Appendix S6: Key mathematical notation

**General notation**

\( F \): distribution functions

\( f \): (probability) density functions

\( \Phi(z) \): standard normal distribution function

\( \varphi(z) \): standard normal density function

**Birth and survival related notation**

\( S \): survival time

\( F_S(s) \): the distribution function of survival time \( S \)

\( f_S(s) \): the density function of survival time \( S \)

\( T \): time of birth of a random individual from the population

\( f_T(t) \): the density function of time of birth \( T \)

\( \tau \): the maximum possible age an individual from the population can attain

**Linear regression related notation**

\( X \): age proxy

\( X_1, \ldots, X_n \): independent and identically distributed copies of \( X \)

\( x_1, \ldots, x_n \): realization of the random variables \( X_1, \ldots, X_n \)

\( Y \): age

\( f_Y(y) \): density function of the age of an individual at time 0

\( g(y) \): regression function relating age proxy to age

\( \alpha \): intercept for linear regression of age proxy against age

\( \beta \): slope for linear regression of age proxy against age

\( \sigma \): standard deviation of the error in the regression model

\( \varepsilon \): standardized error in the regression model

\( f_{\varepsilon}(z) \): density function for \( \varepsilon \)

\( F_{\varepsilon}(z) \): distribution function for \( \varepsilon \)
\( n \): sample size, i.e., the number of sampled individuals of which the age proxy is measured

**Mortality rate related notation**

\( m \): mortality rate

\( \lambda = -\ln(1 - m) \): rate parameter of exponential distribution

\( \beta / \sigma \): the crucial indicator for the variation in estimated mortality rate

\( \mu = \sigma \lambda / |\beta| \): proxy coefficient

\( \hat{\mu}_n \): asymptotically efficient estimator of \( \mu \)

\( I(m) \): Fisher information for mortality rate \( m \)

\( J(\mu) \): Fisher information for \( \mu \)

\( CR(95) \): 95% confidence range

\( EP(95) \): theoretical 95% error percentage for mortality rate \( m \)

\( EEP(95) \): empirical 95% error percentage for mortality rate \( m \)

\( \hat{m}_n \): efficient estimator for mortality rate \( m \)

\( \frac{1}{m \sqrt{I(m)}} \): the basic factor used in the calculation of 95% error percentage \( EEP(95) \)