KOSTAT-UNFPA Summer Seminar on Population

Workshop 1: Introduction to Demography

Mortality and Fertility

24 June, 2025

Instructor: Tim Riffe
Assistant: Inchan Hwang

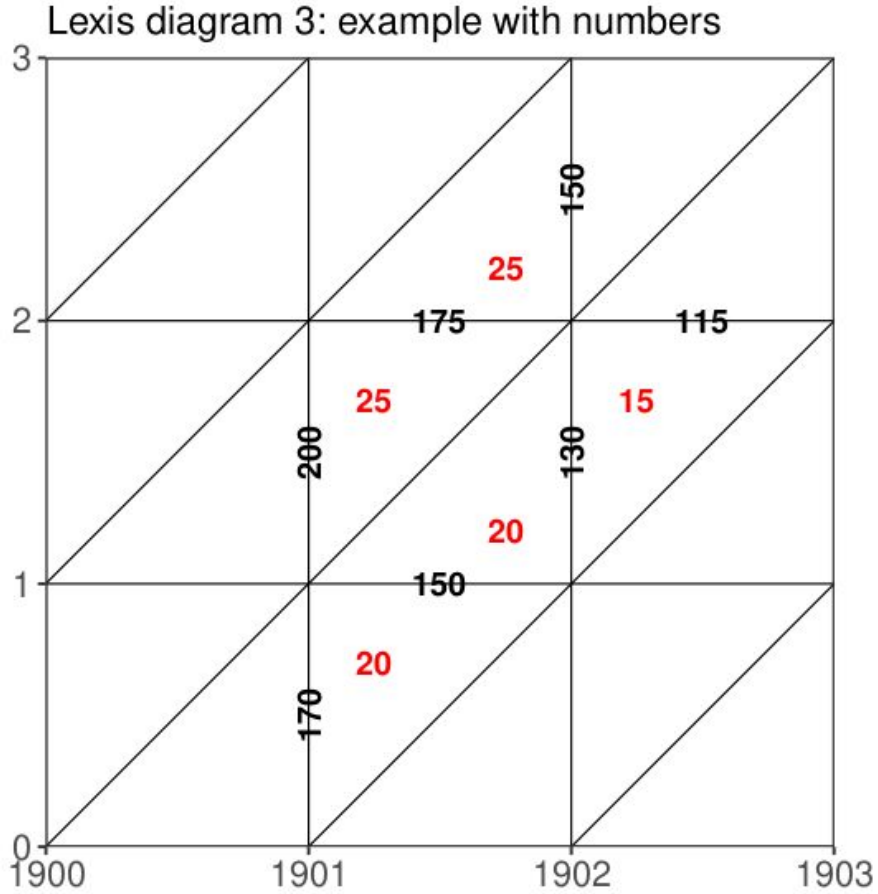
opik
eman ta zabal zazu
Universidad del País Vasco
Euskal Herriko Unibertsitatea
ikerbasque
Basque Foundation for Science
Statistics Korea
UNFPA

Workshop plan, July 1-5, 2024

1: Monday	Intro concepts, and R setup
2: Tuesday	**Mortality and fertility**
3: Wednesday	Structure
4: Thursday	Growth
5: Friday	Projection

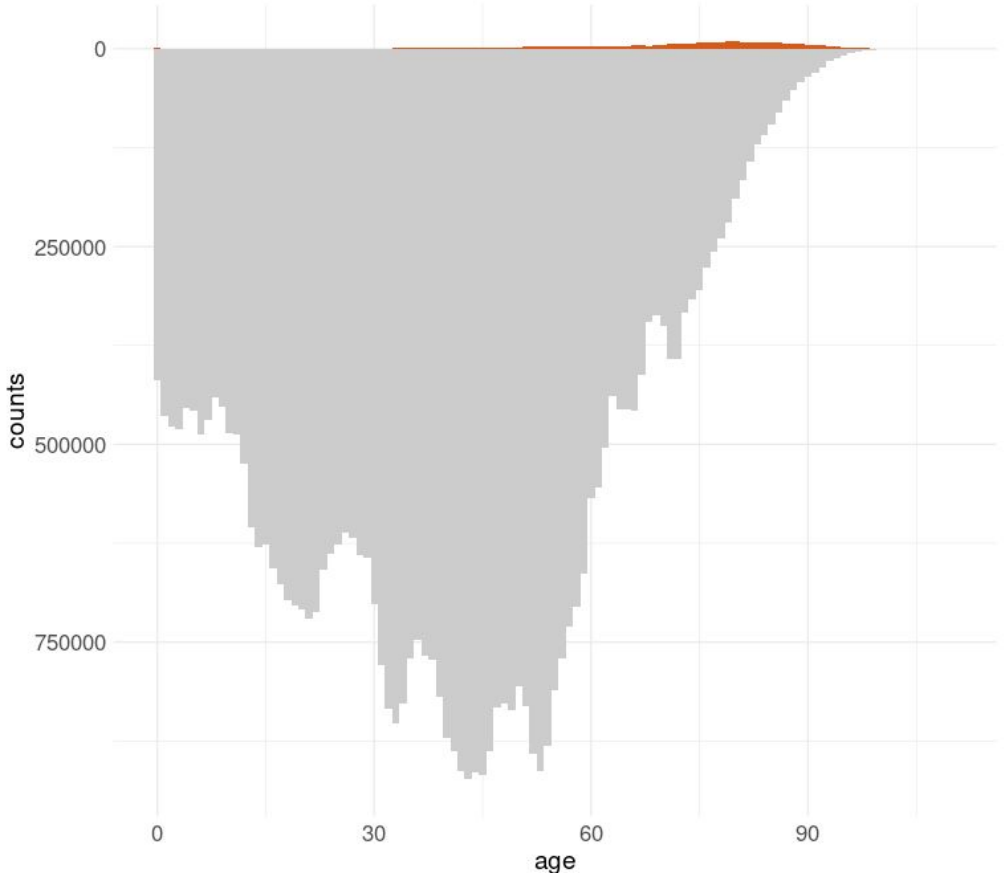
Review of session 1

- age, period, cohort
- rates, probabilities, counts, ratios, stocks, flows
- Crude rate versus age-specific rate
- R projects, R markdown
- Objects, functions, grammar

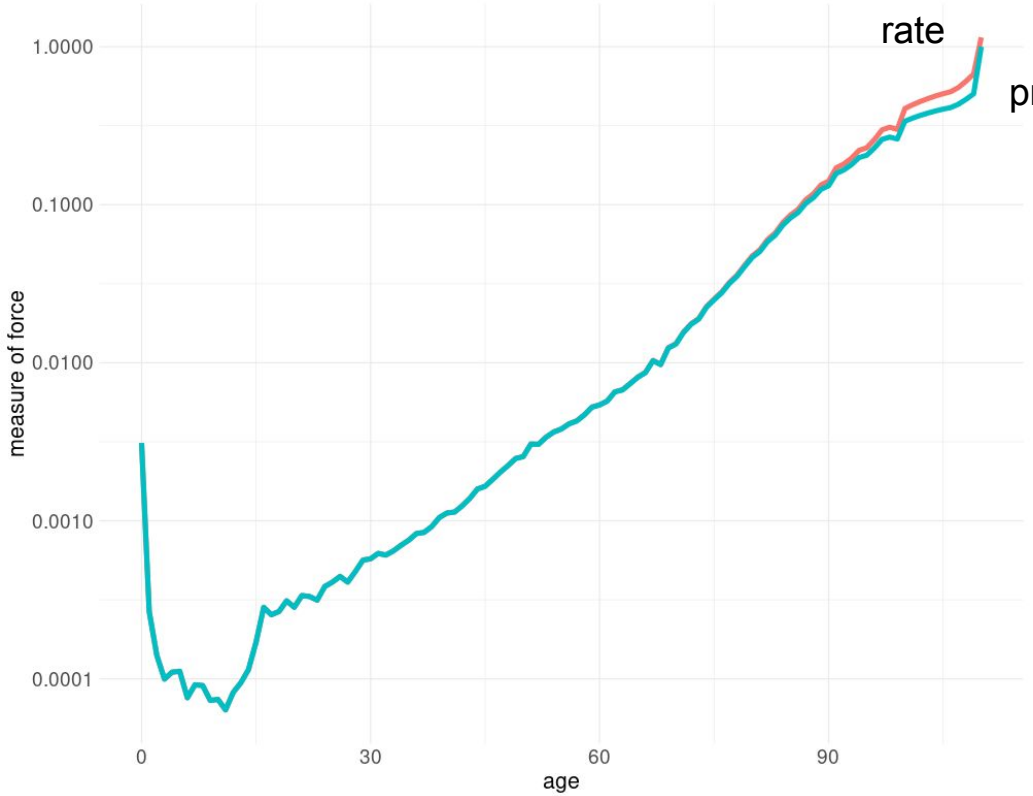


Mortality:

$$M(x) = D(x) / E(x)$$

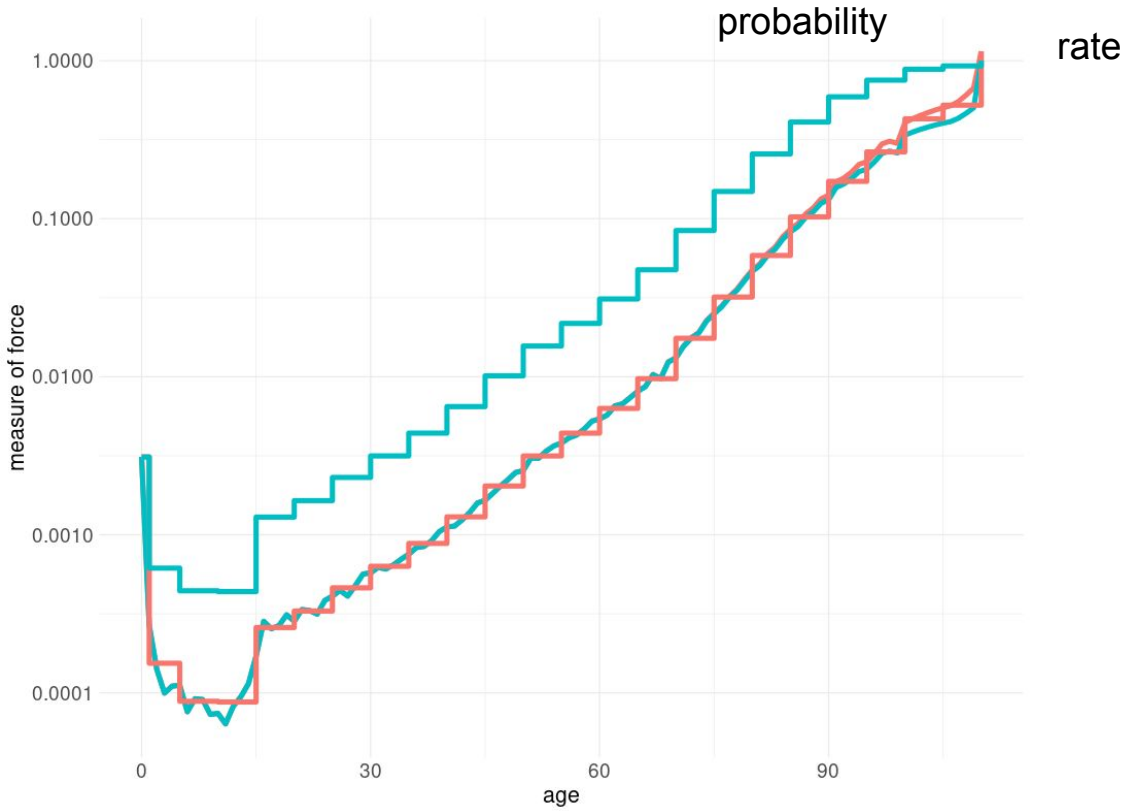


Mortality



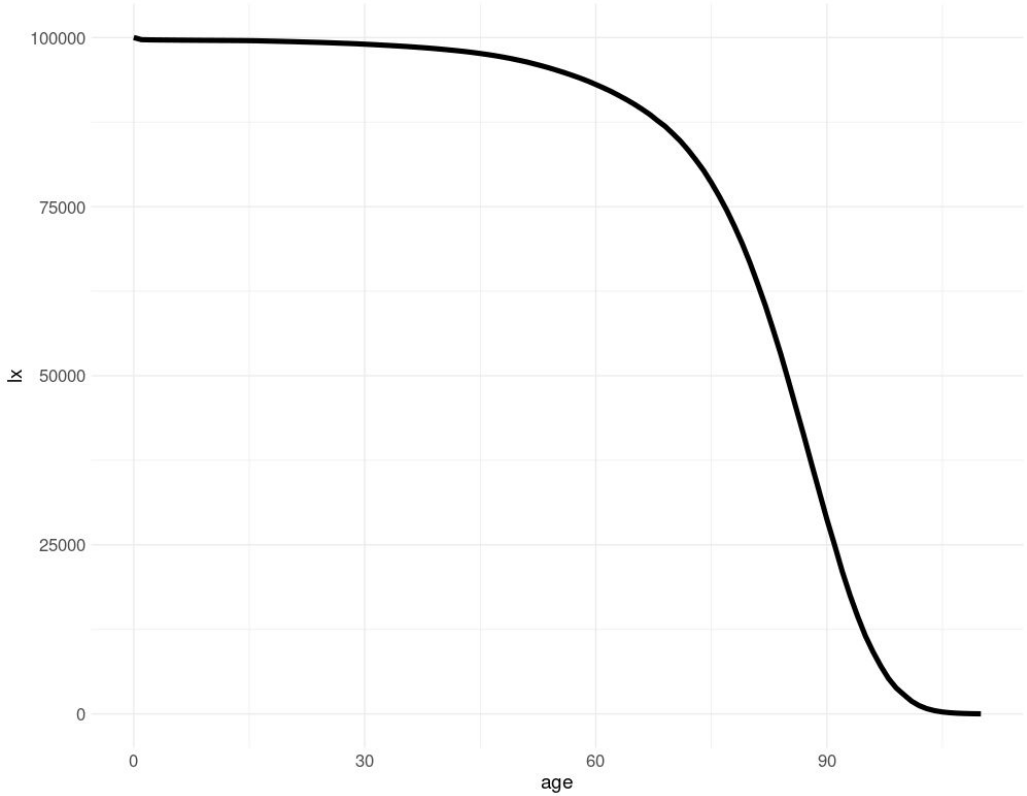
Rates and probabilities are very close for single-age data

Mortality



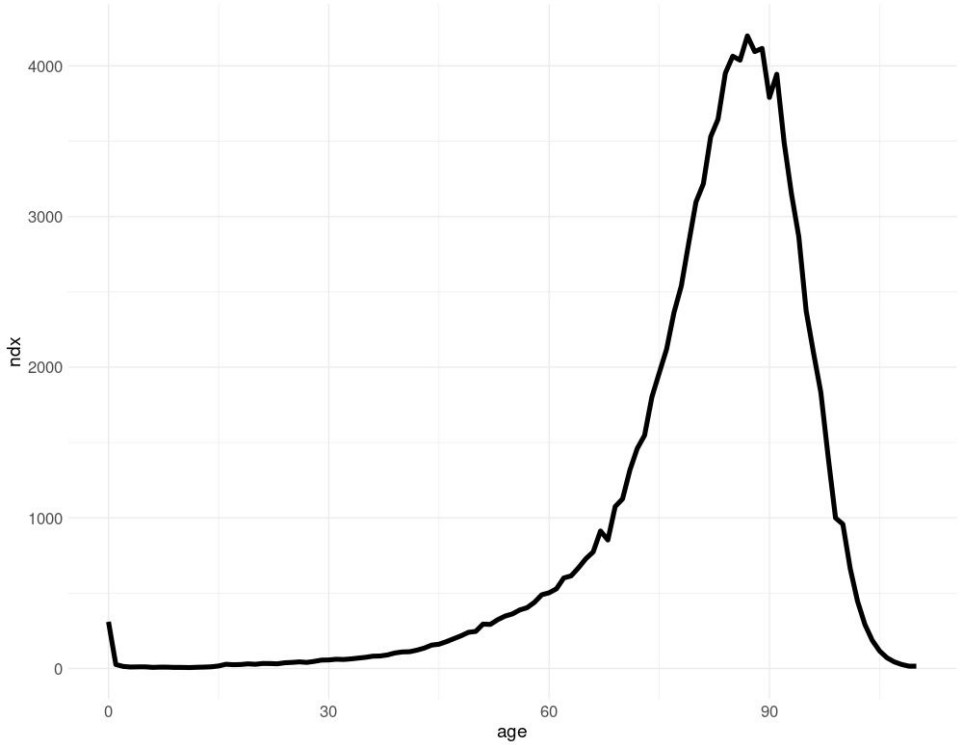
It makes a big difference for data in wider age groups!

Mortality



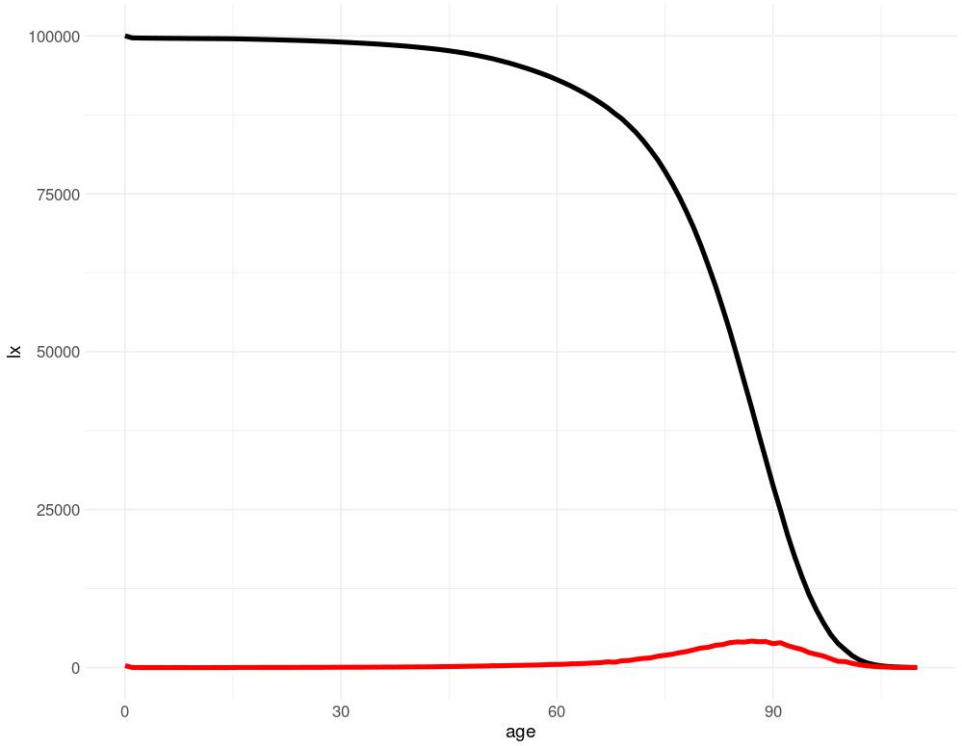
The survivorship curve is inferred by chaining survival probabilities together over successive ages. This is the main trick of the period lifetable and why we call it synthetic. Further quantities are derived from this.

Mortality



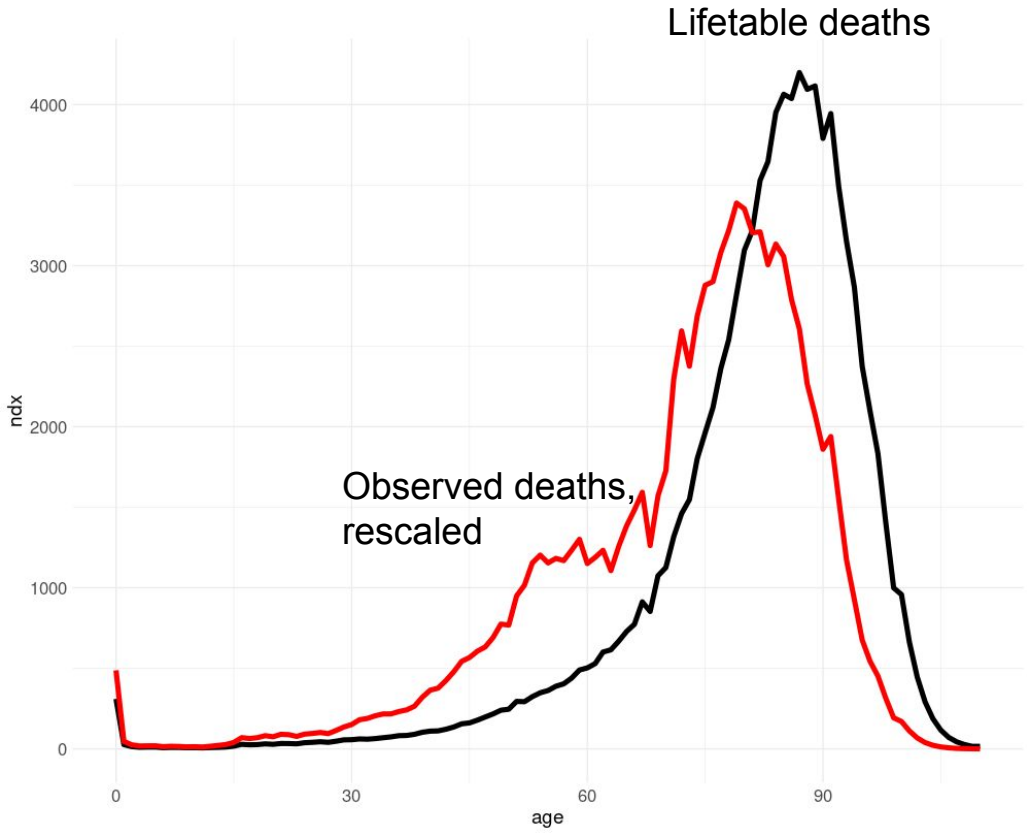
The survivorship curve is inferred by chaining survival probabilities together over successive ages. This is the main trick of the period lifetable and why we call it synthetic. Further quantities are derived from this, such as the lifetable death distribution. These two functions go hand-in-hand.

Mortality



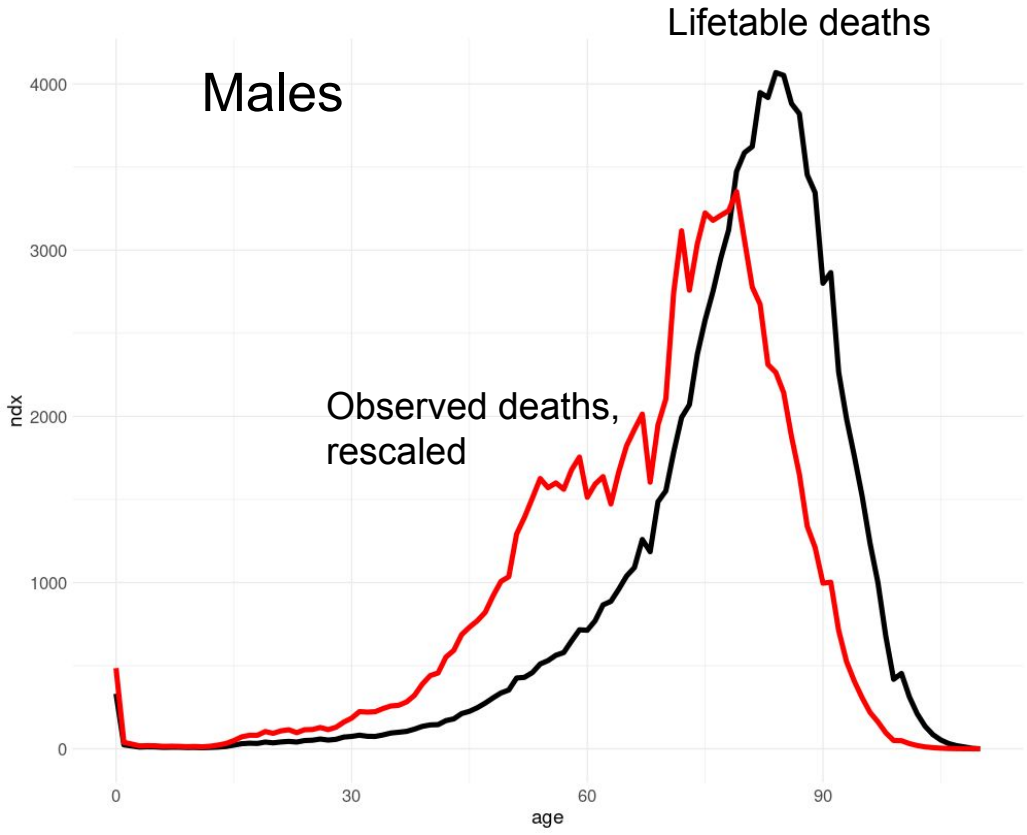
The survivorship curve is inferred by chaining survival probabilities together over successive ages. This is the main trick of the period lifetable and why we call it synthetic. Further quantities are derived from this, such as the lifetable death distribution. These two functions go hand-in-hand. You might even try drawing them together.

Mortality



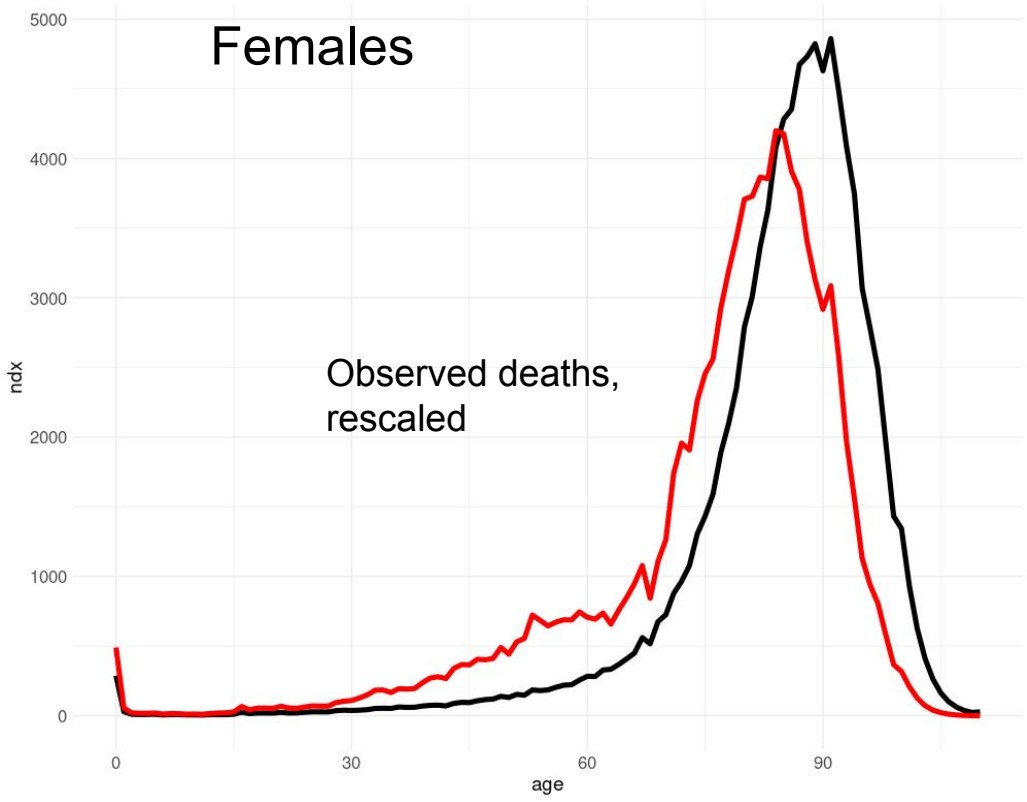
You might wonder how lifetable deaths relate to observed deaths (here rescaled to sum to 100000). They are quite different.

Mortality



You might wonder how lifetable deaths relate to observed deaths (here rescaled to sum to 100000). They are quite different.

Mortality



You might wonder how lifetable deaths relate to observed deaths (here rescaled to sum to 100000). They are quite different.

Mortality

Life expectancy (e0) can be thought of as the **average age at death**, where ***lifetable* deaths are the weights**.

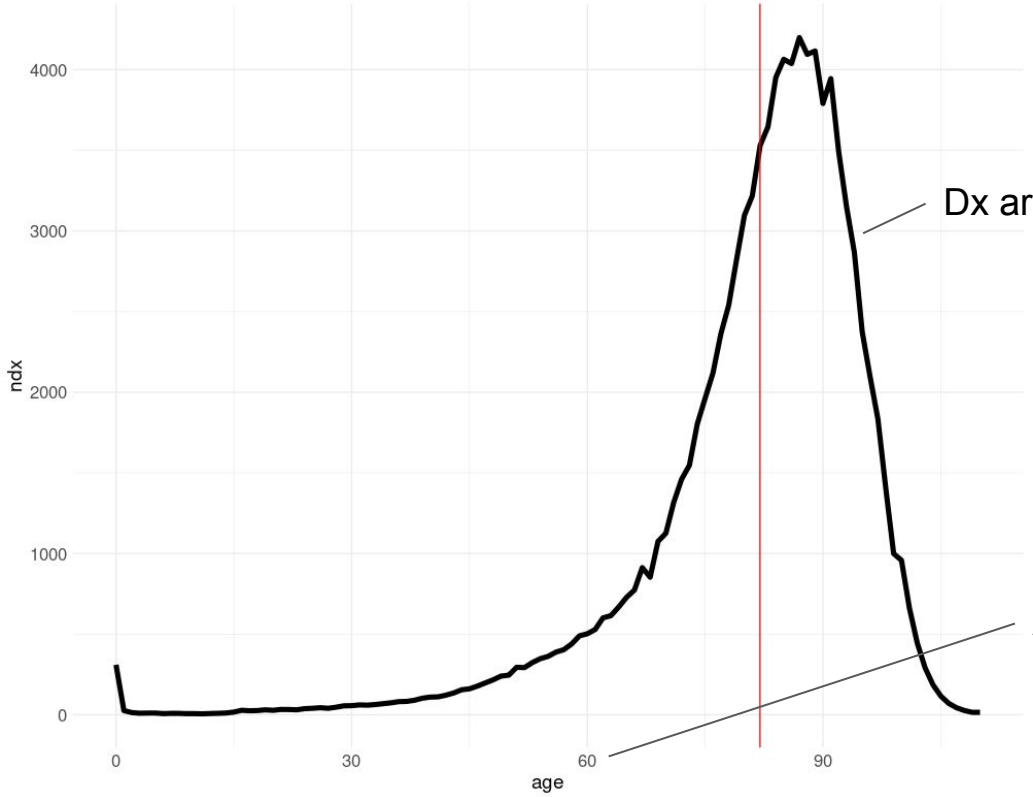
- equivalent to saying e0 is equal to the **area under the survival curve**, lx. In practice we do this, but first understand the dx-weighted age at death.

All other details are one of four kinds:

1. Details for converting rates to probabilities
2. Adjustments to approximate the area under lx given discrete data.
3. Adjustments to calculate remaining life expectancy at each age rather than just for age 0.
4. Adjustments for what values to use for the highest age (closeout)

Mortality

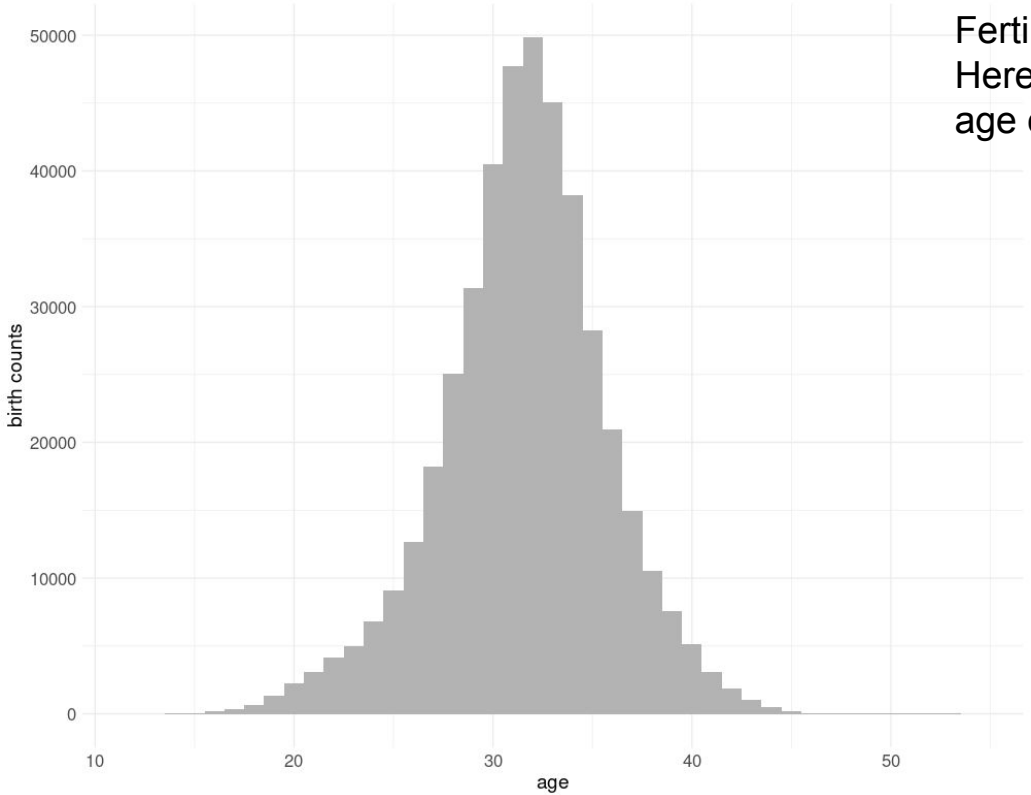
Life expectancy is the lifetable's mean age at death, 81.98 in this case.



Dx are the weights

Age is the thing being weighted

Fertility

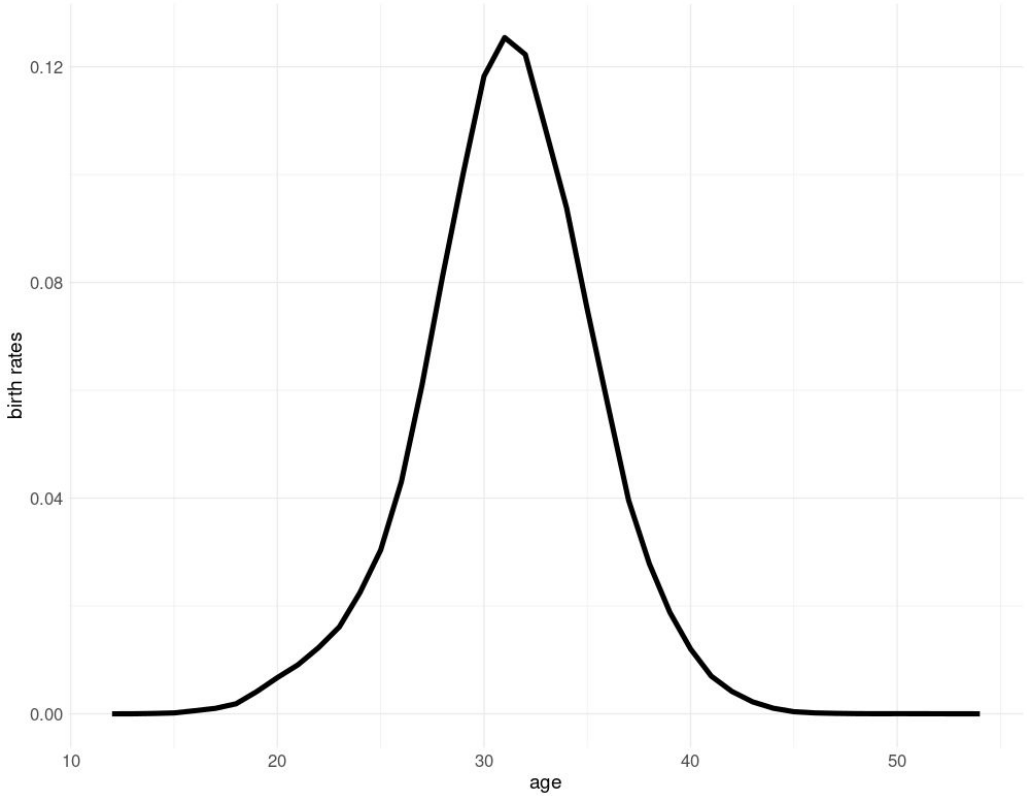


Fertility analysis starts with the registration of births, Here birth records have been tabulated to birth counts by age of mother.

Fertility

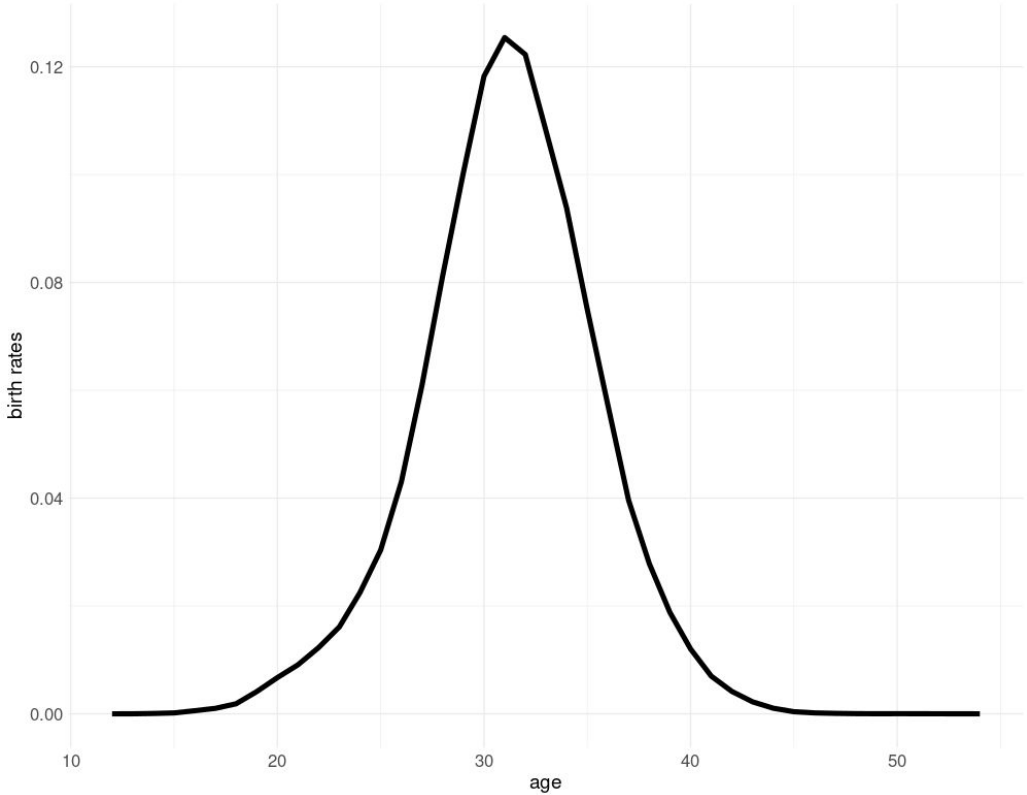
$$F(x) = B(x) / E(x)$$

Fertility



Birth rates are often denoted Fx or ASFR (age-specific fertility rates). Unless otherwise stated, age means age of mother.

Fertility



Birth rates are often denoted Fx or ASFR (age-specific fertility rates). Unless otherwise stated, age means age of mother. The total fertility rate TFR is the sum of these, in this case 1.2

Fertility

Birth rates are often denoted Fx or ASFR (age-specific fertility rates). Unless otherwise stated, age means age of mother. The total fertility rate TFR is the sum of these, in this case 1.2. The mean age of childbearing (MAC or MAB) sometimes uses these rates as weights. Here the MAB matches the mode, 31.2.

Summary

TFR and **e0** both hold the demographic rates of period constant and imagine a synthetic lifecourse running through them.

Neither is a projection

Both are useful: the convert to meaningful units (babies, years of life)

Both summarize rates, where we treat rates as a proxy for conditions. Rates might be a deficient proxy, but they’re better than the other quantities we have (counts)…

Time for us to move to R!