Adult Mortality in the Metropolis of London 100–1850

A Bayesian View from Osteological Data

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Prerequisites

Install required packages, set some options and link the sources for the helper functions.

Please note: Relative paths in the original code, not for documentation purposes, references the workspace, e.g. "./helper_functions.R". Where as in Rmd-files the file location is the root for relative paths, e.g. "../helper_functions.R".

```
require(pacman) || install.packages("pacman")
```

```
## Lade nötiges Paket: pacman
```

```
## [1] TRUE
```

```
pacman::p_load(dplyr, fitdistrplus, flexsurv, ggplot2, gridExtra, kableExtra,
               mortAAR, nlme, osmplotr, reshape2, rgdal, HMDHFDplus, Metrics,
               svMisc, tibble, tidyr, cowplot, MortalityLaws, rio,
               coda, rjags, runjags, demogR, sf, rnaturalearth, readxl,
               ggrepel)

options(scipen = 999)
options(dplyr.summarise.inform = FALSE)

source("./functions/bayes_cat_poisson.R")
source("./functions/gomp_MLE.R")
source("./functions/gomp_MLE_adapted.R")
source("./functions/gomp_MLE_interval.R")
source("./functions/gomp_anthr_age.R")
source("./functions/gomp_anthr_age_r.R")
source("./functions/gomp_bayes_known_age.R")
```

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```
source("./functions/gomp_known_age_r.R")
source("./functions/helper_functions.R")
source("./functions/lt_MC.R")
source("./functions/lt_MC_Gomp.R")
RNGkind("L'Ecuyer-CMRG") # conservative random number generator to avoid periodicity
```

Important for saving time: Decide to run extensive code anew (app. 6 h +). In addition, you can set the folder for preprocessed files.

```
runCodeNew <- FALSE
#runCodeNew <- TRUE

saveFileDir = "preprocessed_files"
if (saveFileDir %in% list.files(getwd()))
 {}else{
    dir.create(file.path(".", saveFileDir), showWarnings = FALSE )
 }
```

```
## NULL
```

The code makes extensive use of the function `source` to call external code. Thus the main part of the code remains slim, well structured and readable.

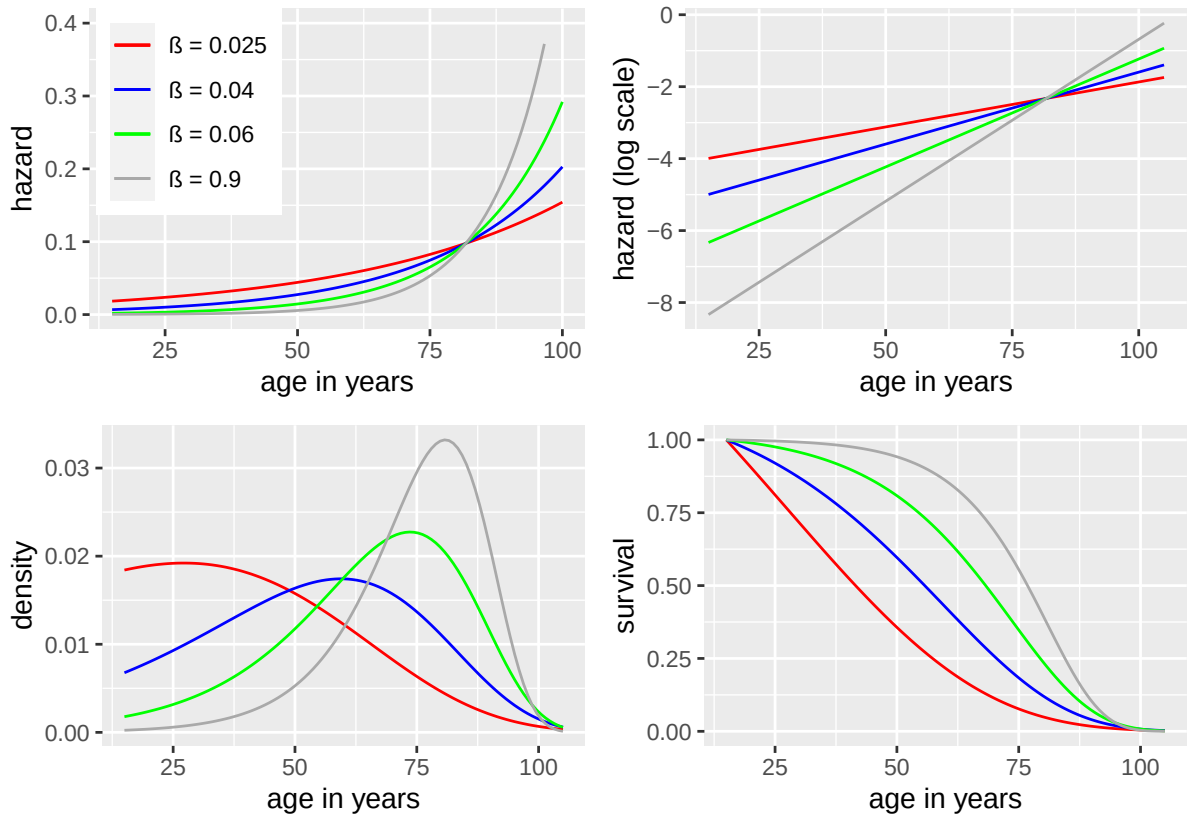
Note: The base path for rmd files is the folder in which they are located. Consequently, order_of_code.R (code with comments) and order_of_code.RMD (information with code) are synchronous and are located in the base folder.

1 Chapter 01 Introduction

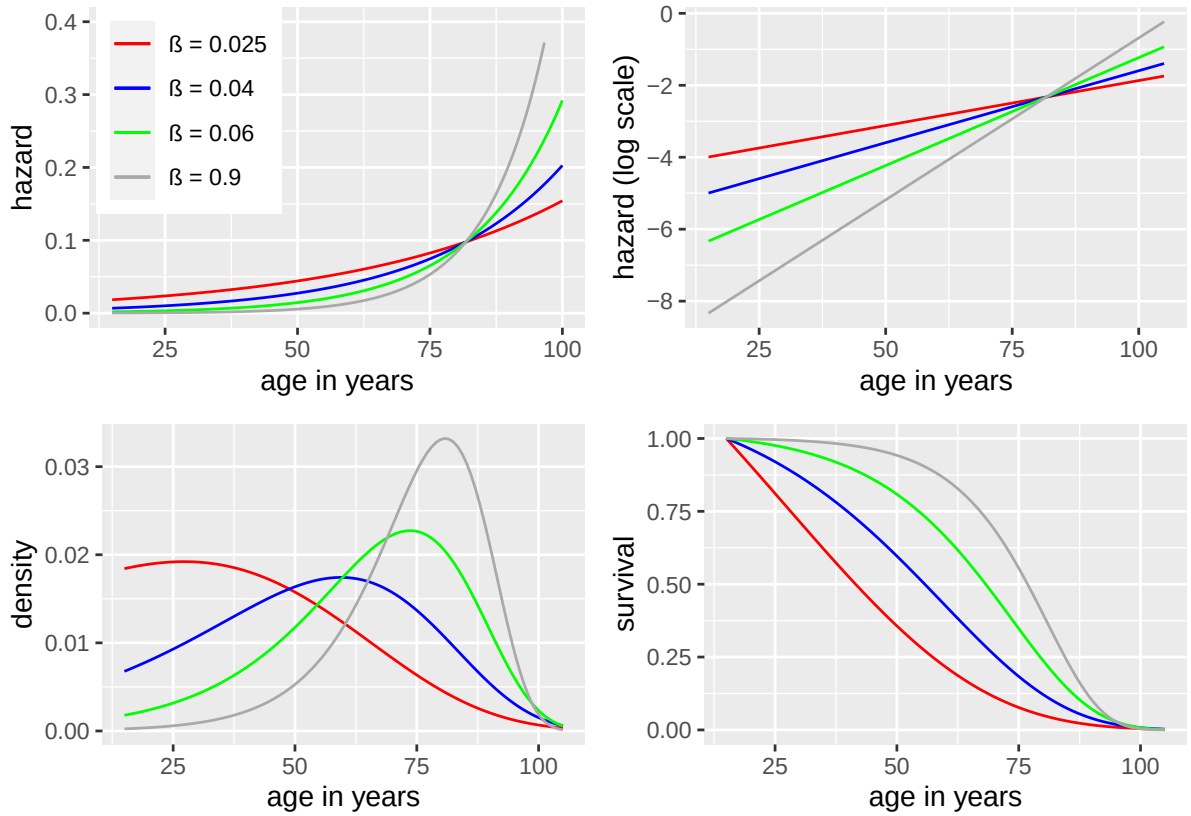
Figure 1: Gompertz.

```
source("./chapter_01_introduction/gompertz_distribution.R")
```

```
## Saving 6.5 x 4.5 in image
```




```
gridExtra::grid.arrange(gompertz_plot)
```

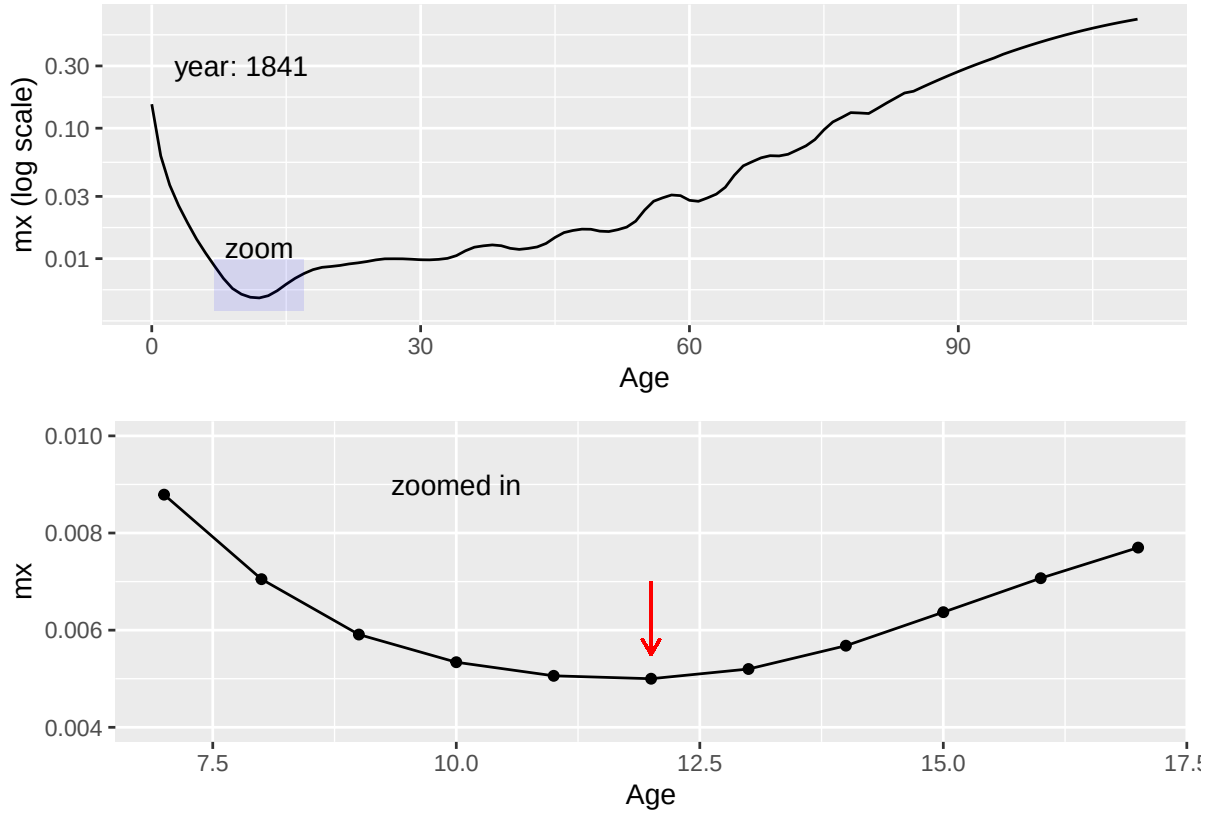

ß = 0.025
ß = 0.04
ß = 0.06
ß = 0.9
hazard
hazard (log scale)
density
survival
age in years
0.4
0.3
0.2
0.1
0.0
0
−2
−4
−6
−8
0.03
0.02
0.01
0.00
1.00
0.75
0.50
0.25
0.00
25
50
75
100

2 Chapter 02 Materials and methods

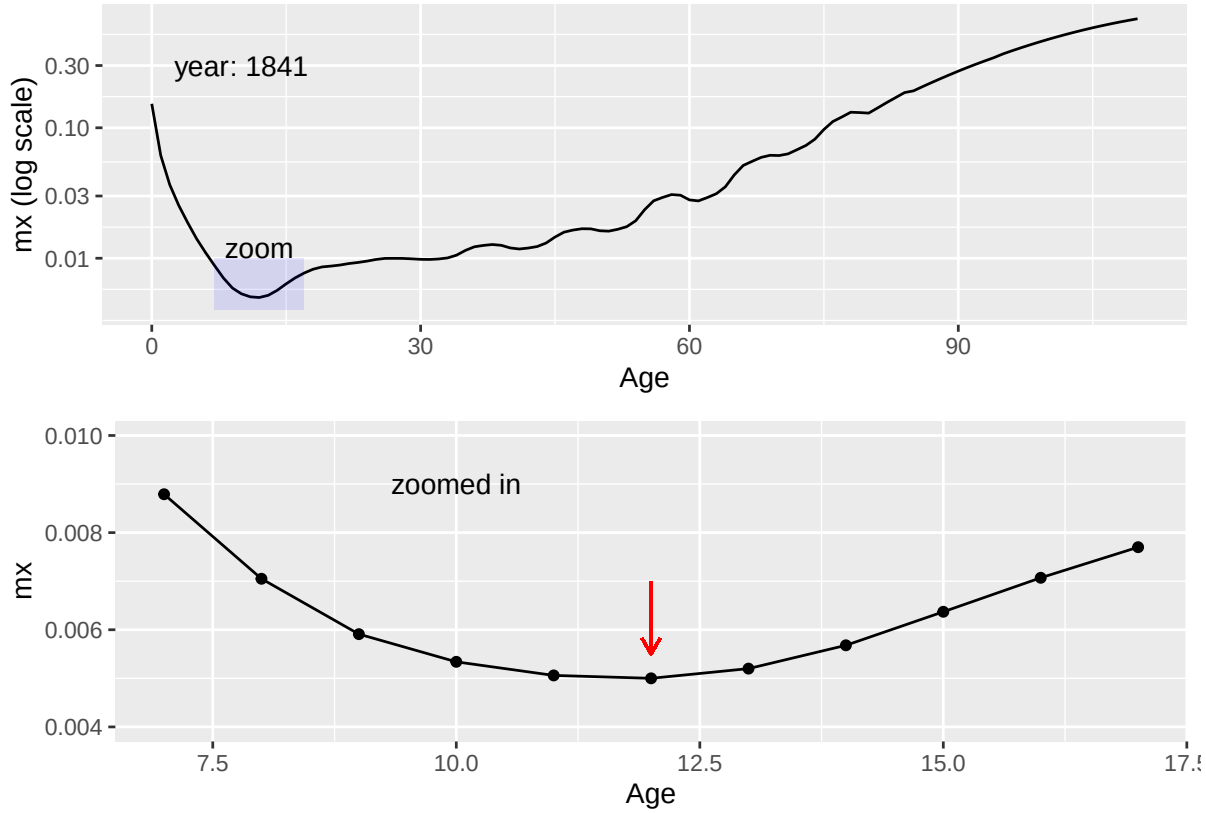
Figure 3 Hazard curve for HMD UK data of the year 1841.

```
source("./chapter_02_materials_and_methods/hazard_curve.R")
```

```
## Saving 6.5 x 4.5 in image
```




```
gridExtra::grid.arrange(HMD_UK_hazard_plot)
```


year: 1841
zoom
mx (log scale)
0.30
0.10
0.03
0.01
0
30
60
90
Age
zoomed in
mx
0.010
0.008
0.006
0.004
7.5
10.0
12.5
15.0
Age

3 Chapter 03 Data

Figure 4 Major cemeteries in Greater London 1100–1850 used in the present study.

```
source("./chapter_03_data/London_places.R")
```

```
## Data (c) OpenStreetMap contributors, ODbL 1.0. https://www.openstreetmap.org/copyright
```

```
## Saving 6.5 x 4.5 in image
```

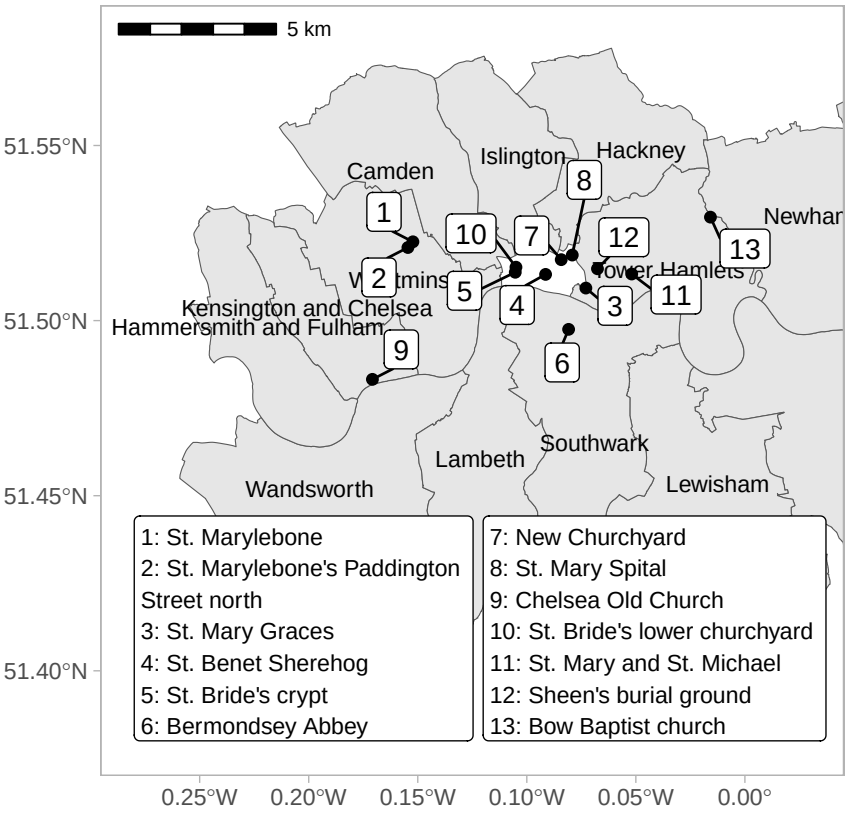
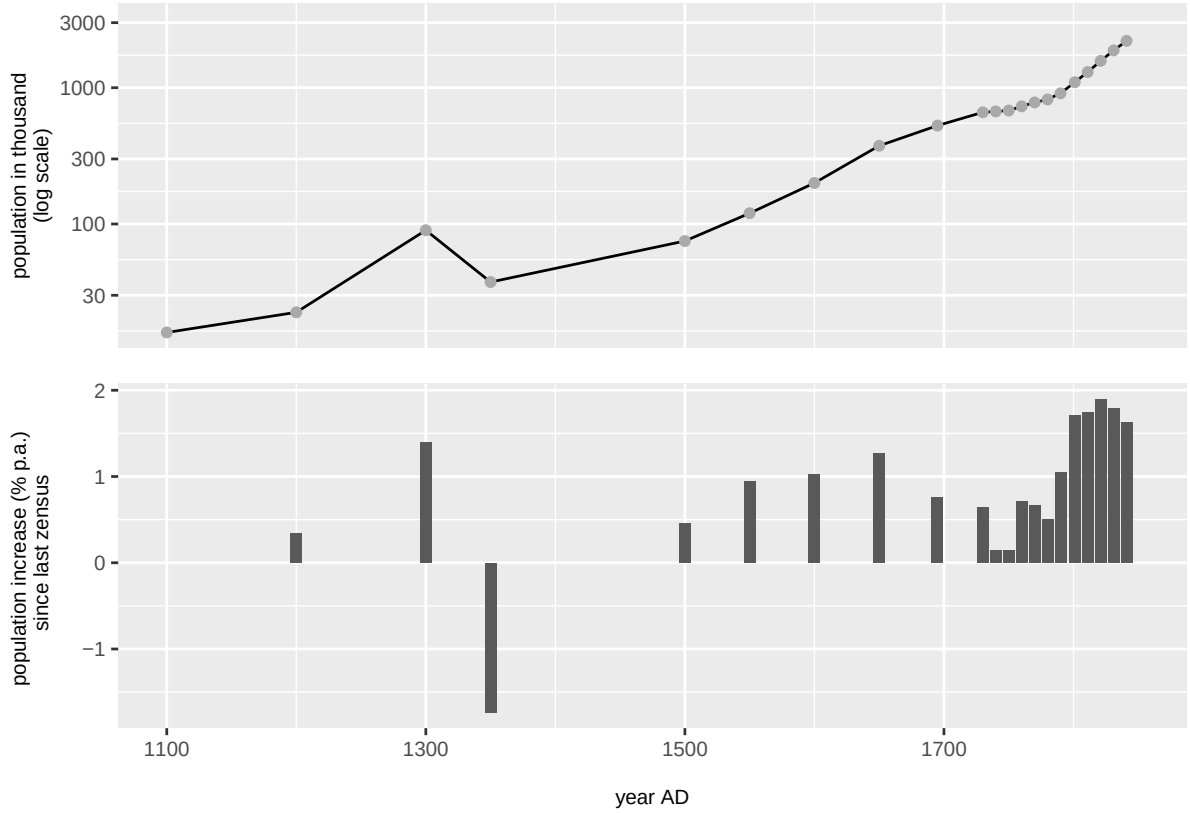


Figure 5 Population development of London

```
source("./chapter_03_data/London_population.R")
grid::grid.newpage()
grid::grid.draw(rbind(london_pop1, london_pop2))
```



Footnote 6 Re-calculation of rates for Razzell/Spence 2007 Calculated in ./chapter_03_data/London_population.R

```
knitr::kable(razz_df, caption = "Re-calculation of rates for Razzell/Spence 2007")
```

Table 1: Re-calculation of rates for Razzell/Spence 2007

date	population	rate.per.year
1520	55000	NA
1600	200000	0.016
1650	400000	0.014
1700	575000	0.007
1750	675000	0.003
1801	960000	0.007
1851	2685000	0.021

4 Chapter 04 Results

4.1 Historical life tables

4.1.1 Written sources, pre-processed

Preprocessing of data used in figure 6: Estimated modal ages.

The data is referenced and aggregated in "./chapter_04_results/historical_lifetables.R". In this file, all records from individual preprocessing files located in "./liftables_preprocessed/" are `sourced`. The corresponding data files are stored in "./data/".

English_Peers.R, russell.txt, `# Source: Hugo J. P. La Poutré & Fanny Janssen, A two-parameter hazard function to describe age patterns of mortality in ancient Northwestern Europe. Genus 77, 12 (2021), Tab. 2. https://genus.springeropen.com/articles/10.1186/s41118-021-00122-w/tabl`

```
source("./chapter_04_results/historical_lifetables.R")
kable(peers_ranges,
      caption = "English Peers")
```

kable(monks_ranges, caption = "Christ Church monks (Medieval England.R)") kable(london_1728_1840_ranges, caption = "London population, range of age modes M (London 1728 1840.R)") kable(london_1728_1840_ranges_r, caption = "London population, range of rate (London 1728 1840.R)") kable(London_1841_ranges, caption = "London population (London 1841 raw all.R)") kable(eng_mort_ranges, caption = "English data (Wrigley et al. 1997) (English Mortality.R)") kable(HMD_UK_ranges, caption = "Human Mortality Database UK (HMD UK.R)")

Table 2: English Peers

parameter	modes	HDI.ranges
beta	0.0613	0.0559-0.0660
M	58.1758	56.4-59.8
e20	33.4148	NA
e25	29.4926	NA