

KOSTAT-UNFPA Summer Seminar on Population

Workshop 1: Introduction to Demography

Mortality and Fertility

24 June, 2025

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Basque Foundation for Science



Statistics
Korea



Workshop plan, July 1-5, 2024

1: Monday Intro concepts, and R setup

2: Tuesday Mortality and fertility

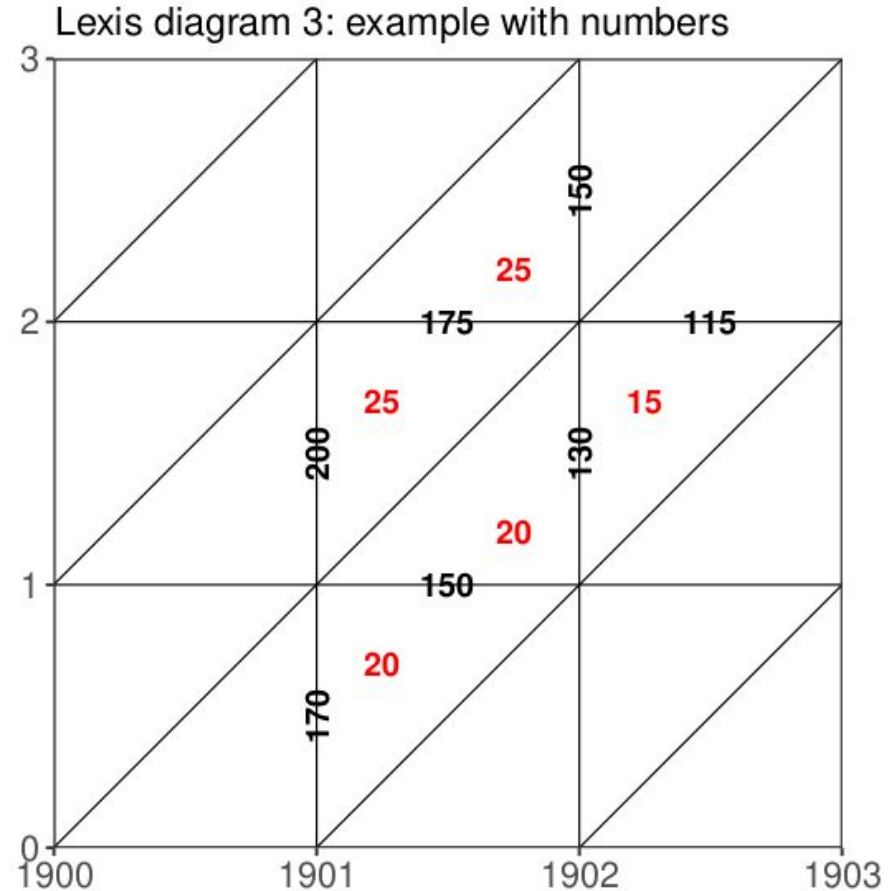
3: Wednesday Structure

4: Thursday Growth

5: Friday Projection

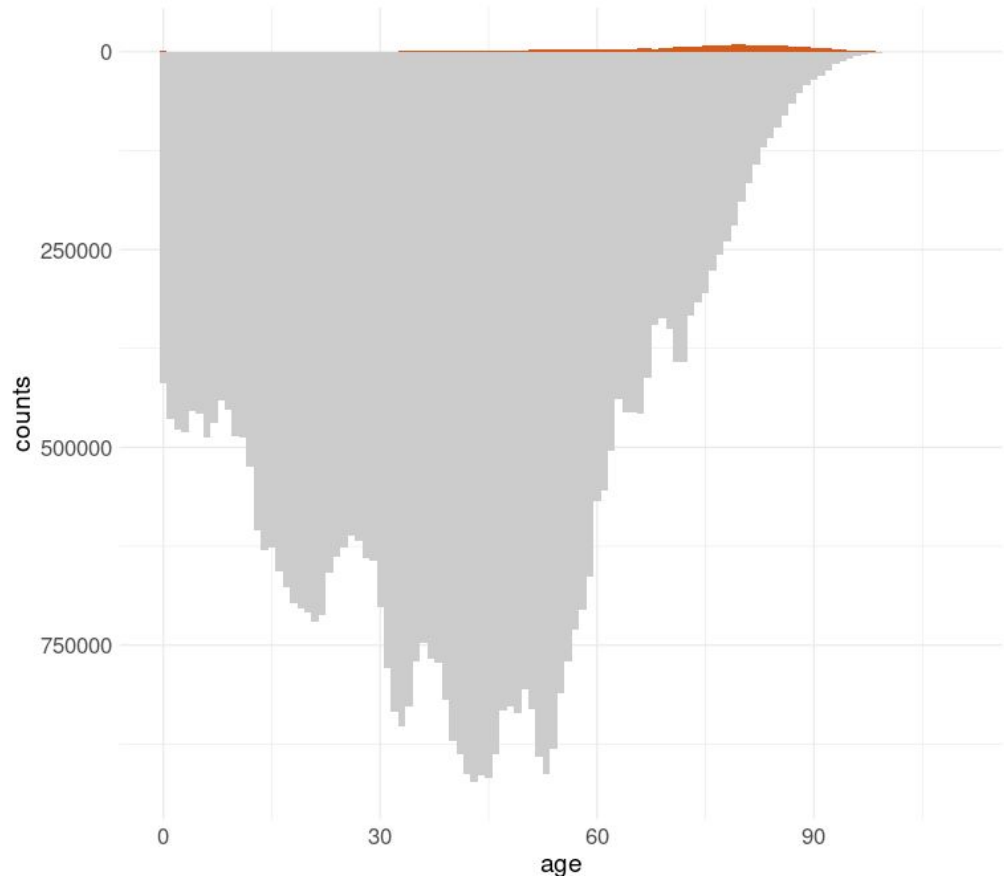
Review of session 1

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

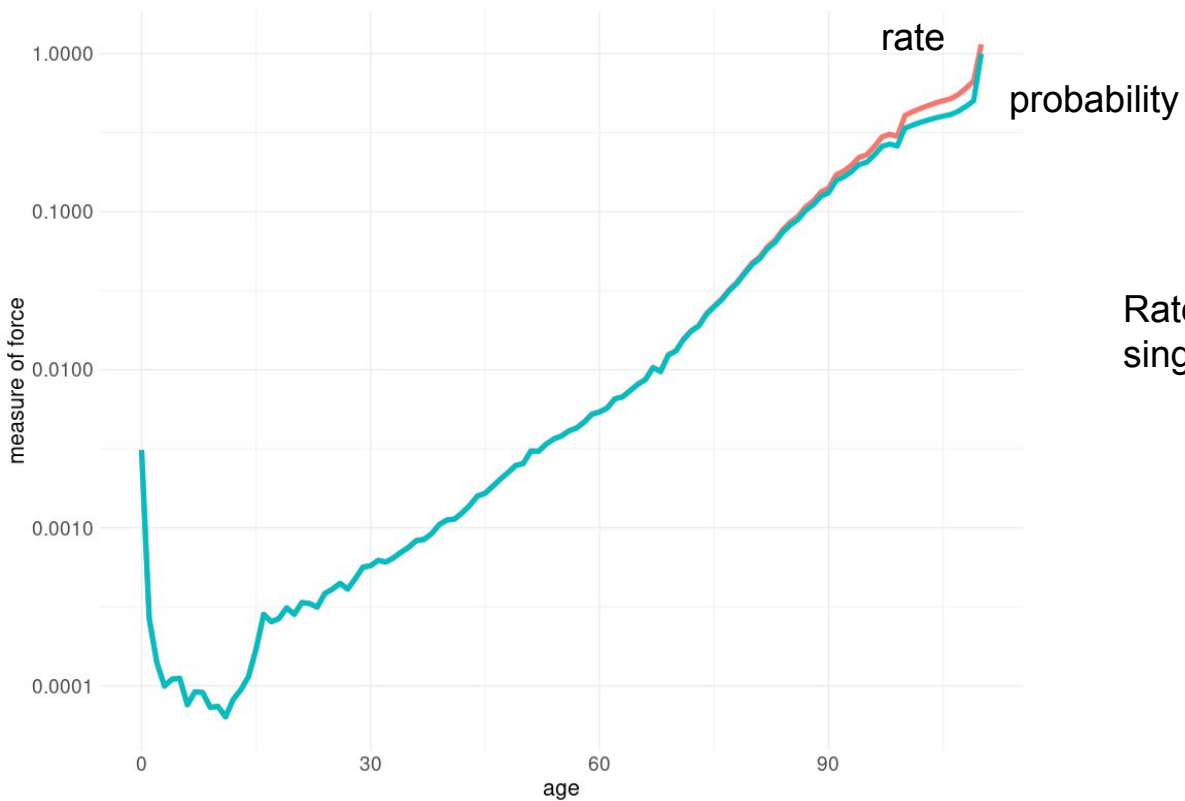


Mortality:

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

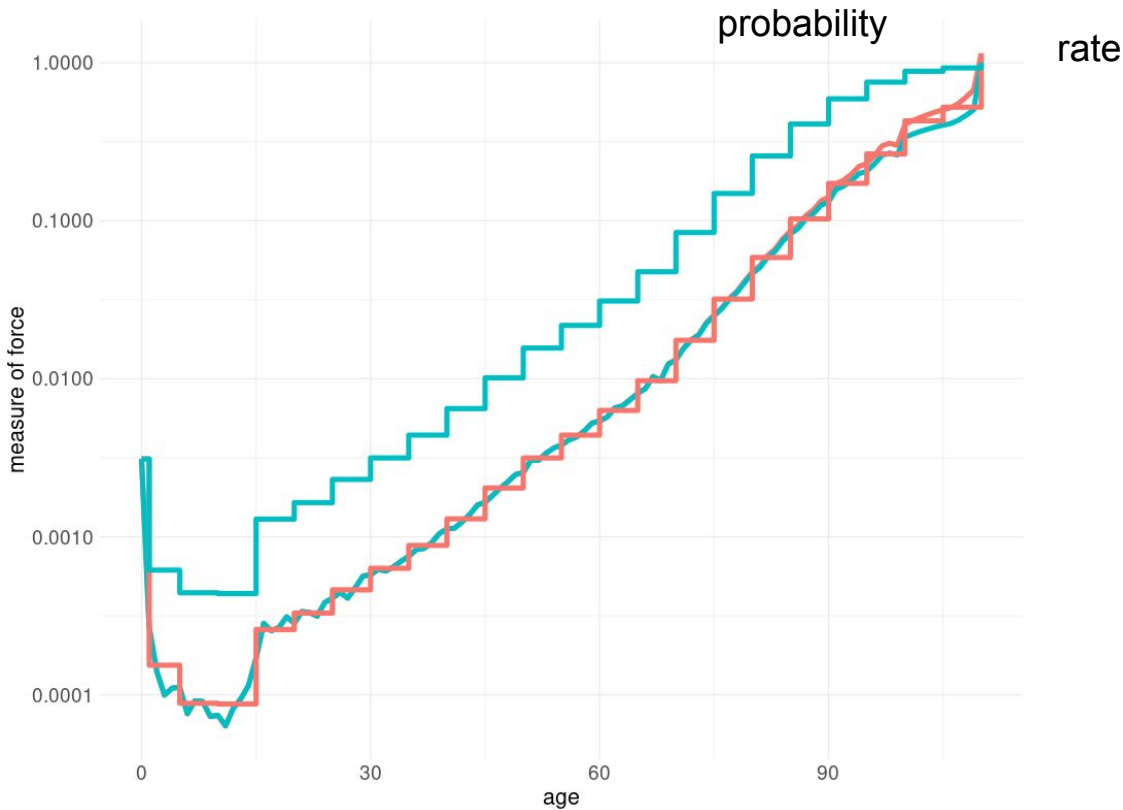


Mortality



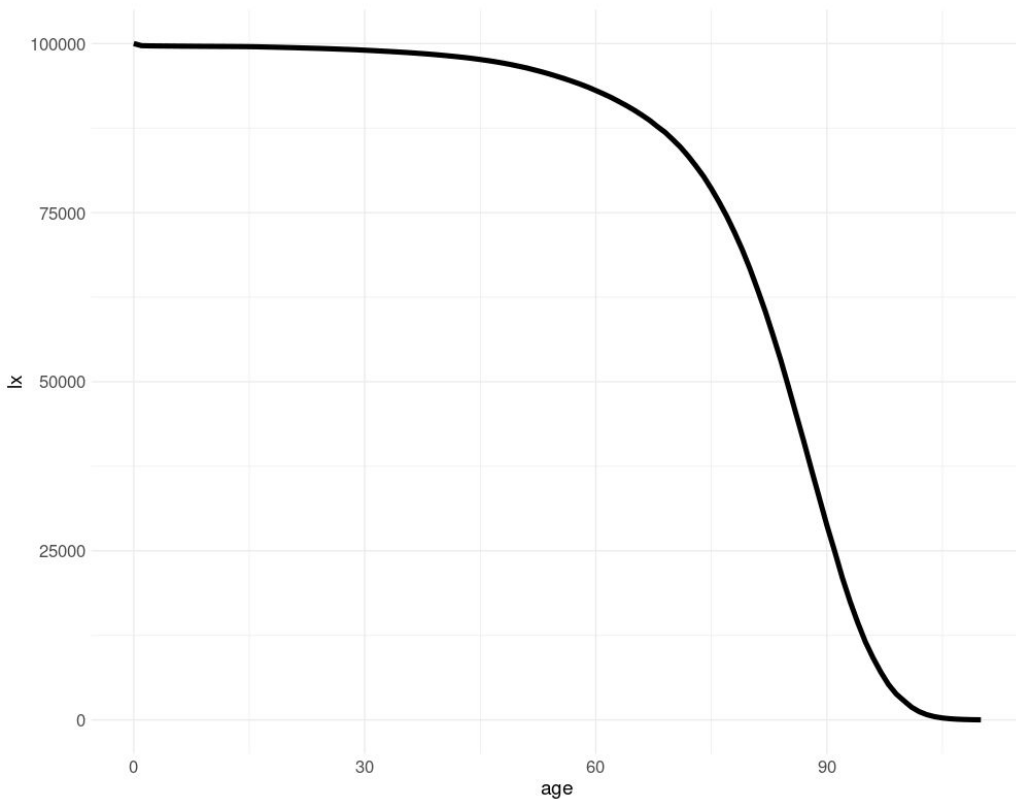
Rates and probabilities are very close for single-age data

Mortality



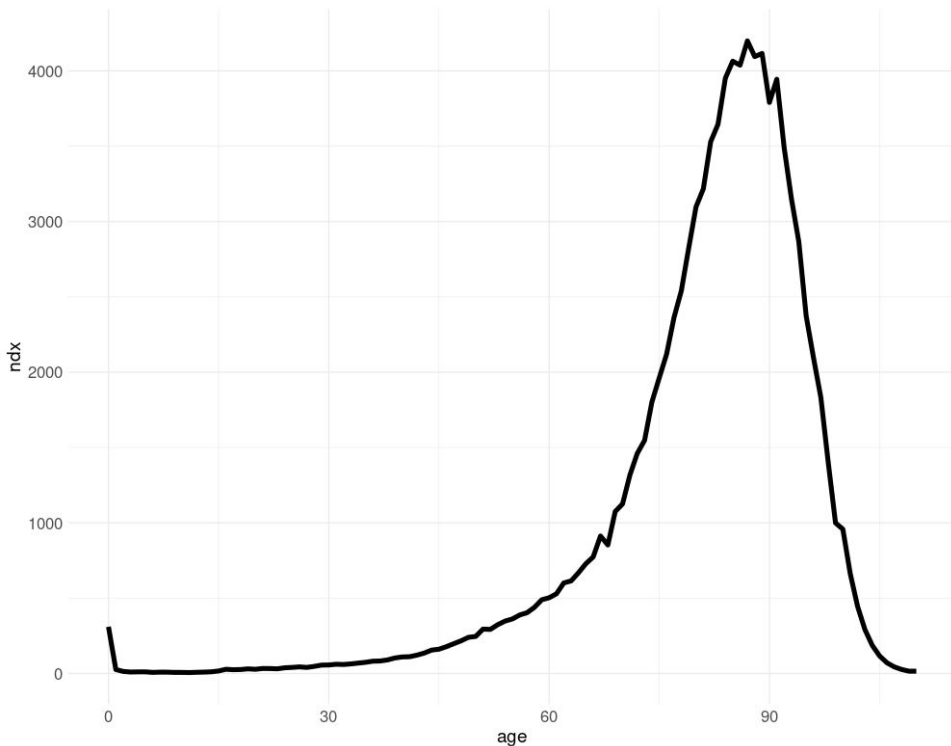
It makes a big difference for data in wider age groups!

Mortality



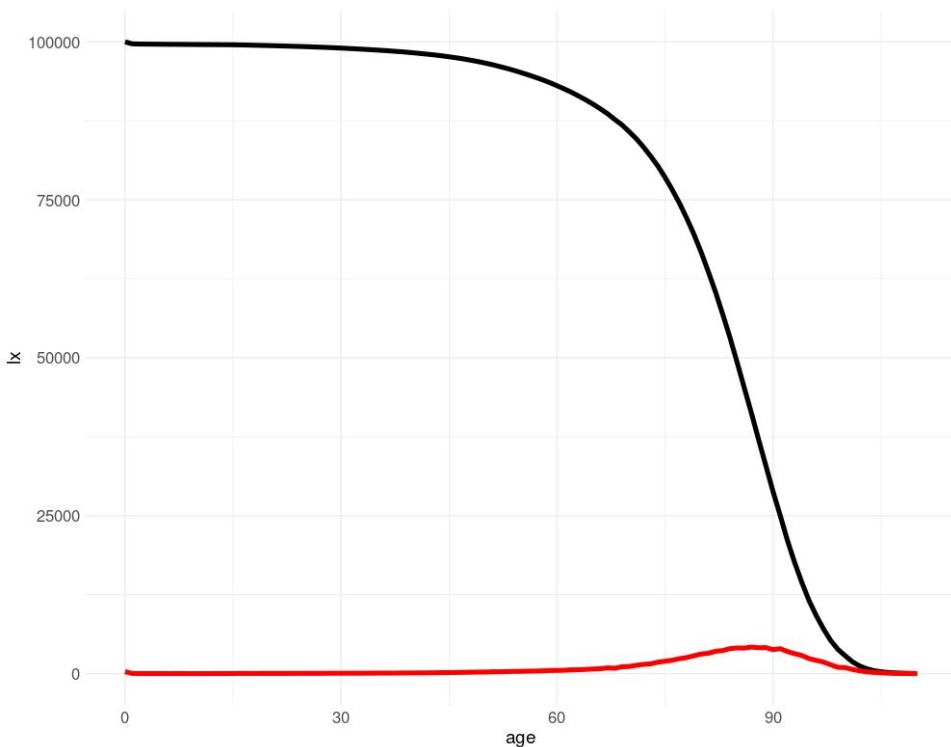
The survivorship curve is inferred by chaining survival probabilities together over successive ages. This is the main trick of the period lifetable and why we call it synthetic. Further quantities are derived from this.

Mortality



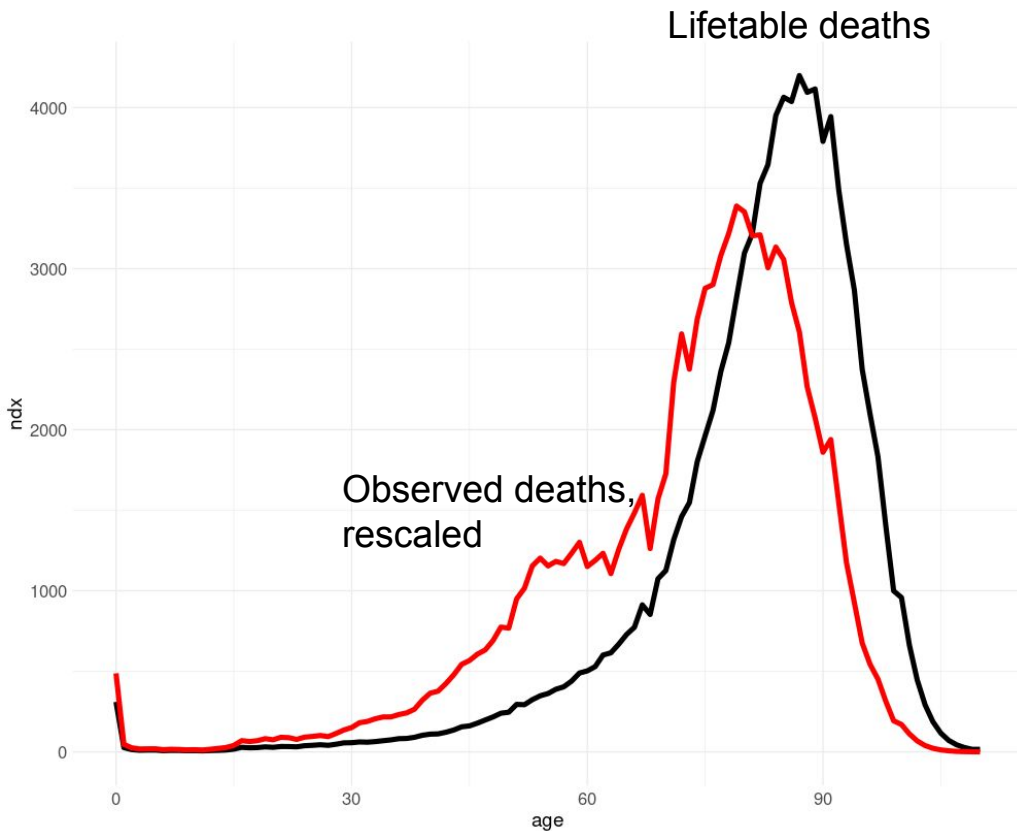
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Mortality



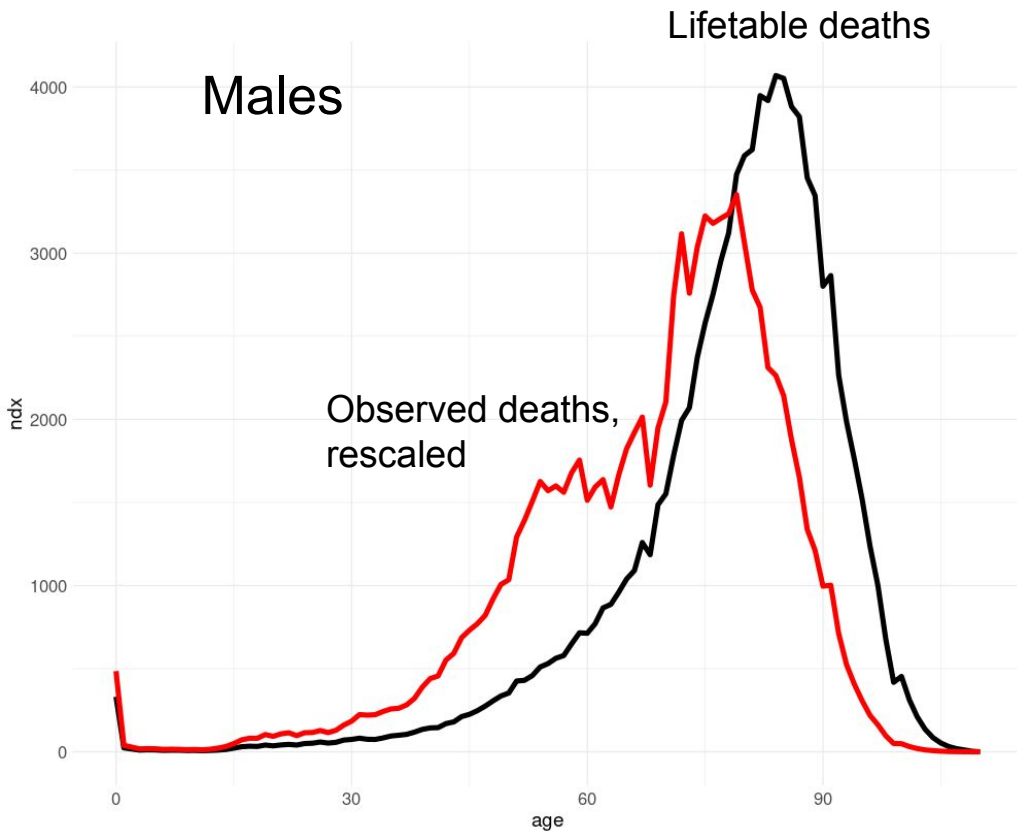
The survivorship curve is inferred by chaining survival probabilities together over successive ages. This is the main trick of the period life table and why we call it synthetic. Further quantities are derived from this, such as the life table death distribution. These two functions go hand-in-hand.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

Mortality



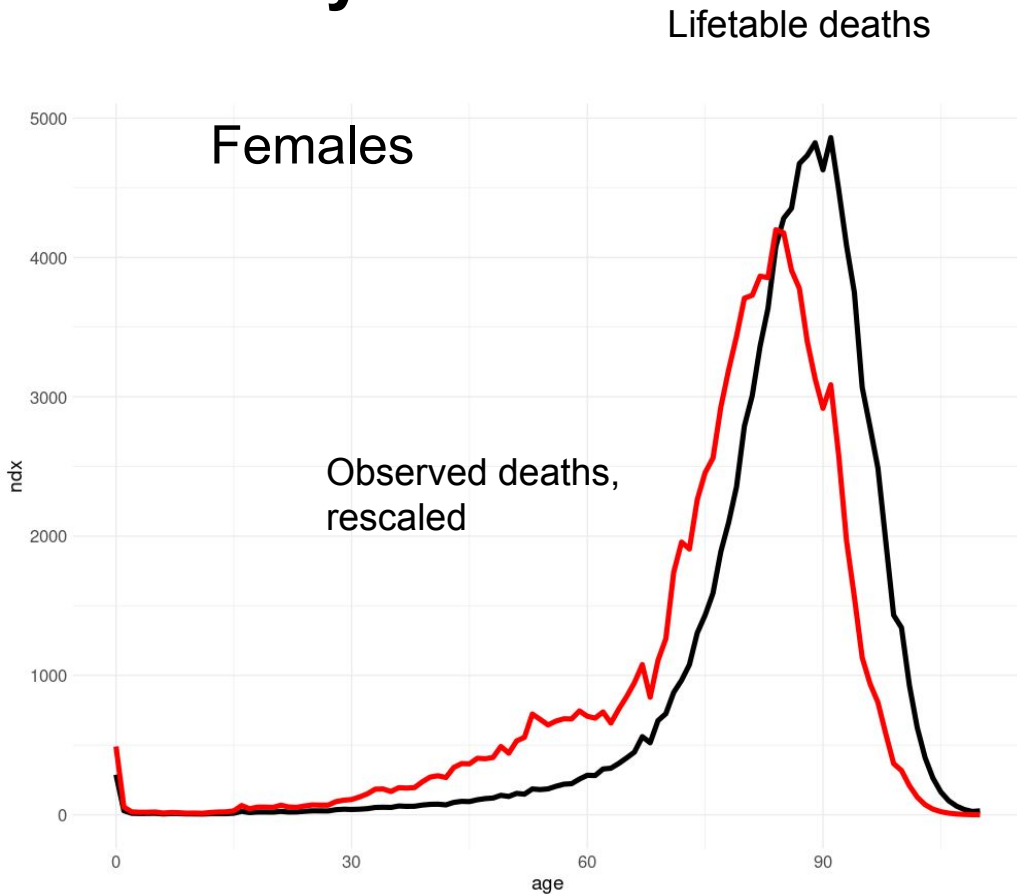
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Mortality

Life expectancy (e_0) can be thought of as the **average age at death**, where ***lifetable deaths are the weights***.

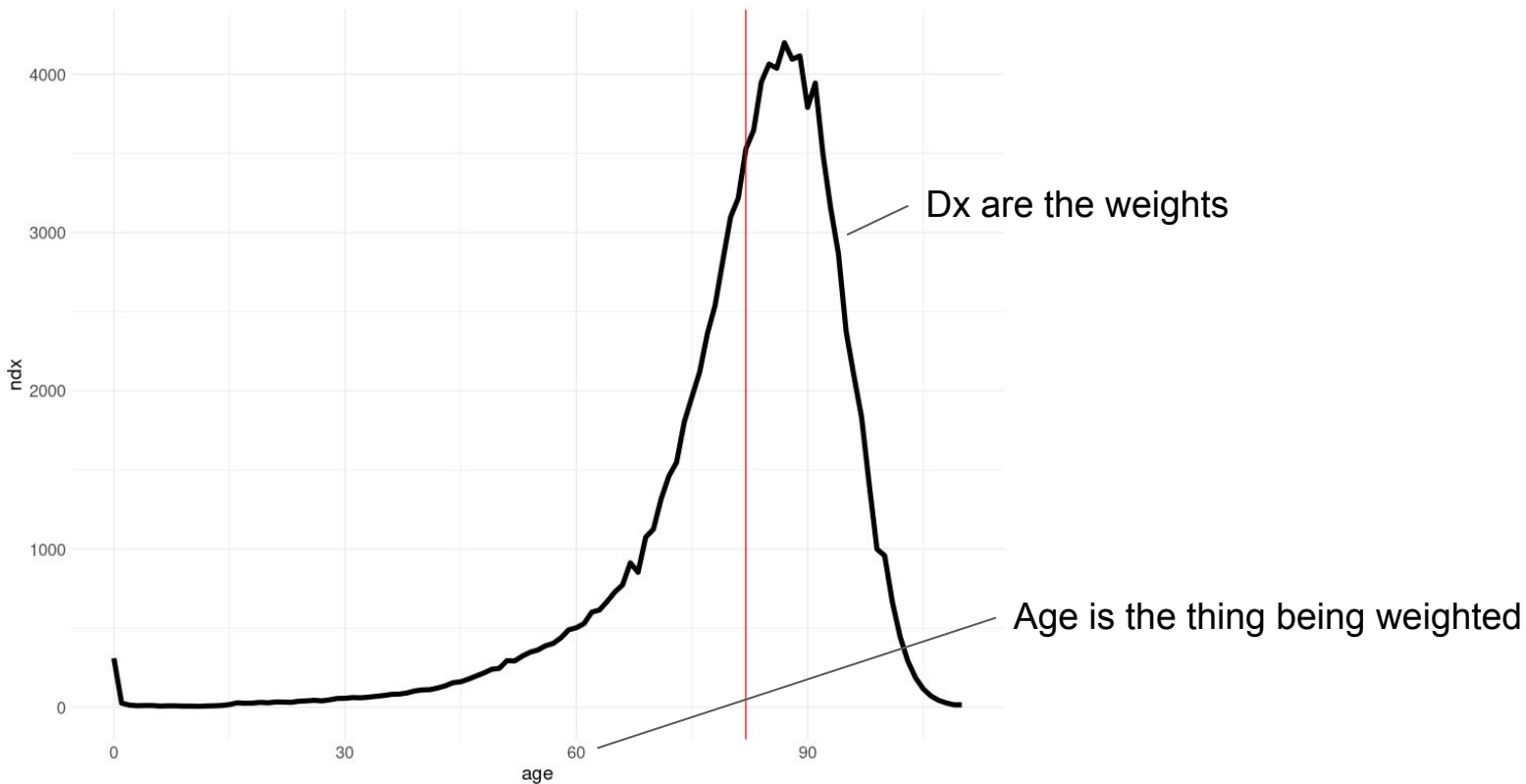
- equivalent to saying e_0 is equal to the **area under the survival curve**, l_x . In practice we do this, but first understand the dx -weighted age at death.

All other details are one of four kinds:

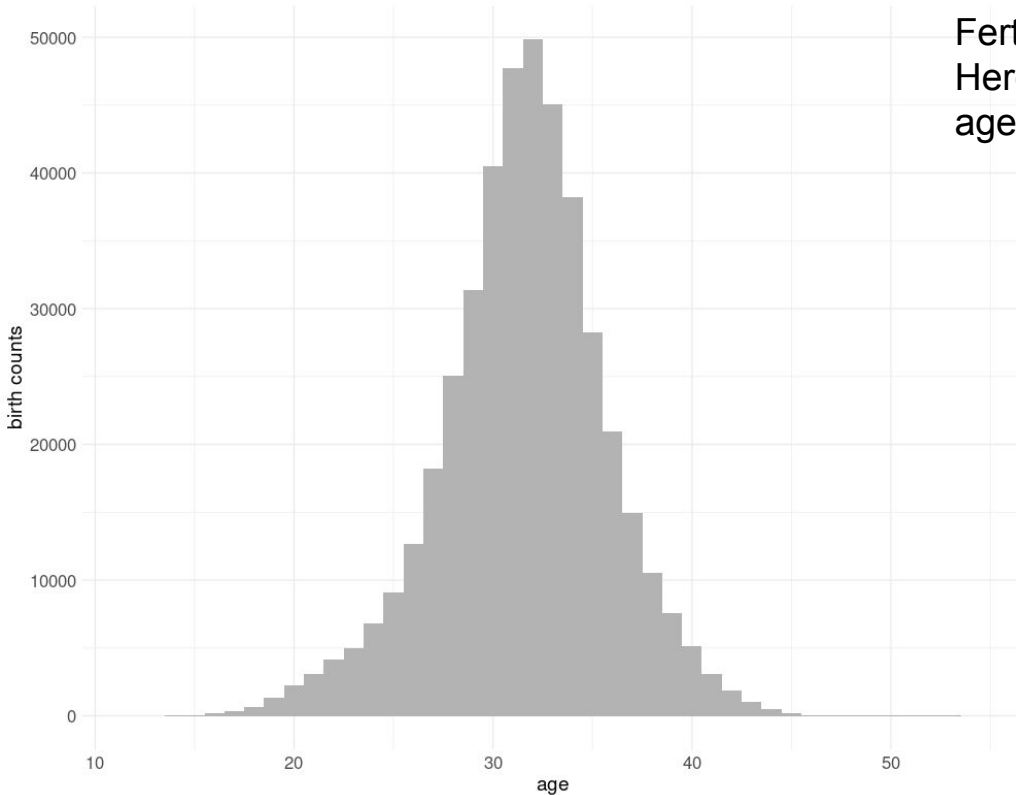
1. Details for converting rates to probabilities
2. Adjustments to approximate the area under l_x given discrete data.
3. Adjustments to calculate remaining life expectancy at each age rather than just for age 0.
4. Adjustments for what values to use for the highest age (closeout)

Mortality

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



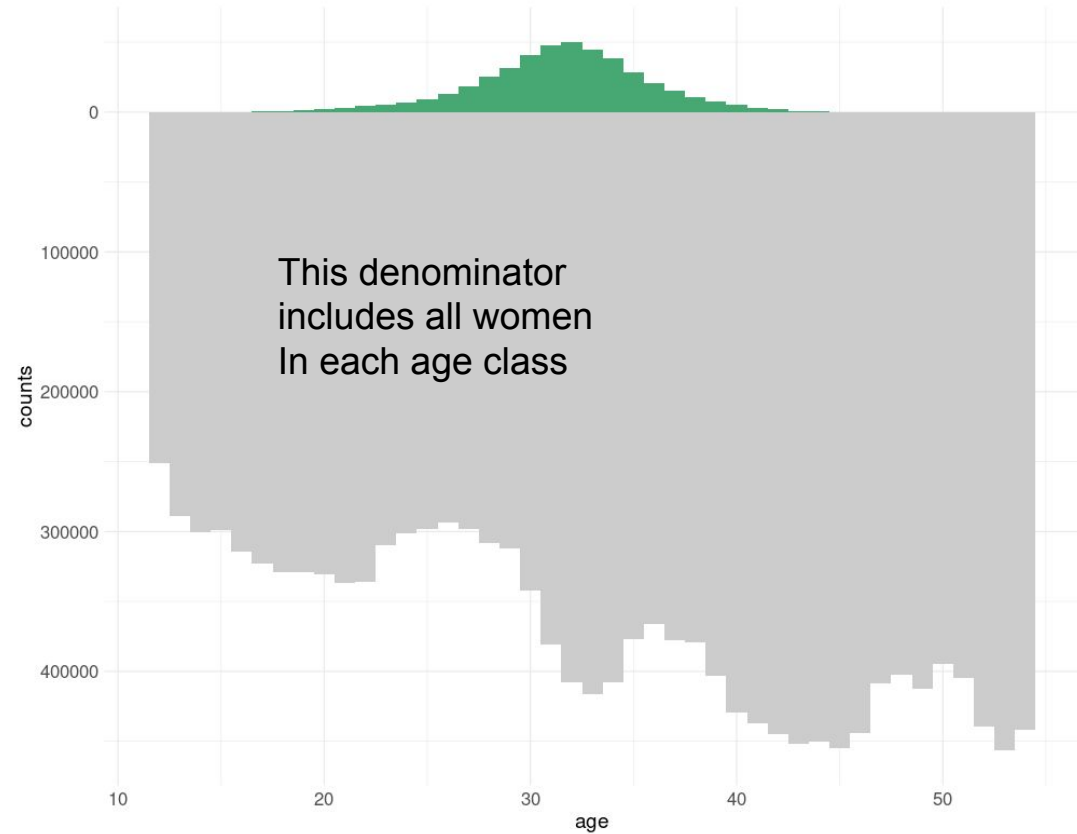
Fertility



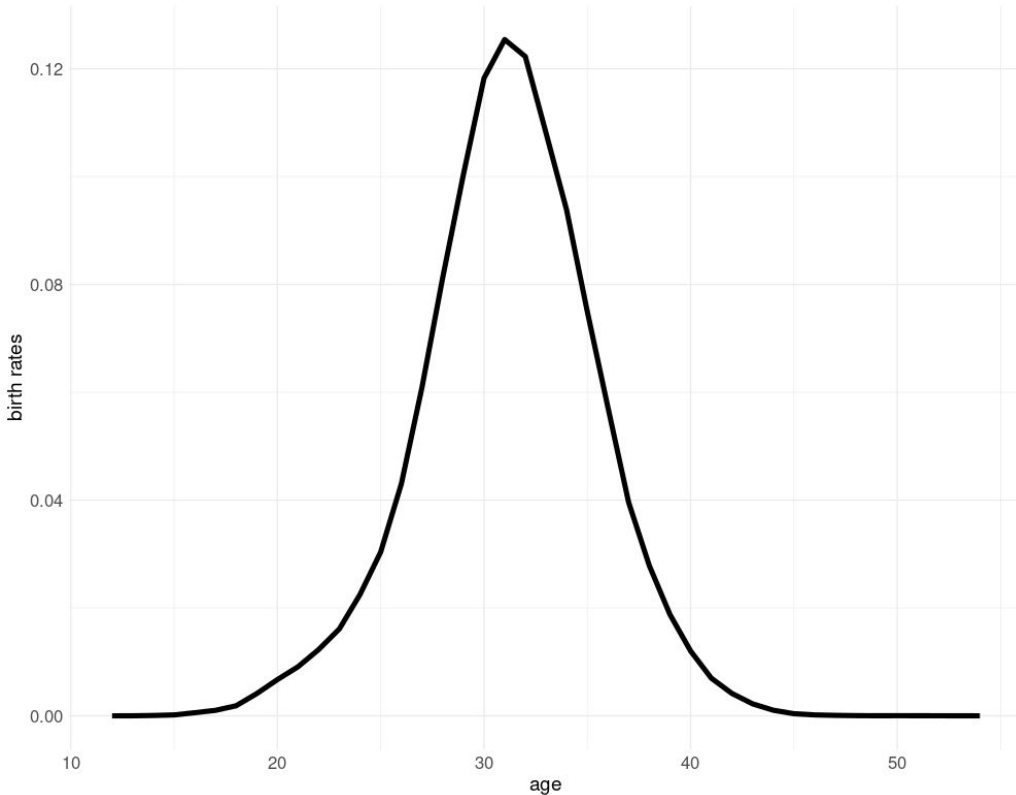
Fertility analysis starts with the registration of births, Here birth records have been tabulated to birth counts by age of mother.

Fertility

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

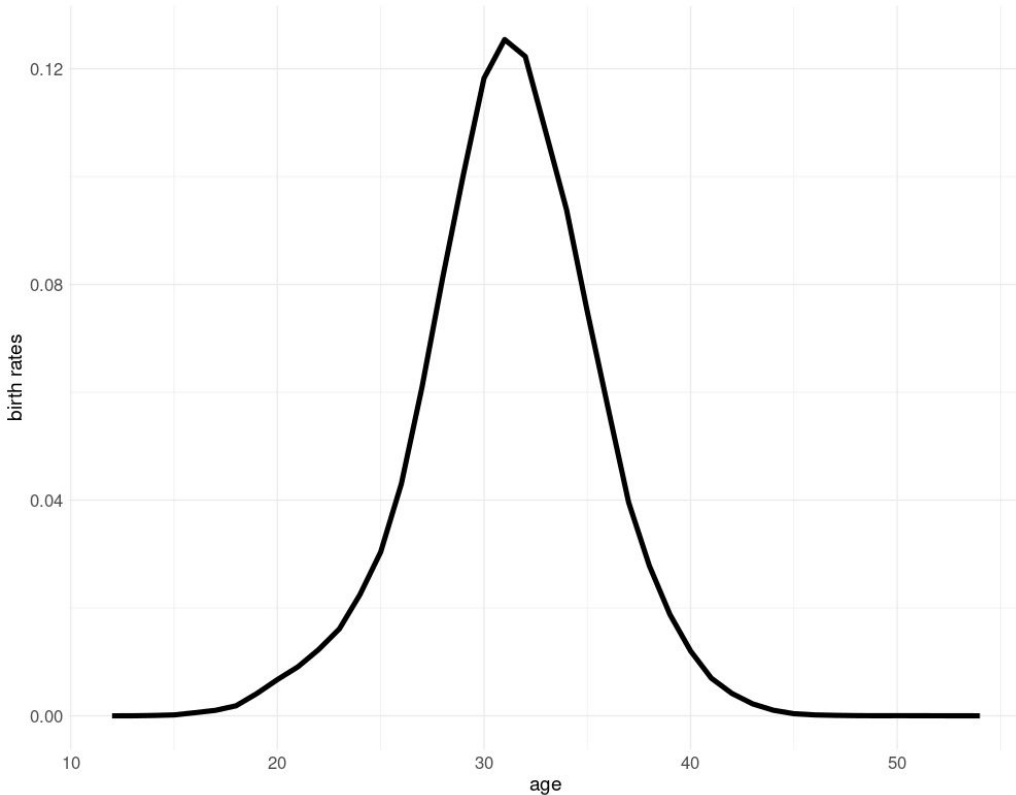


Fertility



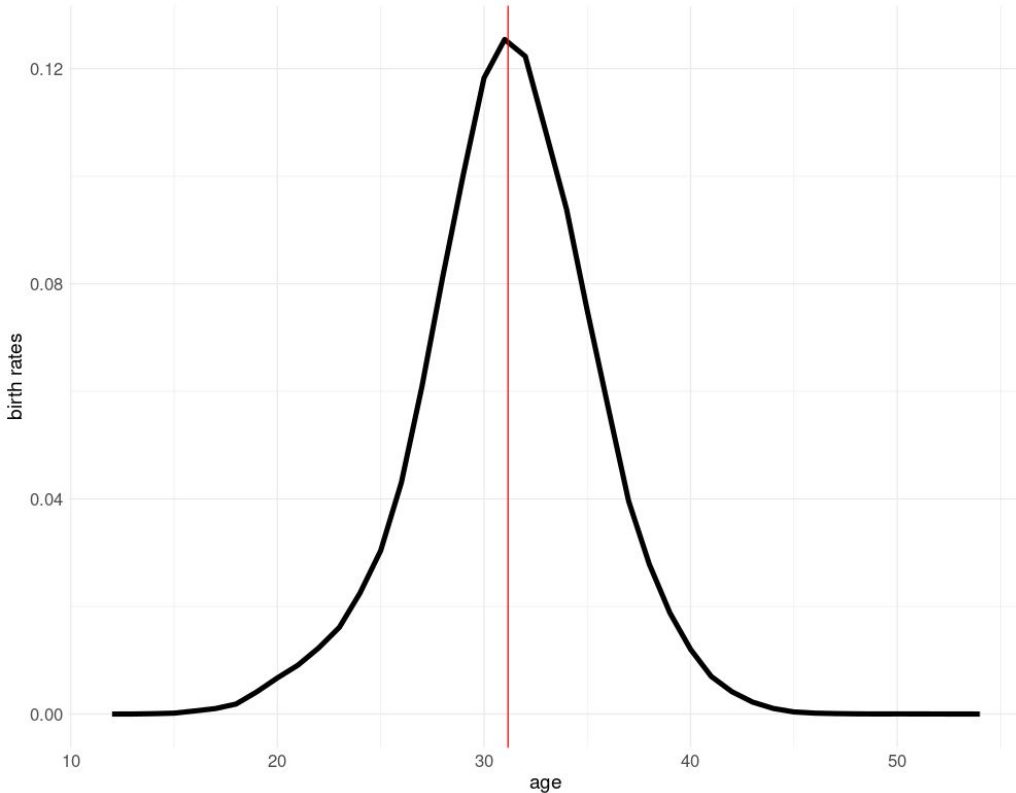
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Birth rates are often denoted F_x or ASFR (age-specific fertility rates). Unless otherwise stated, age means age of mother. The total fertility rate TFR is the sum of these, in this case 1.2. The mean age of childbearing (MAC or MAB) sometimes uses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

Summary

TFR and e_0 both fix the demographic rates of period and imagine a lifecourse running through them.

Neither is a projection

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

Both summarize rates, where we treat rates as a proxy for conditions. It might be a bad proxy, but they're better than the other quantities we have...

Time for us to move to R!