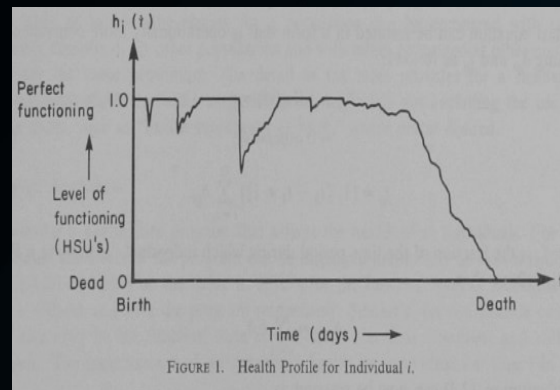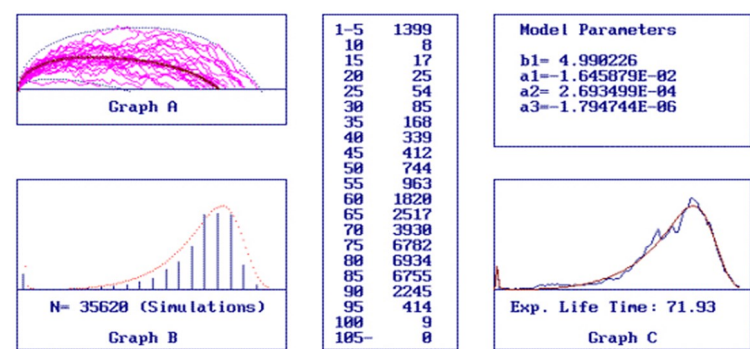# ESTIMATING THE HEALTH STATUS OF A POPULATION—THE HISTORY OF HEALTH STATE CURVES

1976 A First Approach
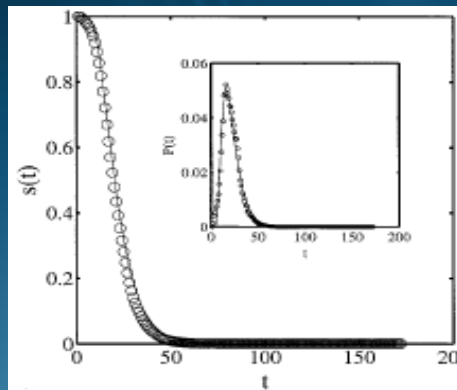

G. W. Torrance. "Health Status Index Models: A Unified Mathematical View", *Management Sci.,* 22(9), 1976: 990-1001
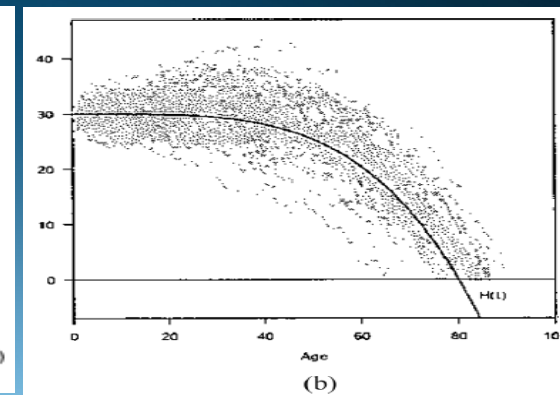
1995 Modeling, Fit and Simulation

Janssen, Jacques and Skiadas, Christos, H. Dynamic modelling of life-table data, *Applied Stochastic Models and Data Analysis*, 11, 1, 35-49 (1995).
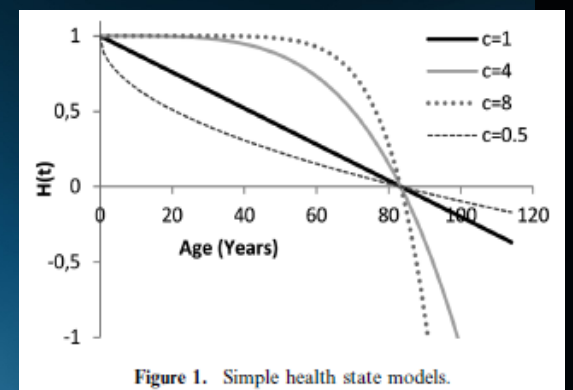
2001 Fit to Medfly

Weitz, J.S. and Fraser, H.B. Explaining mortality rate plateaus, *Proc. Natl. Acad. Sci. USA,* 98(26), 15383 (2001).
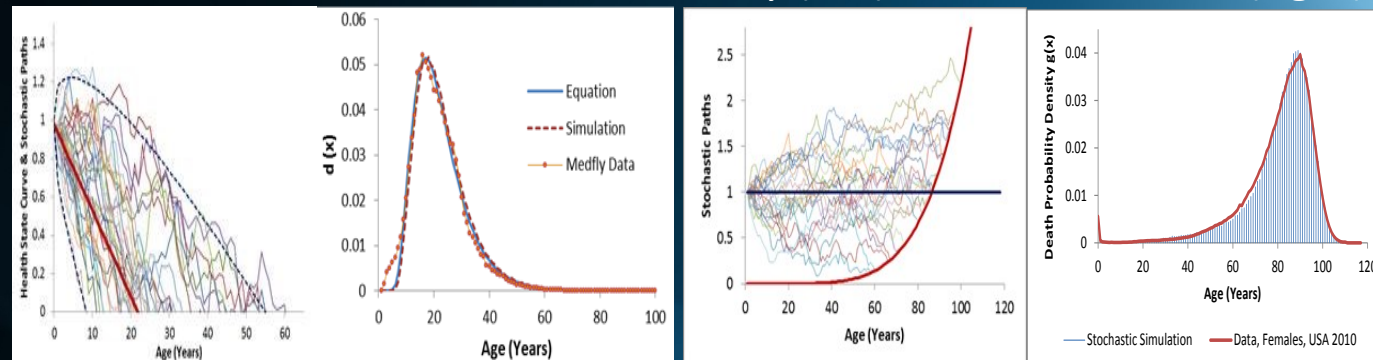
2010 Model-Simulation

Skiadas, C. and Skiadas, C. H. Development, Simulation and Application of First Exit Time Densities to Life Table Data, *Com. Stat.* 39, 2010: 444-451.
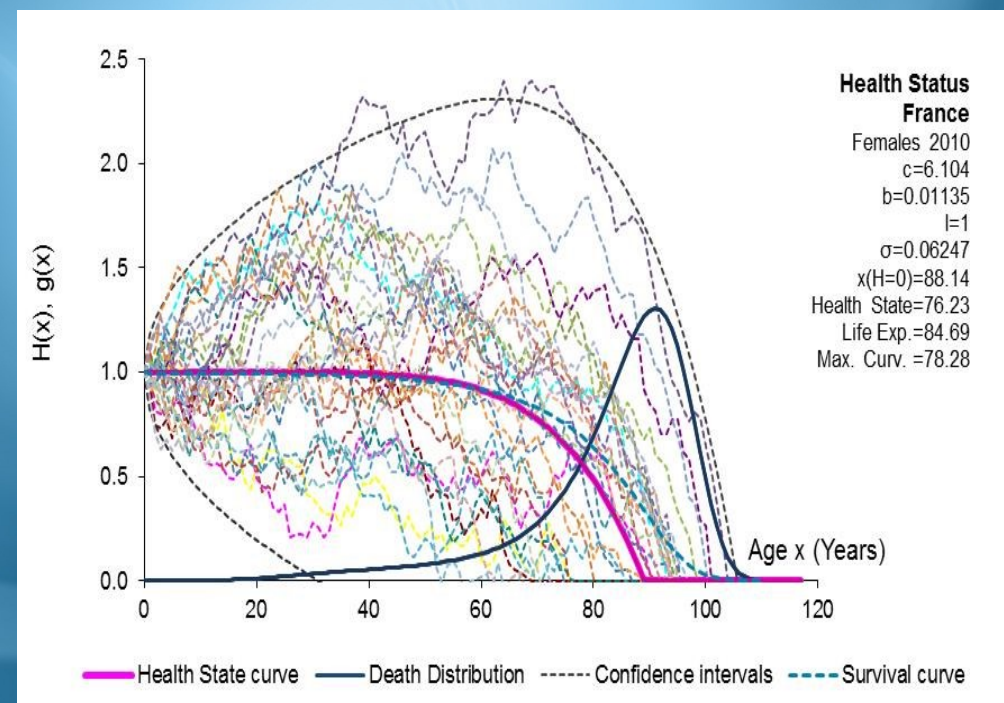
2014 Modeling

Figure 1. Simple health state models.

Skiadas, C. H. and Skiadas, C. The First Exit Time Theory applied to Life Table Data: the Health State Function of a Population and other Characteristics, *Com.. Stat.* 43, 2014: 1985-1600.

2014 Stochastic Simulations of Medfly (left) and USA Females (right)

Skiadas, C. and Skiadas, C.H. Development, Simulation and Application of First Exit Time Densities to Life Table Data, Communications in Statistics 39, 2010: 444-451.
Skiadas, C.H. and Skiadas, C. The Health State Function of a Population, ISAST (2nd Ed., January 2013). Amazon
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Skiadas, C.H. and Skiadas, C. Exploring the State of a Stochastic System via Stochastic Simulations: An Interesting Inversion Problem and the Health State Function. Meth. and Comp. in Applied Probability (2015, Volume 17, Issue 4, pp 973–982).
Skiadas, C.H. and Skiadas, C. The Health Status of a Population: Health State and Survival Curves and HALE estimates, www.ArXiv.org, October 2016.

Health Status
France
Females 2010
c=6.104
b=0.01135
l=1
σ=0.06247
x(H=0)=88.14
Health State=76.23
Life Exp.=84.69
Max. Curv. =78.28

Health State curve —— Death Distribution ------ Confidence intervals ---- Survival curve

Although the Survival Curve is known as long as the life tables have introduced the Health State Curve was calculated after the introduction of the advanced stochastic theory of the first exit time.

The health state curve is illustrated by the heavy magenta line (see left). The corresponding survival curve for the related case is presented by the cyan curve. The blue curve expresses the death distribution. The light curves with various colors are the stochastic paths from the related simulation. The two dashed black curves express the confidence intervals. The Health State, the Life Expectancy and the age at zero health state are also estimated.

Health State and Survival Curves, Age at Maximum Curvature, Health State, Healthy Life Expectancy and HALE, Standard Deviation σ and Comparisons (males-females), Health State as the total area under (AB)