Kerrigan Research Minigrant Proposal

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Bayesian modeling of state wise Tuberculosis (TB) prevalence in the United States

Introduction:

Despite notable improvement in Tuberculosis (TB) eradication over the years, the United States is still not free from TB burden as well as from deaths caused by TB. In 1953, per 100,000 people, the TB prevalence was recorded as 52.6 and the death rate was 12.4 due to TB. In contrast, in 2014, the TB prevalence per 100,000 was 2.9 and the death rate (per 100,000) caused by TB was 0.2 only. However, the data record illustrate that the TB prevalence across states encounter disproportionately. This study intends to estimate the state-wise true TB prevalence by applying Bayesian Hierarchical model technique.

Description of the project: Data on state-wise population and observed number of TB cases (combined both US born and non-US born) for the year, 2015 have been extracted from TBFACTS.ORG [1]. As a part of exploratory analysis, we plan to explore severity wise spatial distribution of TB prevalence. With the assumption of Poisson TB cases, Bayesian model with prior of equal rates as well as prior belief of exchangeability concept[2] can be fitted to the data. In subsequent steps we intend to perform formulation of posterior distribution as well as simulation from posterior, posterior inference, comparisons of states based on posterior TB rates, Bayesian sensitivity analysis, and finally posterior predictive model checking. The analysis would be done by using R packages.

Time frame of the study:

Month	Task
February	Liturature review
March	Explore the baysian model for the data
April	Examine various prior distributions
May	Simulation with posterior distribution and diagnosis of model
June	Write the final report

Reference:

[1] https://www.tbfacts.org/tb-statistics-united-states/

[2] Albert, Jim. Bayesian computation with R. Springer Science & Business Media, 2009