STAT 517: Branching Process Estimation Examples

Reading for: Lecture 3, Tuesday January 15, 2008

Some Extinction Probabilities For Influenza Epidemics

in England and Wales, and Greater London, 1958-73

Year	Location			
	England and Wales		Greater London	
	$\hat{\theta}$	Π^*	$\hat{\theta}$	Π^*
1958-59	1.904	.23	2.055	.19
1960-61	2.019	.20	2.606	.09
1961-62	2.386	.12	1.835	.25
1962-63	1.725	.30	1.652	.33
1965-66	1.652	.33	-	-
1967-68	2.055	.19	2.569	.10
1971-72	1.431	.47	1.725	.30
1972-73	2.092	.18	-	-

* Assuming that $Z_0 = 1$ Poisson: $g(s) = e^{\theta(s-1)}$

Sources: Data and parameter estimates - C.C. Spicer, The mathematical modelling of influenza epidemics, Brit. Med. Bull. 35, 23-28 (1979) and R. Olesen, Investigation of a model for influenza epidemics, MSc. thesis, Imperial College of Science and Technology, London, 1978.

Interpretation as a branching process - I.M. Longini, The generalized discrete-time epidemic model with immunity: A systhesis, Mathematical Biosciences 82, 19-41 (1986).

Estimated Basic Reproductive Rate for Dengue Epidemics

in Mexico, 1978 - 1986

Estimated θ from final values in 78 locals scattered throughout Mexico

$\hat{\bar{\theta}} = 1.248 \pm 0.280$

Range = [1.000, 2.269] Median = 1.151

$\theta = \exp(\beta_o + \beta_1 X)$, where X is the average monthly temperature in C^o

$\hat{\theta} = \exp\ (-0.4701 + 0.02680X)$ using GLIM

When $X = 25^oC$ (77^oF), $\hat{\theta} = 1.221$

When $X = 20^oC$ (68^oF), $\hat{\theta} = 1.068$

When $X = 15^oC$ (59^oF), $\hat{\theta} = 0.934$

Threshhold value of $X = 17.541^oC$ (63.574^oF) ,

where $\hat{\theta} = 1.000$