

MCMC for Influenza Burden Estimation from Hospitalization Surveillance data

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Data

1. N : Total FluSurv-NET (FSN) population (given stratum, e.g. age group, state, etc.)
2. M : Total US population
3. n_H : Number of observed influenza hospitalizations with non-lethal outcome
4. n_D : Observed influenza deaths
5. ρ_k : Prior dist. for test sensitivities (PCR, rapid; mean, SD)

Parameters to be sampled, partial likelihoods L

m_H , **True number of influenza hospitalizations (non-lethal) in FSN population, unobserved**

$$L(m_H | \dots) \propto \frac{e^{-\lambda_H N} (\lambda_H N)^{m_H}}{m_H!} \times \binom{m_H}{n_H} t_n^{n_H} (1 - t_n)^{(m_H - n_H)}, \quad (1)$$

where the “detection probability” in those with non-lethal outcomes is $t_0 = \phi_0 \sum_j \pi_{0j} \sigma_{0j}$; definitions of ϕ_0, π_{0j} , and σ_{0j} as given below.

λ_H , **Hospitalization rate**

$$L(\lambda_H | \dots) \propto \frac{e^{-\lambda_H N} (\lambda_H N)^{m_H}}{m_H!} \times \quad (2)$$

m_D , **total number of influenza deaths deaths in FSN population**

$$L(m_D | \dots) \propto \frac{e^{-\lambda_D p_{osh} N} (\lambda_D p_{osh} N)^{m_D}}{m_D!} \times \binom{m_D}{n_D} t_1^{n_D} (1 - t_1)^{(m_D - n_D)}, \quad (3)$$

λ_D

Influenza mortality rate

$$L(\lambda_D | \dots) \propto \frac{e^{-\lambda_D p_{osh} N} (\lambda_D p_{osh} N)^{m_D}}{m_D!}, \quad (4)$$

p_{osh}

Outside-hospital death proportion

$$L(m_D|\dots) \propto \frac{e^{-\lambda_D p_{osh} N} (\lambda_D p_{osh} N)^{m_D}}{m_D!} \quad (5)$$

ϕ_k

True influenza-positivity rate, by outcome k (death vs. survival)

π_{kj}

g_{kj}

Unobserved number of influenza positives, by outcome k and test type j

σ_{kj}

Test sensitivity, by outcome k and test type j