

## Healthy Life Years Lost estimates (HLYL)

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1. Data from the Human Mortality Database
2. Methods applied from the paper: C. H. Skiadas (9 March 2016) The Health–Mortality Approach in Estimating the Healthy Life Years Lost Compared to the Global Burden of Disease Studies and Applications in World, USA and Japan <http://arxiv.org/ftp/arxiv/papers/1603/1603.02414.pdf>
3. The WHO estimates for the healthy life years lost (HLYL) come from the HALE figures for all the years provided except of 1999 belonging to DALE (cyan color).
4. The recently presented WHO estimates for 2000, 2012 and 2013 are illustrated with red color.
5. The estimates of the characteristic parameter  $b$  based on  $mx$  are close to the recently presented WHO estimates whereas the  $qx$  based  $b$  estimates are smaller to the  $mx$  estimates.
6. Two Intervals with  $(b-1)$  and  $(b+1)$  are included: the first is close to the HALE estimates for 2002 and 2007 and to the DALE estimates for 1999. The second is close to the higher values for HALE for 1990 and 2010.
7. The health method estimates are based on the estimation of the parameter  $c$  of the IM-Model:

$$f_x = \frac{2|l+(c-1)(bx)^c|}{\sqrt{2\pi x^3}} e^{-\frac{(l-(bx)^c)^2}{2x}} \quad \text{or the advanced form with similar estimates for } c:$$

$$f_x = \left( \frac{2}{\sqrt{2\pi}} \right) \left( \frac{|l+(c-1)(bx)^c|}{\sqrt{x^3}} + \frac{k\sqrt{x^3}c(c-1)b^c x^{(c-2)}}{2|l+(c-1)(bx)^c|} \right) e^{-\frac{(l-(bx)^c)^2}{2x}} \quad (\text{The HLYL} = c-1/2 + \ln(c-1))$$

8. The Weibull health parameter  $b$  is estimated from the formula  $f_x = \frac{b}{T} \left( \frac{x}{T} \right)^{b-1} e^{-\left( \frac{x}{T} \right)^b}$
9. The Gompertz health parameter  $l$  is estimated from the formula  $f_x = be^{-l+bx} e^{-e^{-l+bx}}$
10. Both the Weibull and the Gompertz health parameters coincide for the case of Canada females and for the time period selected, from 1985 – 2011.
11. An important point is that the HLYL estimates from  $mx$  based on the Direct, Simple Model, IM-model, Weibull and Gompertz are very close each other and close to the recently presented WHO estimates for 2000, 2012 and 2013. See first Figure 1 and Table I.
12. The same methods are applied to 22 countries for males with good results (see below) supporting the recently presented WHO estimates for 2000, 2012 and 2013 and future applications. The simpler is to use the models' approach along with the WHO methodology.

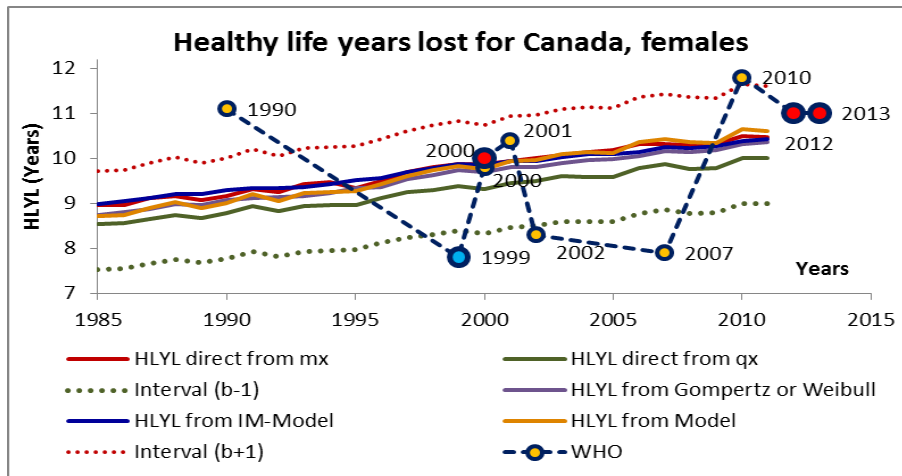
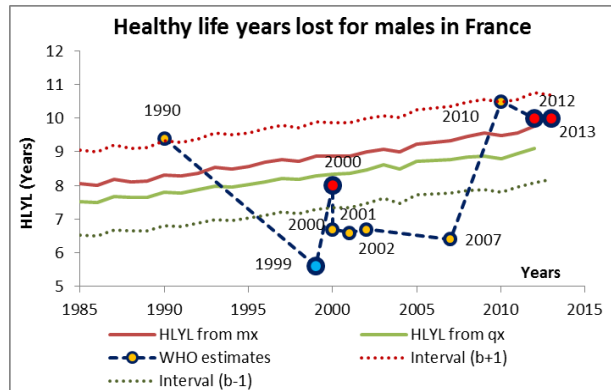
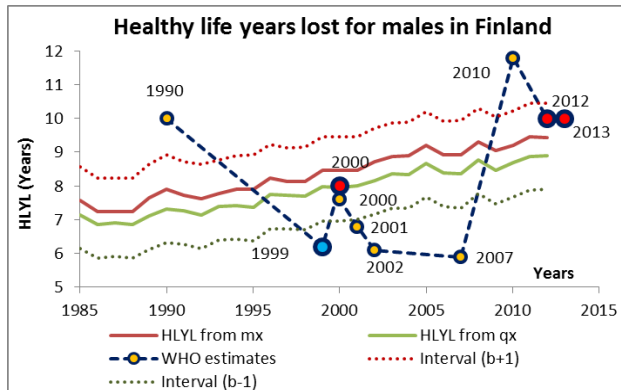
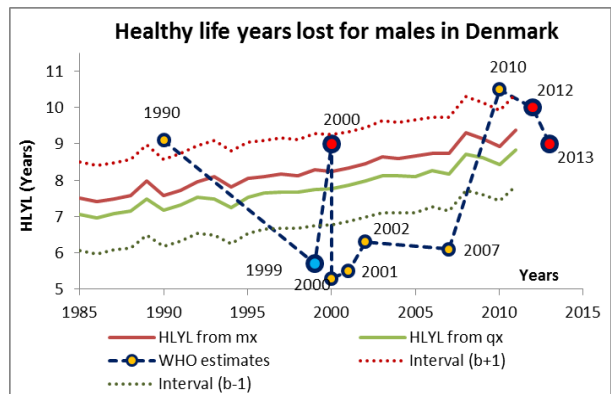
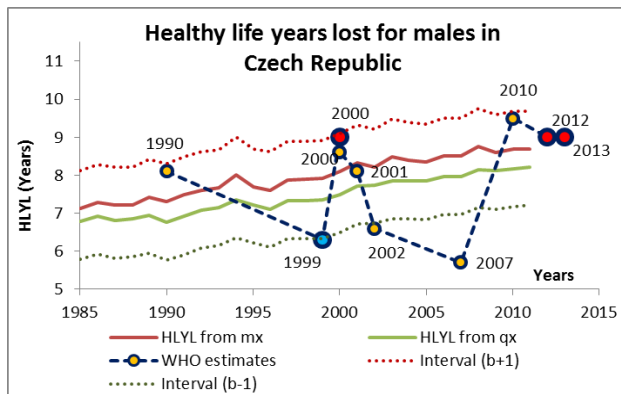
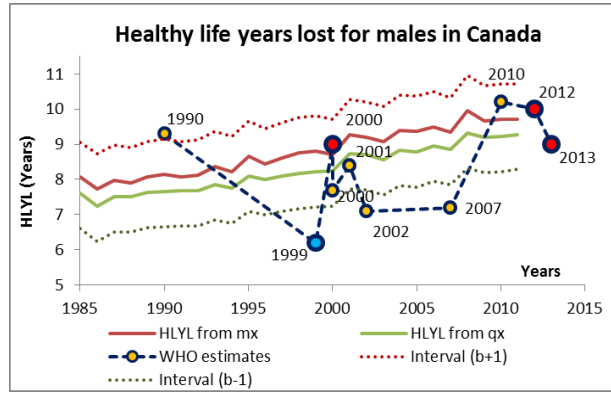
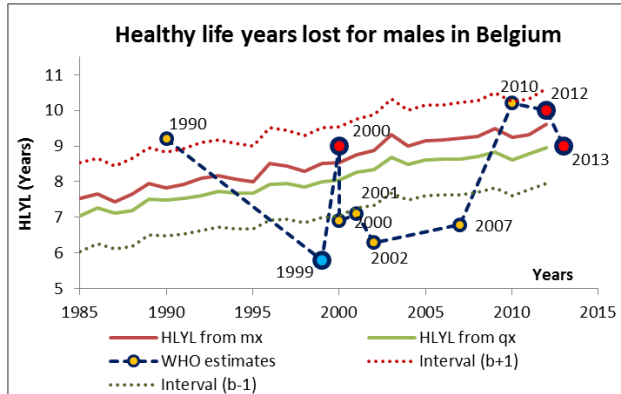
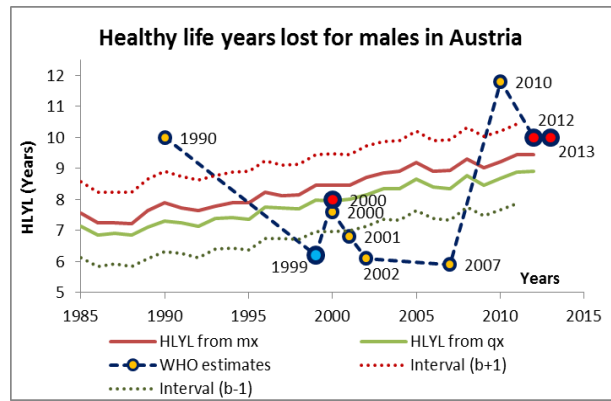
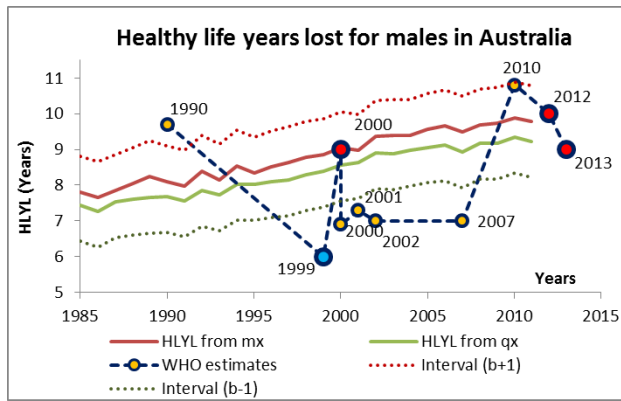
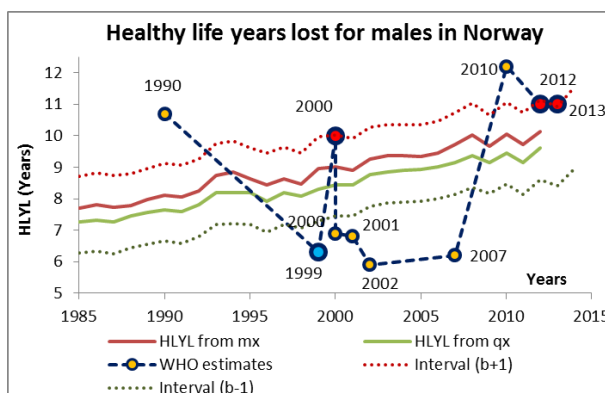
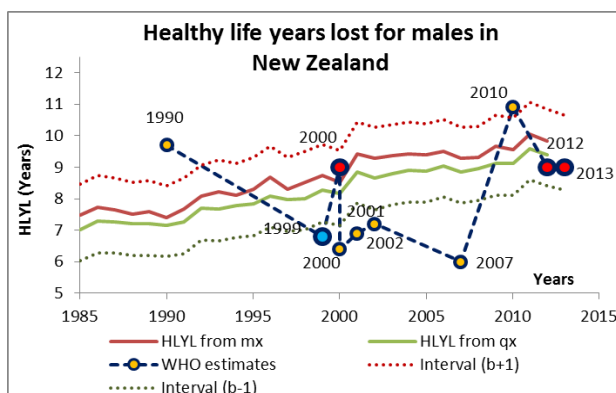
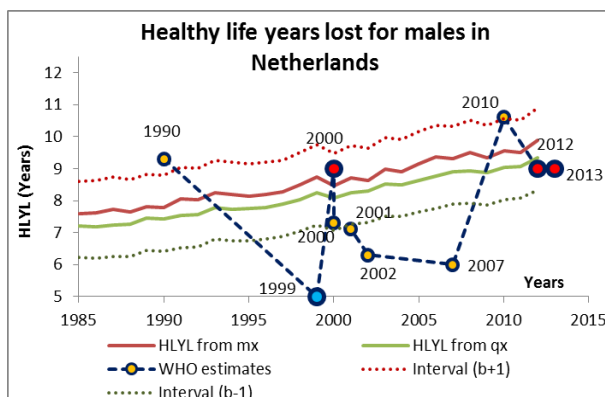
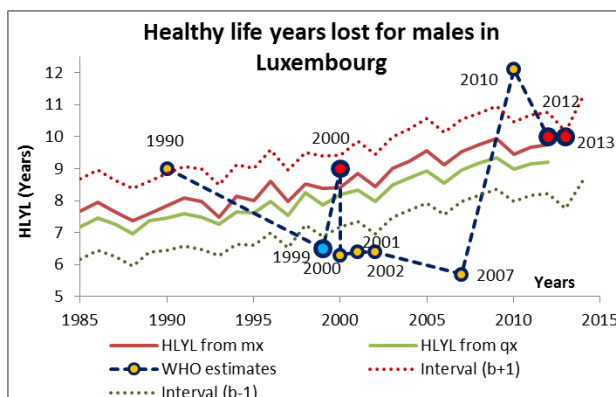
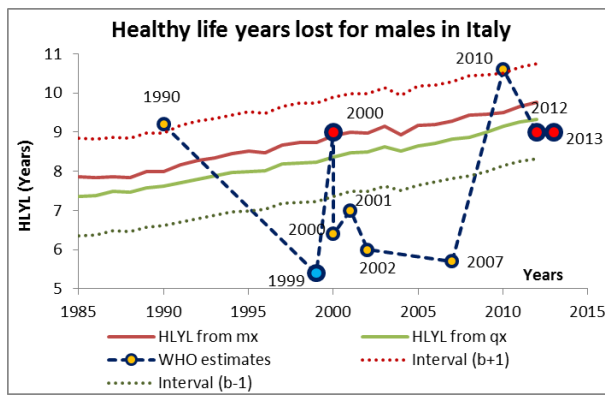
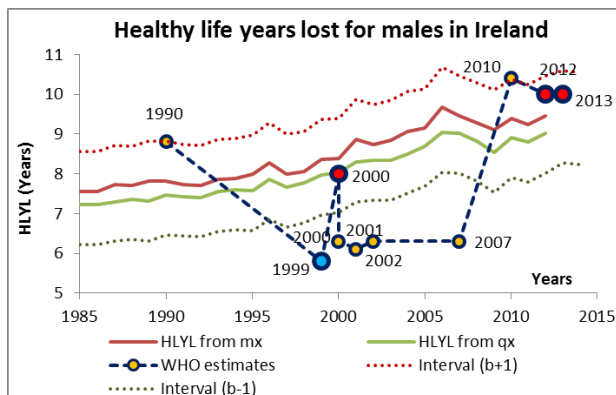
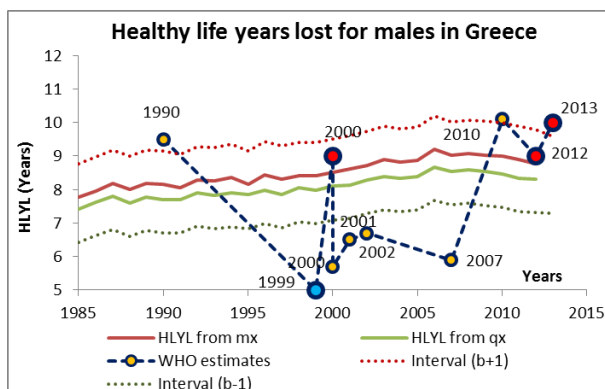
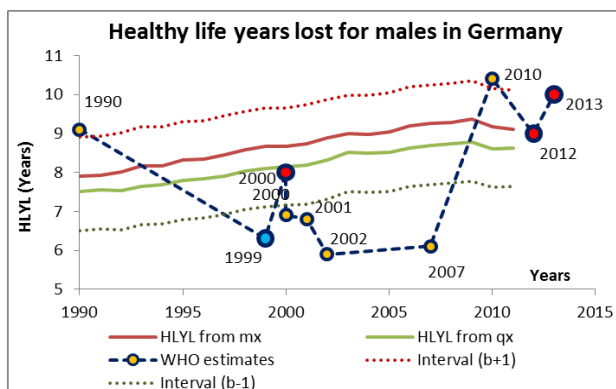


Fig. 1. Estimates of the Healthy Life Years Lost for Canada (females)





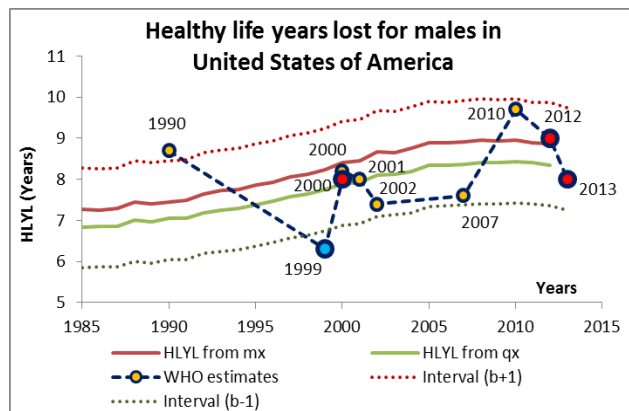
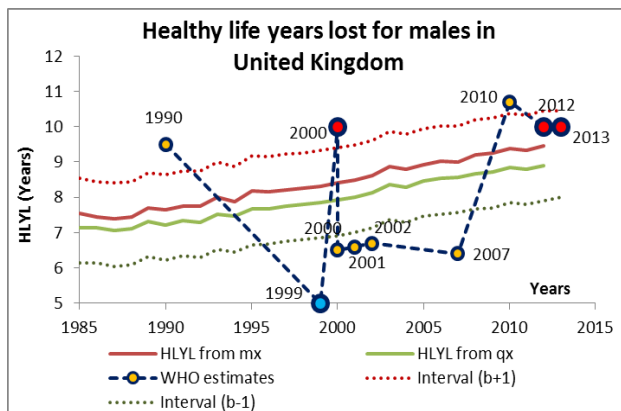
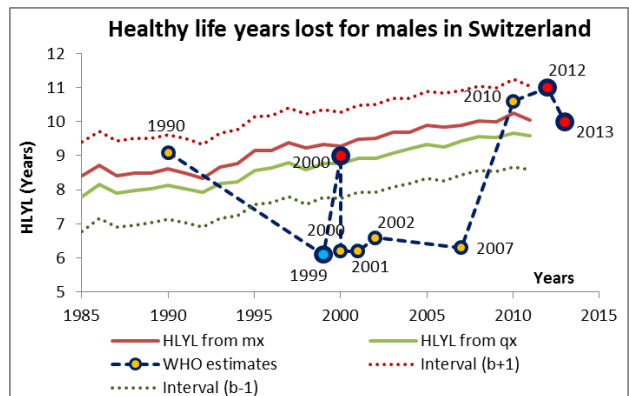
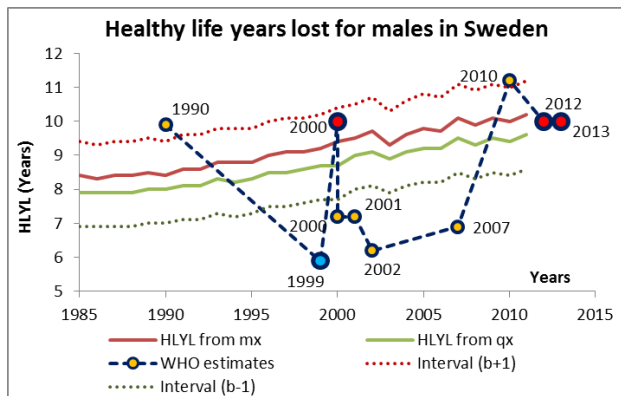
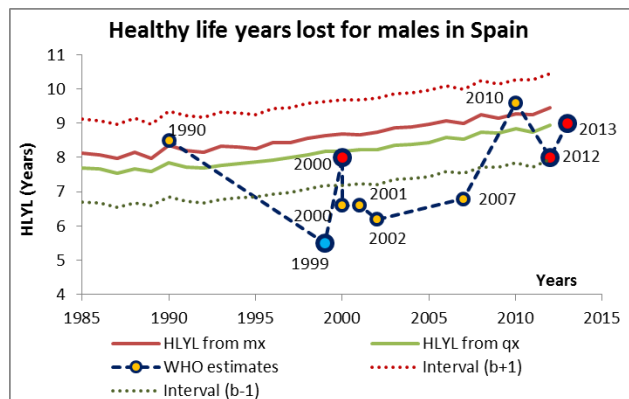
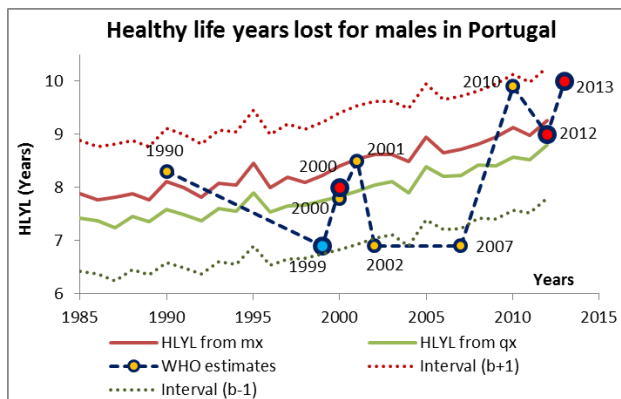


FIGURE I

Healthy Life Years Lost (HLYL) for Canada (females)							
Year	Direct from mx	Direct from qx	Weibull - Gompertz	SKI-IM	SKI-IM Extended	From SKI_IM HLYL= $c - 0.5 + \ln(c-1)$	Model Full life table
1985	8.96	8.53	8.73	7.60	7.59	8.99	8.71
1986	8.96	8.56	8.81	7.66	7.65	9.06	8.74
1987	9.11	8.65	8.87	7.71	7.69	9.11	8.90
1988	9.16	8.75	8.98	7.79	7.78	9.21	9.02
1989	9.06	8.68	8.97	7.78	7.77	9.20	8.89
1990	9.16	8.77	9.07	7.86	7.85	9.29	9.01
1991	9.33	8.94	9.11	7.90	7.89	9.33	9.20
1992	9.26	8.82	9.13	7.91	7.90	9.34	9.06
1993	9.43	8.93	9.16	7.93	7.91	9.37	9.23
1994	9.46	8.96	9.22	7.98	7.96	9.42	9.26
1995	9.34	8.97	9.33	8.06	8.05	9.52	9.28
1996	9.50	9.12	9.36	8.09	8.07	9.55	9.42
1997	9.70	9.25	9.53	8.22	8.20	9.70	9.61
1998	9.79	9.30	9.62	8.29	8.27	9.78	9.74
1999	9.88	9.39	9.73	8.37	8.36	9.87	9.83
2000	9.86	9.33	9.70	8.34	8.33	9.84	9.75
2001	9.93	9.46	9.80	8.43	8.41	9.93	9.93
2002	10.00	9.50	9.80	8.43	8.41	9.94	9.96
2003	10.07	9.60	9.90	8.51	8.49	10.02	10.09
2004	10.15	9.59	9.97	8.56	8.55	10.09	10.13
2005	10.17	9.59	9.99	8.58	8.56	10.10	10.12
2006	10.31	9.78	10.04	8.62	8.60	10.15	10.36
2007	10.32	9.87	10.16	8.71	8.70	10.26	10.43
2008	10.30	9.77	10.14	8.69	8.67	10.23	10.36
2009	10.31	9.79	10.19	8.73	8.71	10.27	10.35
2010	10.49	10.00	10.31	8.83	8.81	10.39	10.65
2011	10.48	10.00	10.36	8.86	8.84	10.42	10.61