CHAPTER 51

STATISTICS

Doctoral Theses

01. JOSHI (Lalit Mohan)
Statistical Modelling for Assessing Psychological Health of Young Adults- An Insight of Three Chronological Surveys During COVID-19 Period in India.
Supervisor: Prof. Alka Sabharwal
Th 29276

Abstract

The uncommon uncertainty of the COVID-19 pandemic had a major effect on the psychological well-being of individuals, especially young adults. We collected data on young adults through three chronological surveys using the Strength and Difficulty Questionnaire (SDQ) 17+ extended version. The first survey (May–June 2020) collected 1,020 responses; the second survey (October 2020–February 2021) collected 743 responses; and the third survey (January–February 2022) collected 934 responses and included both the SDQ and the General Health Questionnaire (GHQ-12). The thesis offers a statistical and empirical study. We examine the effect of lockdown on the behavioural issue through the 'Chronicity' (duration of distress). Next, we examine post-first COVID-19 wave recovery, highlighting more behavioural issues among females. Using the Ordinal Regression (OR) model, we predicted the 'Impact' score (social dysfunction) through four 'Difficulty' scales, but the OR model was unable to predict the 'Borderline' category. After the 'delta' wave in India, we conducted a third survey to assess changes in distress over time by gender, age, income, and COVID-19 status. Female respondents reported higher distress, while age and income had no significant effect. Academic disruption emerged as the area most affected across the surveys. To overcome limitations of the OR model, Quantile Regression (QR) and Quantile Regression Neural Network (QRNN) models were used. The QRNN model indicates better predictive power. A Markovian model was developed to estimate transition probabilities and stationary distributions across surveys for common respondents, using QR and QRNN outputs. Finally, the Bivariate Normal (BVN) model was used to estimate GHQ-12 scores from SDQ data. The model was validated through simulation and applied to earlier datasets, including 162 common respondents. Overall, the thesis highlights the critical role of statistical modelling in understanding the development of psychological problems in young adults during the pandemic.

Contents

1. Introduction 2. Assessing psychological health of young adults at the time of outbreak of covid-19 in India through internalizing and externalizing scores of sdq: a survey report 3. Evaluating the dynamics of the psychological health of young adults in India as the first covid-19 pandemic wave subsided over time: second survey report 4. An application of ordinal regression to extract social dysfunction levels through behavioral problems 5. Changes in psychological health with progression of covid-19: a study through three chronological surveys 6. Extracting social dysfunction through components of difficulty scores using quantile regression and

quantile regression neural network models 7. A markov model to quantify the transitions in the psychological health of young adults in India during the covid-19 pandemic 8. Modeling GHQ total and SDQ difficulty score to extract incomplete information on one using the other 9. Conclusion and future directions. List of Publications, Conferences, Appendixes and Bibliography.

02. SONI (Sakshi)
Contributions to Reliability Modelling with Prediction for Future Observations using Censored Lifetime Data.
Supervisor: Dr. Ashish Kr. Shukla
Th 29378

Abstract

This research focuses on performing inferential analysis for specific lifetime distributions under various censoring schemes. Several key measures for examining these lifetime models include parameter estimation, reliability and hazard rate estimation and stress strength reliability analysis which have been extensively utilized in research for a significant duration. This thesis is mainly concerned with estimating and comparing model parameters, hazard rate and reliability measures within both classical and Bayesian paradigm. Another key objective is to predict censored and future observations employing Bayesian techniques. The thesis begins by articulating the underlying motivation for the research and providing a critical review of the existing literature, followed by a systematic exposition of the fundamental principles on which the subsequent analyses are based. We examine a Weibull-G family of distributions under progressively type-II censoring scheme. We derive the uniformly minimum variance unbiased, maximum likelihood (ML) and Bayes estimators for the parameter and reliability measures along with their exact confidence intervals. Next, we examine the generalized half logistic distribution under hybrid and unified hybrid censoring schemes (UHCS) and compare the resulting outcomes. In classical estimation, we use ML, Expectation-Maximization based ML, and maximum product of spacing (MPS) estimators, while in Bayesian estimation we employ importance sampling and the Metropolis–Hastings algorithm. We again employ UHCS and conduct inference for power Lindley distribution under classical and Bayesian paradigm. For all the considered distributions, we have performed Bayesian prediction for future and censored observations. The study employs both simulated and real-life data sets related to failure times to implement statistical methods. We perform a simulation study to evaluate the effectiveness of the proposed estimators. In addition, we examine multiple real-world datasets to illustrate the efficacy of the proposed approaches. Lastly, we highlighted the major findings and several possible directions for future research expansion.

Contents

1. Introduction 2. Statistical inference and prediction for the Weibull-G family of distributions under progressive type-II censoring 3. On estimation and prediction for the generalized half-logistic distribution under hybrid censoring 4. Statistical inference for a unified hybrid censored generalized half logistic lifetime model 5. An inferential analysis for the power Lindley distribution using unified hybrid censored data 6. Conclusion and future Scopes. Bibliography.