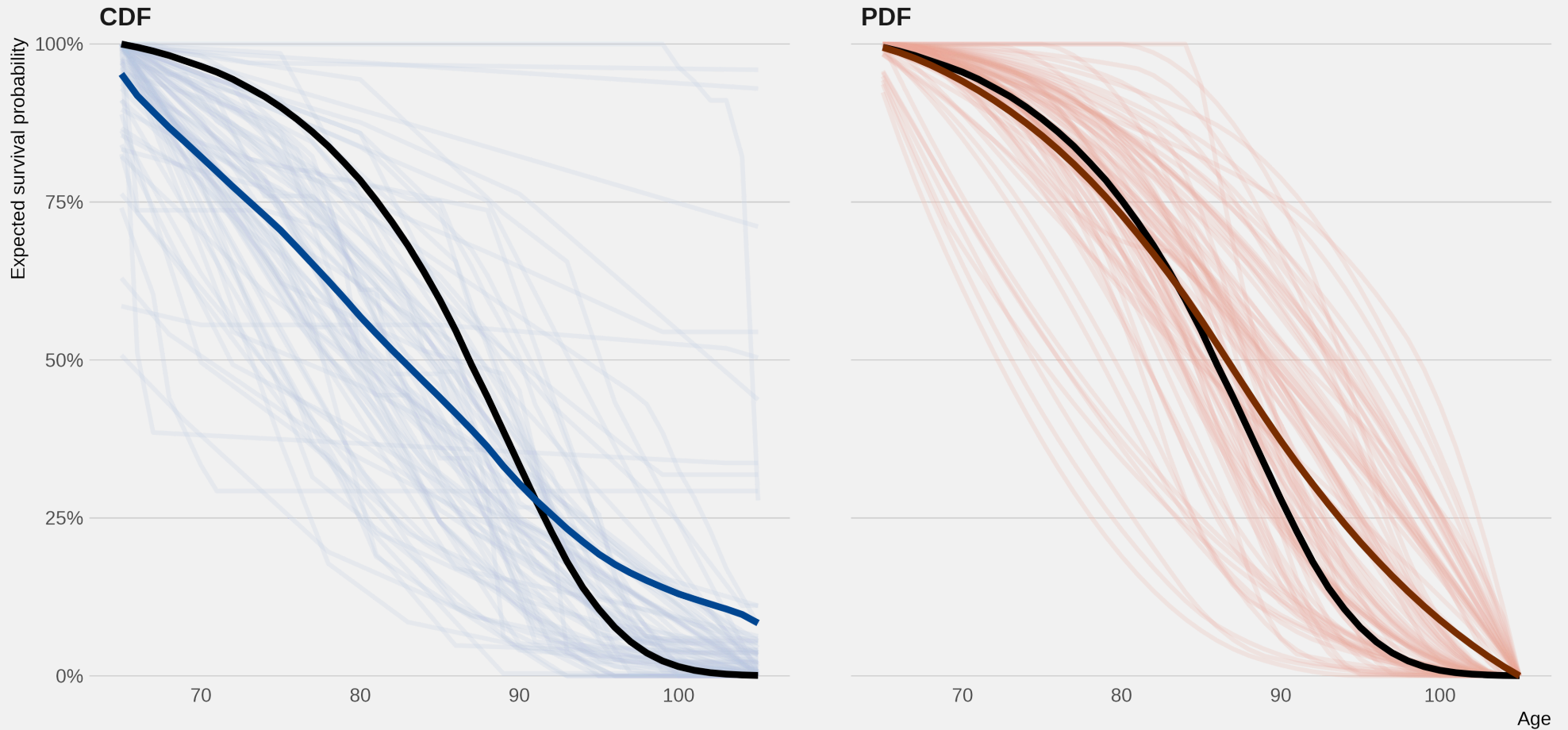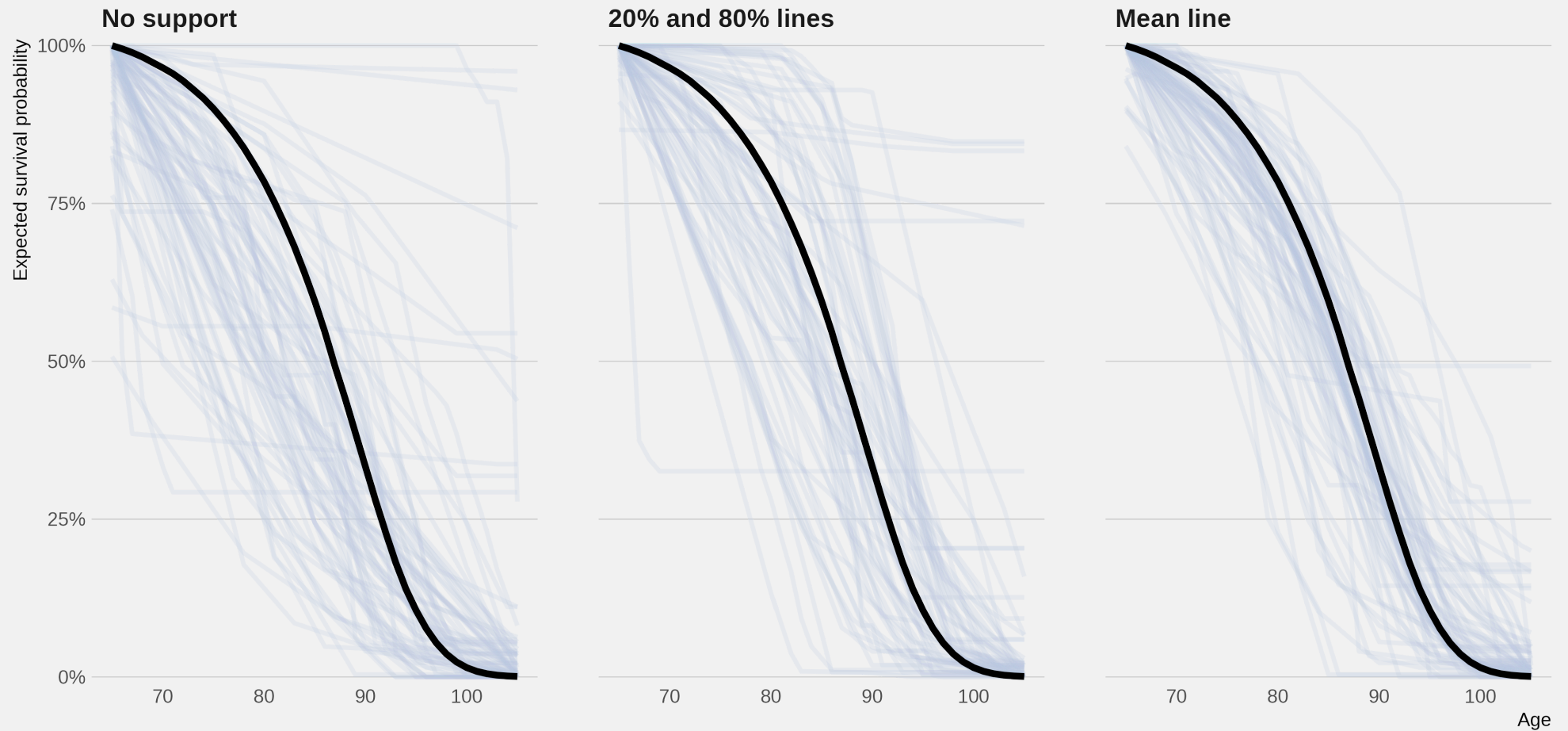Each line is an estimation · target as solid black line · mean estimation as solid colored line

Individual estimations · males · healthy scenario · no support

Each line is an estimation · target as solid black line

CDF

PDF

Expected survival probability

Age

Individual estimations · males · healthy scenario · no support

Each line is an estimation · target as solid black line · mean estimation as solid colored line

CDF

PDF

Expected survival probability

100%

75%

50%

25%
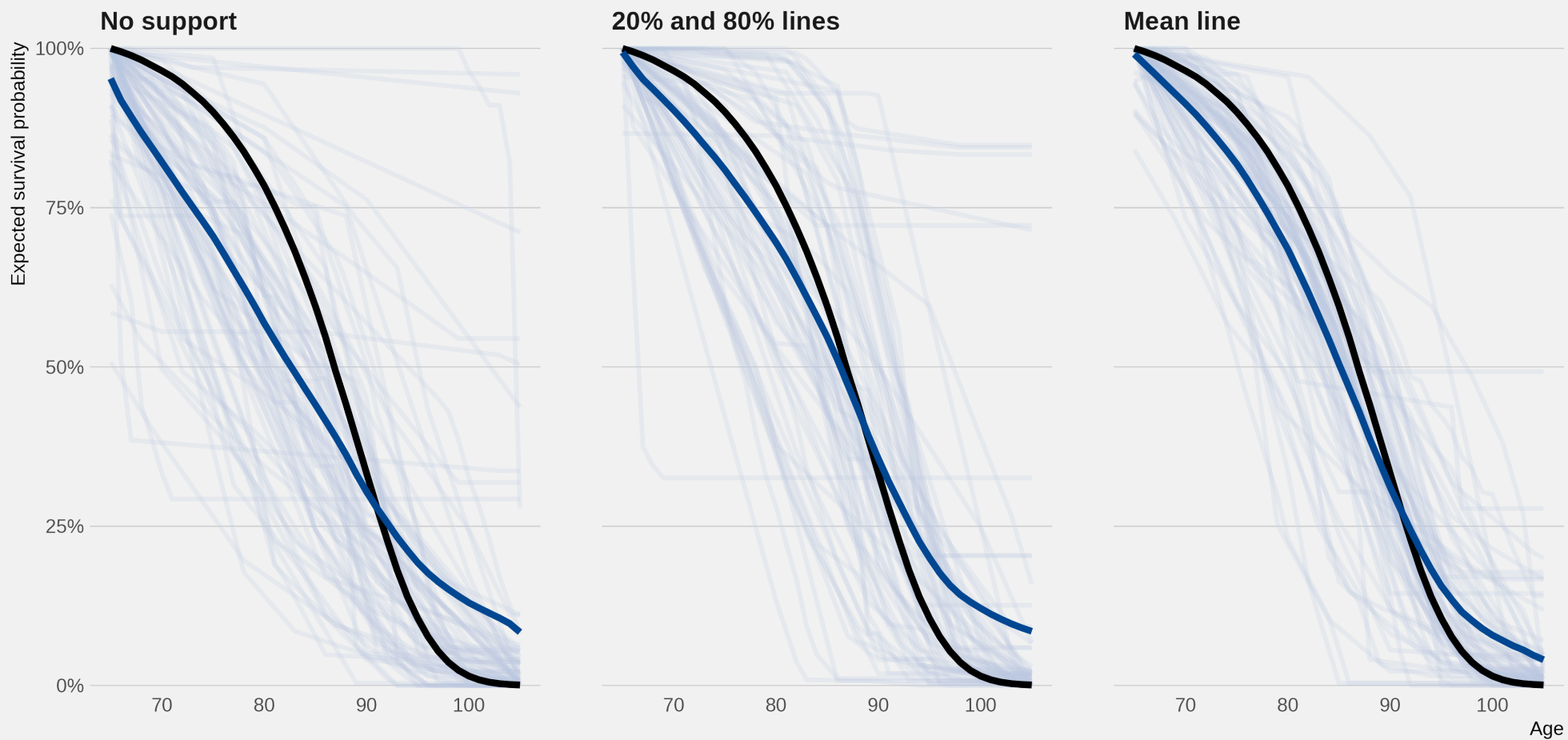
0%

70 80 90 100

Age

Visual aid

Individual estimations · males · healthy scenario · CDF

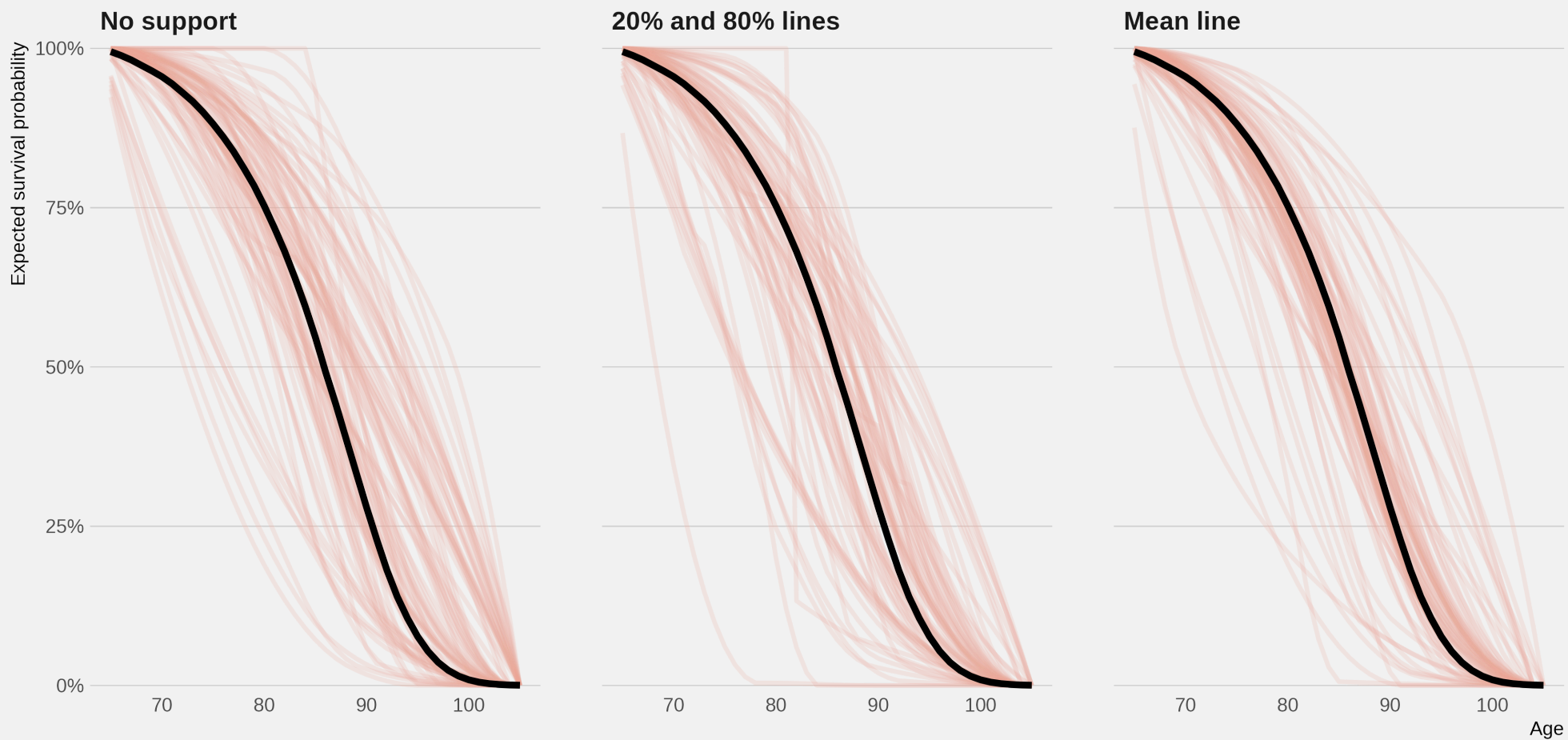Each line is an estimation · target as solid black line

Individual estimations · males · healthy scenario · CDF

Each line is an estimation · target as solid black line · mean estimation as solid colored line
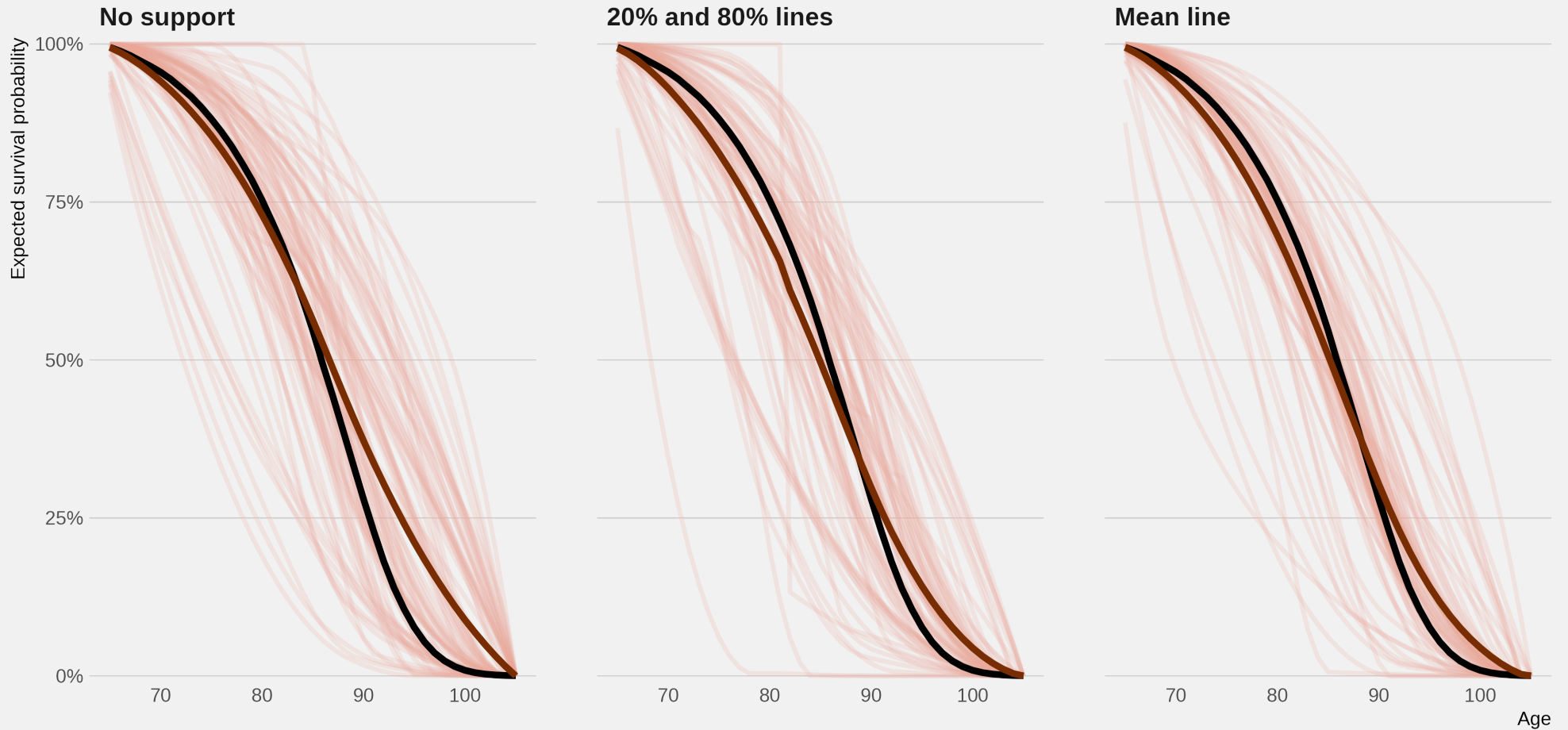
Individual estimations · males · healthy scenario · PDF

Each line is an estimation · target as solid black line

Individual estimations · males · healthy scenario · PDF

Each line is an estimation · target as solid black line · mean estimation as solid colored line

No support · **20% and 80% lines** · **Mean line**

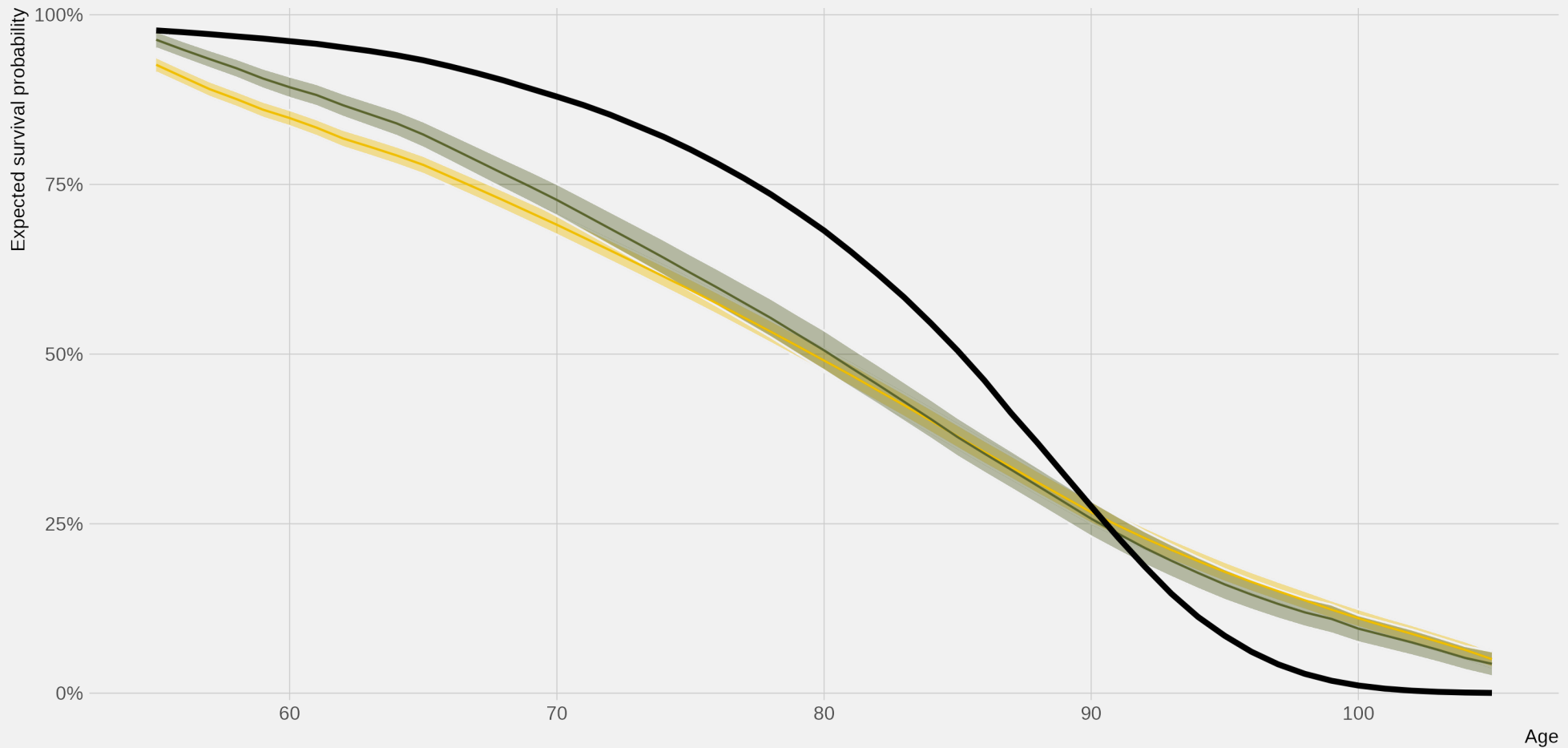# Mean absolute distance from actuarial tables median and t-test of difference

by scenario and type of support: t-test across interfaces

	No support			Mean line			20% and 80% lines		
	CDF	PDF	P	CDF	PDF	P	CDF	PDF	P
Archetype	8.43	5.40	0.000	5.85	3.56	0.000	7.00	5.11	0.000
Scenario: HBP	8.36	4.87	0.000	6.84	3.49	0.000	7.48	4.42	0.000
Scenario: HTY	6.73	4.18	0.000	4.55	2.65	0.000	5.18	3.55	0.000
Scenario: LTD	9.11	4.83	0.000	8.02	4.03	0.000	6.89	4.92	0.000
Scenario: SH1	10.78	5.79	0.000	8.24	4.57	0.000	9.25	5.17	0.000
Scenario: SH2	10.49	5.72	0.000	8.39	4.13	0.000	8.28	5.44	0.000
Scenario: SH3	9.95	5.95	0.000	8.82	4.42	0.000	8.88	4.64	0.000
Scenario: SH4	9.11	5.98	0.000	7.73	5.17	0.000	6.72	5.04	0.000

Eliciting
archetype *vs* self

Mean estimations · males · archetype vs self

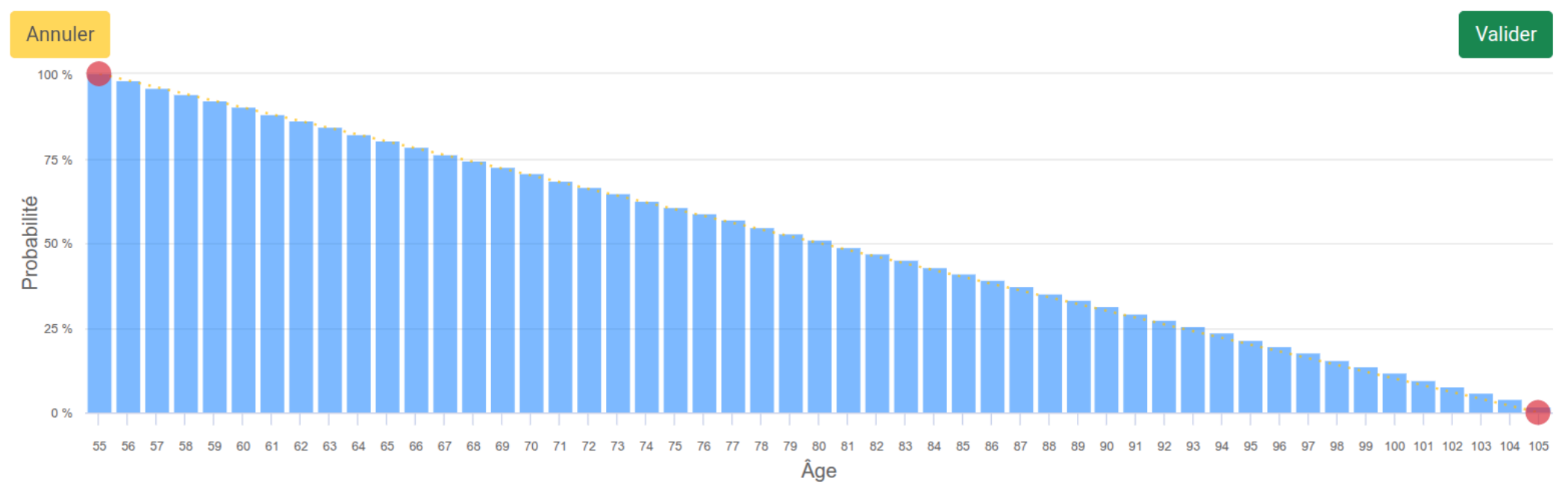Target as solid black line · confidence interval as shaded area

Limited role for private info; if at all, it *reduces* bias
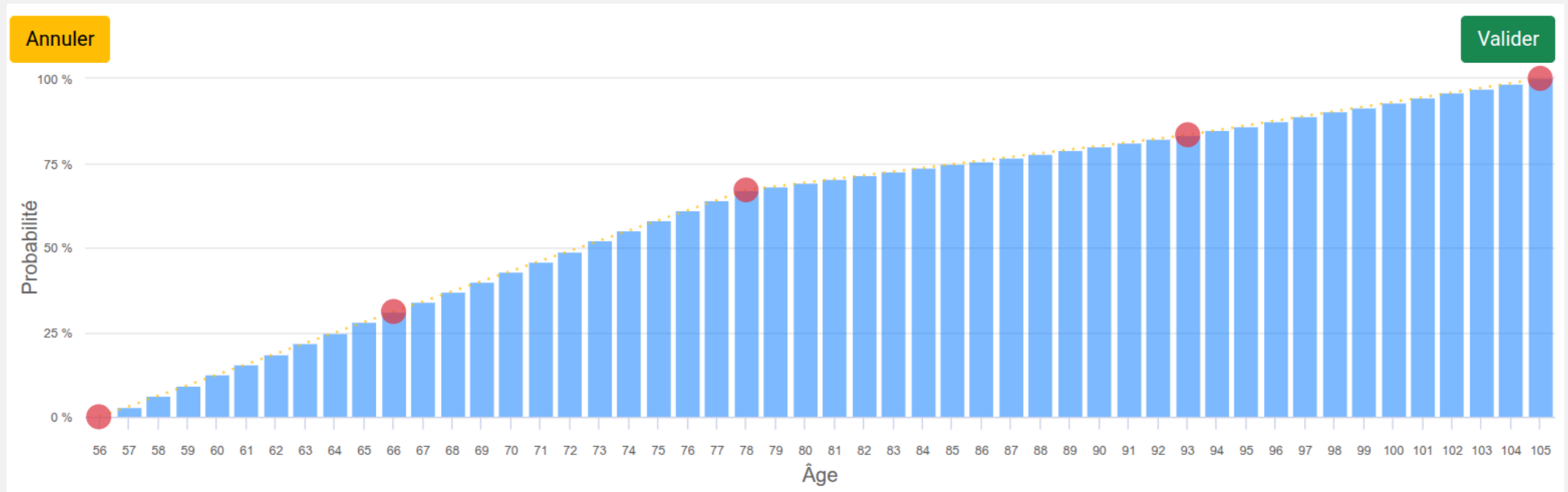
BEEN 2025 Cagliari

Why is CDF bad?
Two robustness treatments

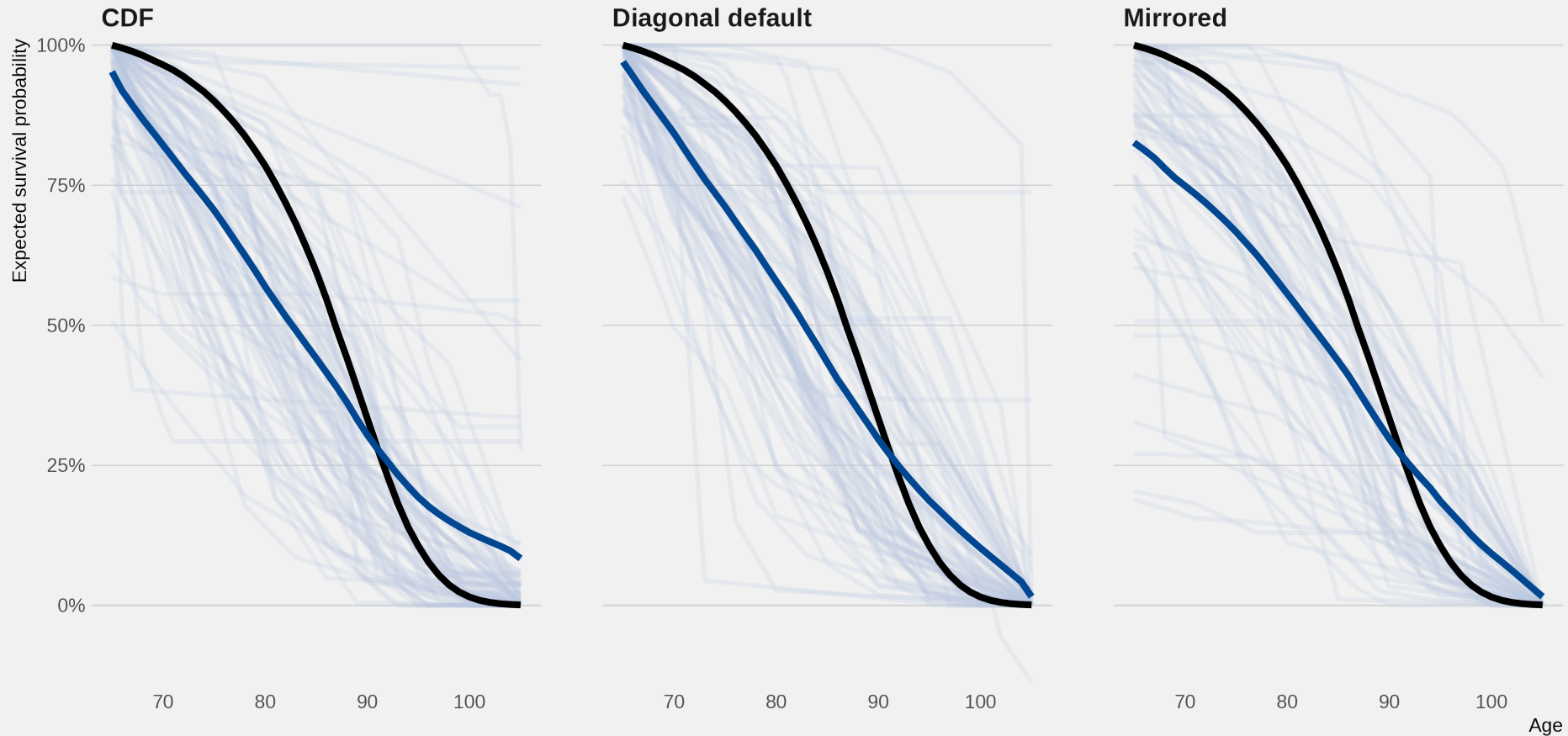# CDF starts with "always alive" · PDF with "nothing"

CDF asks probability still alive · that might be awkward

*"how likely is a typical **your_age** year old **your_gender** person **to have already died** at each of the future ages given on the plot?"*

Individual estimations · males · healthy scenario · CDF variations

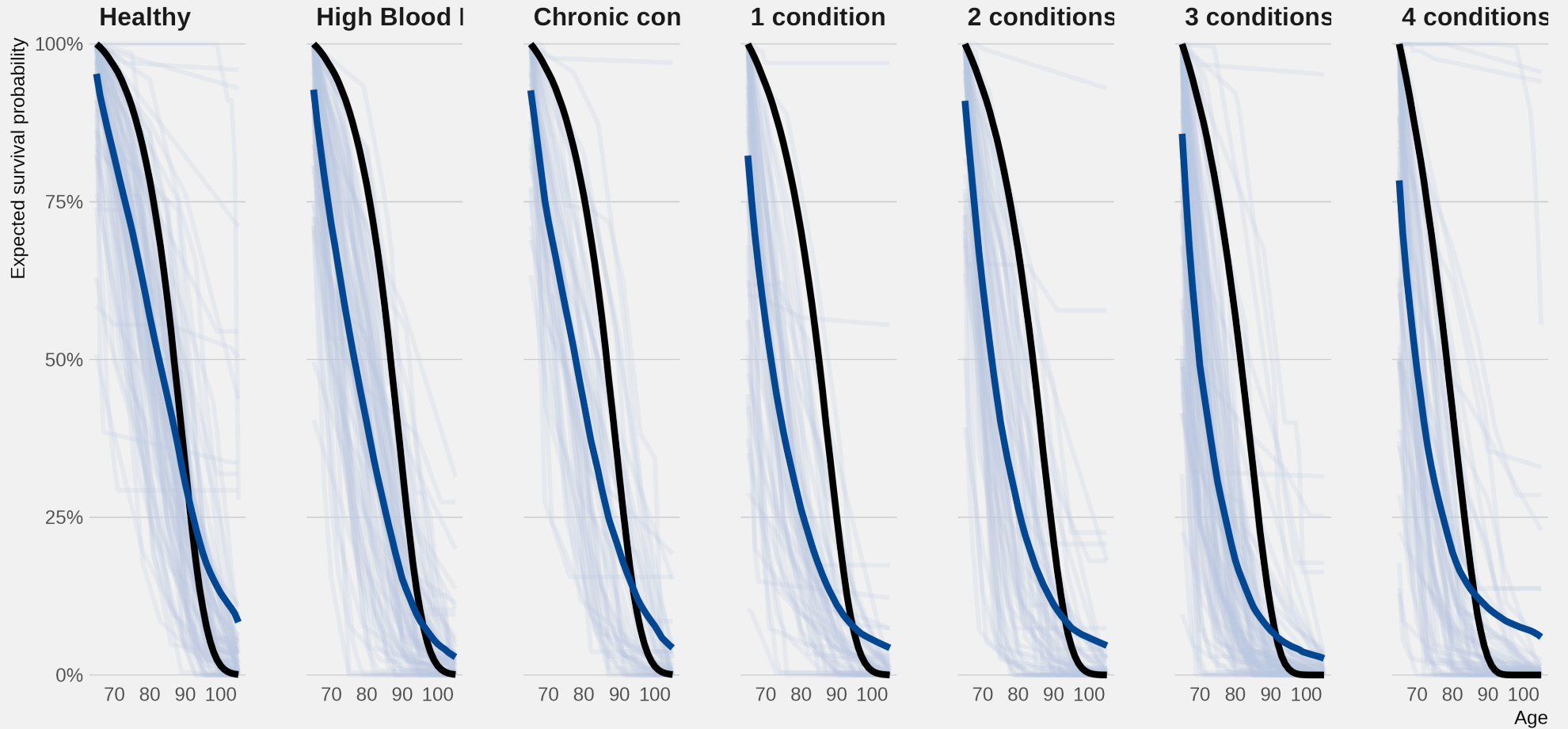Each line is an estimation · target as solid black line · mean estimation as solid colored line

Health scenarios and subjects' accuracy
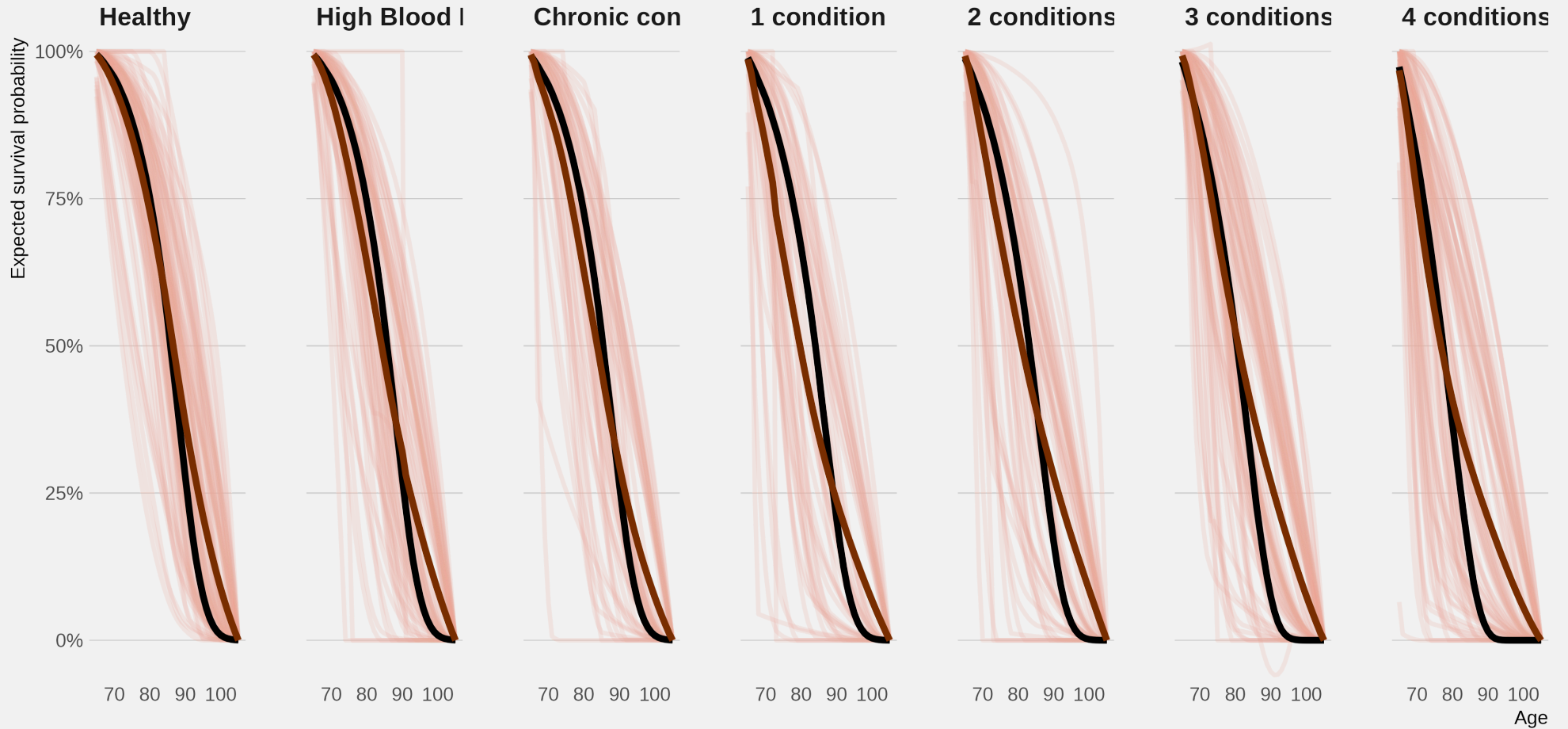
Subject accuracy

Individual estimations · males · all scenarios · no support · CDF

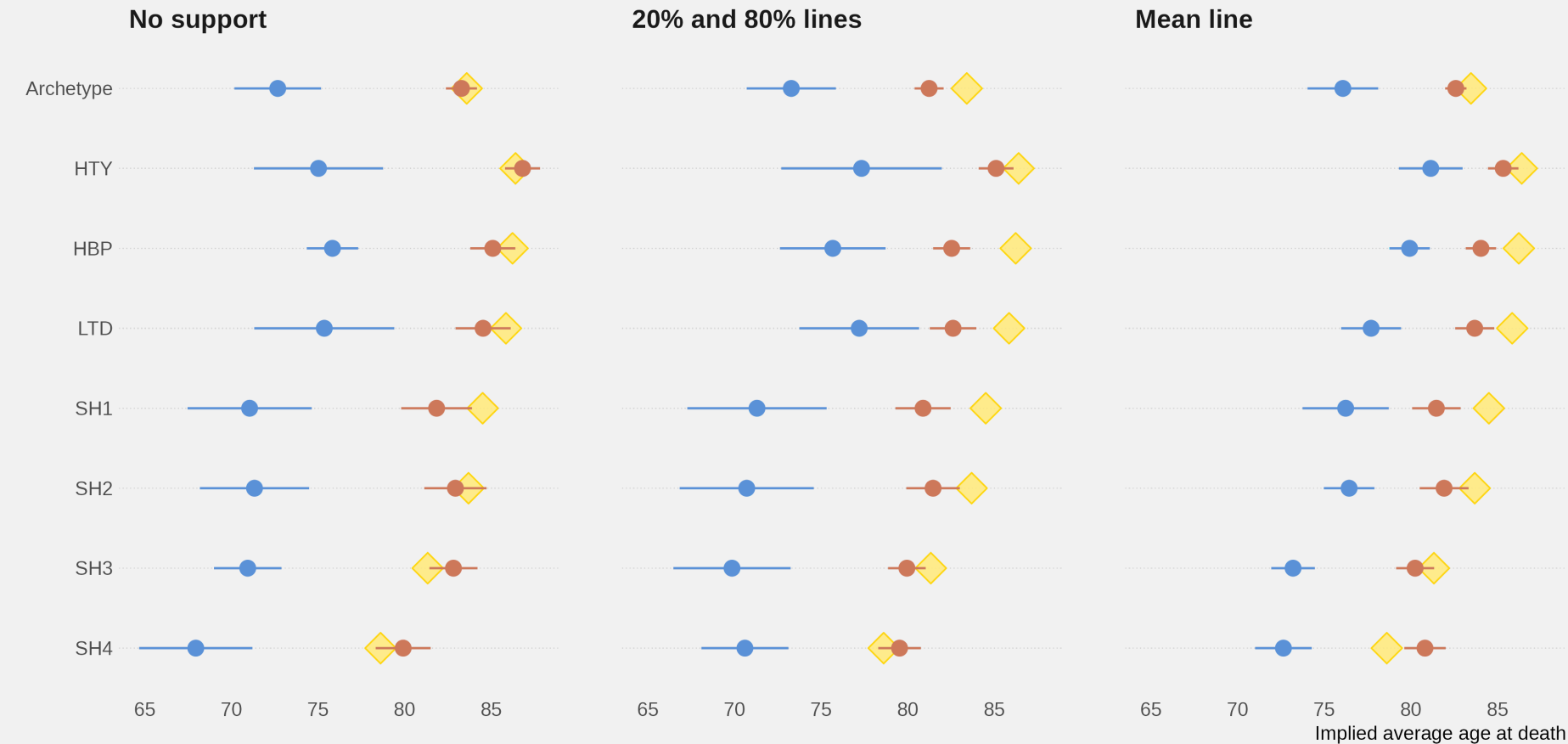Each line is an estimation · target as solid black line · mean estimation as solid colored line

Individual estimations · males · all scenarios · no support · PDF

Each line is an estimation · target as solid black line · mean estimation as solid colored line

Implied average age at time of death · males · actual · CDF · PDF

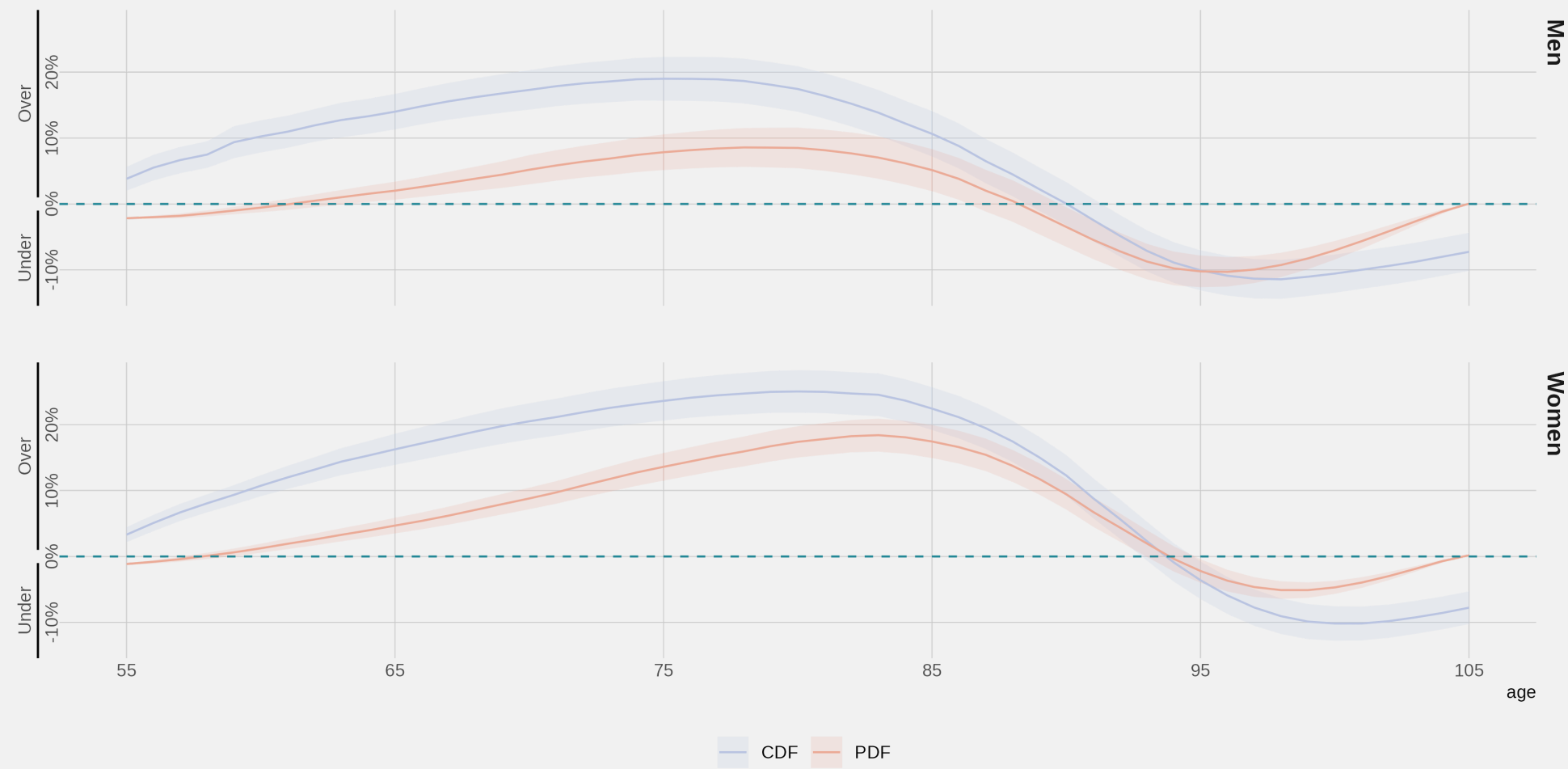For each scenario · by type of visual aid

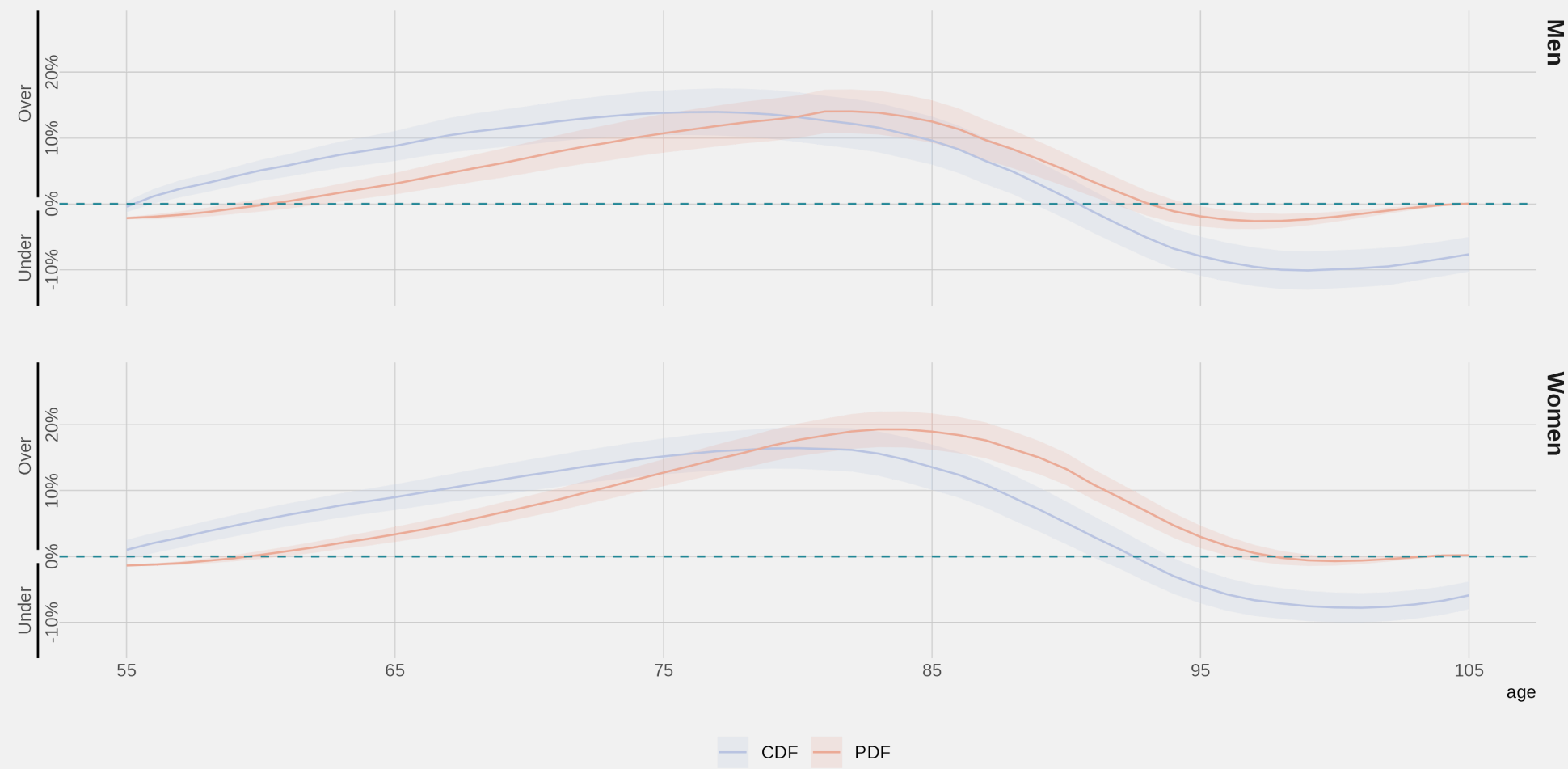# Comparison with earlier data

Take-home message

Mortality beliefs bias · No support · CDF vs PDF
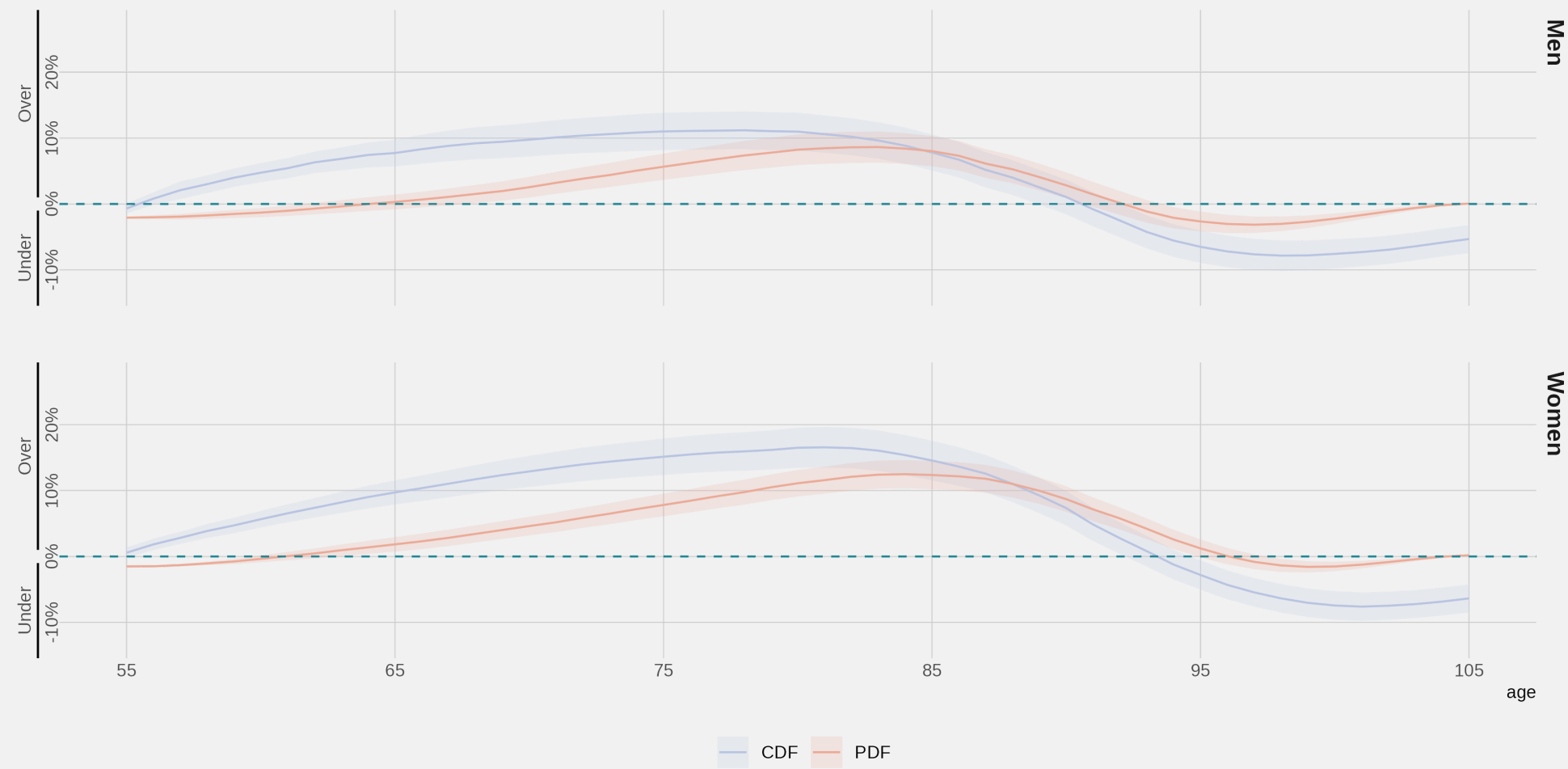
Archetype mortality elicitation

Mortality beliefs bias · 20% and 80% lines · CDF vs PDF

Archetype mortality elicitation

Mortality beliefs bias · Mean line · CDF vs PDF

Archetype mortality elicitation

- **PDF** beats **CDF**, hands down
- *why?*
  - **boundary** effect – errors can go one way only
  - imposed **monotonicity** compounds errors
  - possibly **not intuitive** to ask survival till X

- there is **still** a bias, but way **smaller**
- people are **rather good** at health expectations – if a bit pessimistic
- giving visual cues help, up to a point

- use new, better **tools**!

Thanks