MSLT equations, BAU

Inputs are $\mathrm{ACMR}(a, t_0)$ and $APC(a, t)$. Interventions are evaluated by comparing the business-as-usual values of $\mathrm{PY}_{adj}(a, t)$ and $\mathrm{LE}_{adj}(a, t)$ to their intervention-specific values.

$$
\begin{aligned}
\mathrm{ACMR}(a, t+1) &= \mathrm{ACMR}(a, t) \times \left[1 + \frac{\mathrm{APC}(a, t)}{100}\right] \\
\mathrm{ACMR}(a, t_0+n) &= \mathrm{ACMR}(a, t_0) \times \prod_{k=0}^{n-1} \left[1 + \frac{\mathrm{APC}(a, t_0+k)}{100}\right] \\
\mathrm{PD}(a, t) &= P(t < T_{death,a} < t+1 | T_{death,a} > t) = 1 - e^{-\mathrm{ACMR}(a,t)} \\
\mathrm{PD}_{cum}(a, t_0, n) &= \prod_{k=0}^{n} \left[1 - e^{-\mathrm{ACMR}(a+k, t_0+k)}\right] \\
\mathrm{Deaths}(a, t_0) &= \mathrm{Pop}(a, t_0) \times \mathrm{PD}(a, t_0) \\
\mathrm{Deaths}_{cum}(a+n, t_0+n) &= \mathrm{Pop}(a, t_0) \times \mathrm{PD}_{cum}(a, t_0, n) \\
\mathrm{Pop}(a+1, t_0+1) &= \mathrm{Pop}(a, t_0) - \mathrm{Deaths}(a, t_0) \\
&= \mathrm{Pop}(a, t_0) \times (1 - \mathrm{PD}(a, t_0)) \\
\mathrm{Pop}(a+n, t_0+n) &= \mathrm{Pop}(a, t_0) \prod_{k=0}^{n-1} [1 - \mathrm{PD}(a+k, t_0+k)] \\
\mathrm{PY}(a, t_0) &= \mathrm{Pop}(a, t_0) \times \left(1 - \frac{\mathrm{PD}(a, t_0)}{2}\right) \\
\mathrm{PY}(a+n, t_0+n) &= \mathrm{Pop}(a, t_0) \prod_{k=0}^{n-1} [1 - \mathrm{PD}(a+k, t_0+k)] \times \left(1 - \frac{\mathrm{PD}(a+k+1, t_0+k+1}{2}\right) \\
\mathrm{LE}(a, t) &= \sum_{k=0}^{a_{\max}-a} \frac{\mathrm{PY}(a+k, t+k)}{\mathrm{Pop}(a+k, t+k)} \\
\mathrm{YLDrate} &: a \mapsto \mathrm{YLDrate} \\
\mathrm{PY}_{adj}(a, t) &= \mathrm{PY}(a, t) \times [1 - \mathrm{YLDrate}(a)] \\
\mathrm{LE}_{adj}(a, t) &= \sum_{k=0}^{a_{\max}-a} \frac{\mathrm{PY}_{adj}(a+k, t+k)}{\mathrm{Pop}(a+k, t+k)}
\end{aligned}
$$

Symbol	Definition
ACMR	All-cause mortality rate
APC	Annual percent change in ACMR
PD	Probability of death in a cohort over a single year
Pop	Number of individuals in a cohort
PY	Person-years in a cohort over a single year
LE	Life expectancy, relative to current age
YLDrate	Year-life disability discount rate
PY_{adj}	Person-years, adjusted for YLD
LE_{adj}	Life expectancy, relative to current age and adjusted for YLD

Table 1: Definition of symbols used in equations.