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A STUDY ON BAYESIAN APPROACH TO COMPARE HUMAN BLOOD PRESSURE COUNTS IN KANYAKUMARI DISTRICT USING UNIFORM PRIOR

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Abstract
Analysis of count data is widely used in medical studies, epidemiology, ecology and many Research of interest. The Bayesian approach is very useful in real world situation. In Bayesian estimation prior distribution and posterior distribution are the most important ingredients. The objective of this paper is to compare Blood Pressure in 20 places in Kanyakumari district using uniform prior. The posterior probabilities have been calculated to find the risk of the Blood Pressure throughout the district.

Introduction

Stochastic process is applicable in many fields like medical data such as patient's Blood pressure or temperature. The Blood Pressure in principally due to pumping action of the heart. The rate of mean blood flow depends on the resistance to flow presented by blood vessels. BP is expressed In terms of systolic BP over diastolic BP and is measured in millimeters of mercury (mm/Hg) BP is divided into 2 categories. They are high BP, systolic and low BP, diastolic. Then BP is random in nature.

The possion distribution is a discrete probability distribution and is used to model the number of occurrences of rare events occurring randomly through time or space at a constant rate during a fixed time interval. The Poisson distribution has one parameter, it is not symmetrical, it is skewed toward the infinity end. Then the conditional model for distributed number of occurrences is

$$P(y_i/\lambda)=\frac{e^{-\lambda}\lambda^{y}}{y!}, y=0,1,2,\ldots,\lambda>0$$

Bayes prediction plays an important role in different areas of applied statistics. Miler (1980) used the conjugate prior and showed that the Bayes estimates can be obtained only through numerical integration. Son and Oh (2006) consider the poisson model compute the Bayes estimates using Gibbs sampling procedure under vague priors and compare their performance with the maximum likelihood estimators and modified moment estimators.

This BP comparison can be helpful in providing necessary guidelines for planning the cause of action for the place. The public health facility to present the BP and the health service facility to stop BP fatal are played important role to rank the places. The observed cases for each place can be modeled as a poisson model. The Bayes estimators of the parameter of the poisson model are studied under Uniform prior. All relevant calculations are performed by using SPSS software. For the Blood Pressure the posterior distribution using uniform prior has been calculated.

Model

The comparison of BP is performed by comparing the observed number of cases per number of cases for region i. Let the probability for an individual to get BP be λ, with the probability distribution function f(λ). The relative risk for the ith place has poisson distribution with mean $n_i\lambda_i$ (i=1, 2…, n).

Likelihood Function and Posterior Distribution

The Likelihood function is the joint probability function of the data but viewed as parameters, treating the observed data as

$$L[y_i,\lambda] = \prod_{i=i}^{n} P\left[y_i/\lambda\right]$$

$$= \prod_{i=1}^{n} \frac{e^{-\lambda}\lambda^{y}}{y!}$$

$$\propto e^{-n\lambda}\lambda^{y}, y=\sum y_i$$

Posterior Distribution using Uniform Prior

The posterior pdf is P (λ/y_i) is given by P $(\lambda/y_i) = \frac{H(y_i,\lambda)}{P(y_i)}$ ---------------- (1)

The uniform prior distribution for a poisson probability $g(\lambda) \propto 1$

The joint pdf $H(y_i, \lambda) = e^{-n\lambda}\lambda^y$

The marginal pdf is given by

$$P(y_i) = \int H(y_i, \lambda) d\lambda$$
$$\propto e^{-n\lambda}\lambda^y dy$$

$$\therefore P(\lambda/y_i) = \frac{e^{-n\lambda}\lambda^y}{\int e^{-n\lambda}\lambda^y d\lambda}$$ Which is proportional to (y+1,n) density.

The posterior mean and varience are $\frac{m+1}{n}, \frac{m+1}{n^2}$. The Shrinkage estimator B is useful to know the true posterior mean. $B = \frac{n}{\alpha + n_i}$. This estimator is useful to improving, the estimation by reducing the mean squared error towards zero. The use of shrinkage estimators in the context of regression analysis has been discussed by copper (1983) in presence of large number of explanatory.

Posterior Probability under Uniform Prior and Ranks

S. No	Place	yi	ni	$\frac{y_i}{n_i} = \lambda_i$	P( )	Rank
1	Anchugramam	1	25	0.04	0.0530	18
2	Nagercoil	2	32	0.0625	0.1608	12
3	Thuckaly	3	53	0.0566	0.1259	14
4	Azhakiyamandapam	1	11	0.0909	0.3754	6
5	Marthandam	1	21	0.04761	0.07725	16
6	Kuzhiturai	1	31	0.0322	0.0267	20
7	Panachamoodu	2	18	0.111	0.4699	3
8	Kazhiyakavilai	1	29	0.03446	0.0393	19
9	Kollemcode	3	34	0.088	0.3473	7
10	Keripparai	1	21	0.04761	0.07725	16
11	Thittuvilai	6	47	0.1276	0.4723	1
12	Kallankuzhi	2	23	0.0869	0.3162	8
13	Kaliyal	1	17	0.0588	0.1321	13
14	Pechipparai	2	24	0.0833	0.3071	9
15	Palukal	3	31	0.0967	0.3861	4
16	Kulasekaram	4	43	0.0930	0.3754	5
17	Karugal	3	26	0.1153	0.4685	2
18	Monday Market	2	37	0.0540	0.1207	15
19	Manjalumoodu	3	37	0.0810	0.2936	10
20	Attor	3	40	0.075	0.2413	11

Discussion

Among the places in Kanyakumari district maximum BP cases are recorded in Thittuvilai and Azhahiyamandabam, Palukal, Kulasekaram, Karungal are the places with high risk from the results in the table1. Anchugramam, Kuzhithurai, Kollemcode are the places with low risk factor. However, when the true burden of BP is considered via the posterior expectation of λ the ranking of the places showed several changes as evident from table 1. Since the risk factor is high almost in all the districts, necessary steps should be taken to control the deaths due to Blood Pressure. A rapid and appropriate laboratory diagnostic tests are needed to control the deaths due to Blood Pressure.

Conclusion

The ranking is based on blood pressure can be computed. It is helpful in providing necessary guidelines for planning the course of action for the places.

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