Fitting Mathematical Models to Data

Adapting Likelihood Based Inference

Meaningful Modeling of Epidemiologic Data, 2010
AIMS, Muizenberg, South Africa

Steve Bellan
MPH Epidemiology
Department of Environmental Science, Policy & Management
University of California at Berkeley
Fitting Dynamic Models to Data

Adapt our dynamic models in a probabilistic framework so we can ask:

What is the probability that a model would have generated the observed data?

What is the likelihood of a model given the data?
Likelihood of parameters (given data)
Likelihood of parameters (given data)
Likelihood of parameters (given data)

Normal Distribution

(approximately) continuous variable
Likelihood of parameters (given data)

Exponential Distribution

Distribution

probability

0.0
0.2
0.4
0.6
0.8
1.0

time until event
Likelihood of parameters (given data)
Likelihood of parameters (given data)

Distribution

Stochastic Component of Model

Binomial Distribution

# successes in N trials

Probability
HIV in Harare

Data

Distribution

Likelihood of parameters (given data)
Likelihood of parameters (given data)

Data

Distribution

Expectation of distributional parameters, given model

Stochastic Component of Model
Likelihood of parameters (given data)

Data

Distribution

Model

Deterministic Component of Model

Stochastic Component of Model

Expectation of distributional parameters, given model
Likelihood of parameters (given data)

Data Distribution Expectation of distributional parameters, given model

Parameters
(some fixed and others to be fitted)

Model

Deterministic Component of Model

Stochastic Component of Model

Distribution

Likelihood of parameters (given data)
Parameters
(some fixed and others to be fitted)

Model

Time series cases

Time series prevalence

Distribution

Expected distributional parameter(s), given model

Likelihood of parameters (given data)

Data