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Editorial Office

Department of Biostatistics

National Institute of Mental Health and Neuro Sciences

Bengaluru - 560 029

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Message from the ISMS President

Dear esteemed Editor and Editorial board members,

Thank you very much for your Interest in bringing out the first issue of ISMS bulletin 2025. Congratulation for all your joint hard work. I am sure you must have incorporated good academic content, recent news items, and information regarding statistical events etc.

Now as we know Biostatistics as a subject and Biostatisticians as a community are opened with opportunities and challenges. There are many players dealing with medical research and medical data. New paradigm of AI, Machine learning, ChatGPT etc. create a challenging environment and demand for reshaping our approach to Medical research and to Medical researchers. As a group our communication and unity is very important. I am sure under your leadership, bulletin will be connecting the dots.

All the best.

Sincerely
Dr.N. Sreekumaran Nair
President, ISMS

Message from the ISMS General Secretary

Dear Esteemed Members,

Greetings from the Indian Society for Medical Statistics!

It is with great pleasure that I am elated to hear about the release of the latest issue of the ISMS Bulletin. This platform always strengthens our professional bonds and allows us to exchange knowledge. Moreover, regularly publishing the Bulletin, further strengthening our society, brings together a wealth of ideas, recent scientific advancements and other activities related to our discipline.

I hope you will find several insightful articles and updates about the recent conferences, workshops, and other initiatives undertaken by our members. I encourage all members to contribute actively by submitting articles, sharing noteworthy developments, and participating in society activities.

I sincerely thank the ISMS Bulletin Editorial team and contributors for their hard work and commitment in bringing out this edition.

Finally, I invite each one of you to participate in the 43rd Annual Conference of the ISMS (ISMSCON-2025) at All India Institute of Medical Sciences, Mangalagiri, scheduled from 20-22 November 2025.

Let us continue to work together and support one another for the growth of our profession.

Dr. B. Binukumar

General Secretary, ISMS

Message from Editor's Desk

Dear ISMS Members,

Warm greetings from the Editorial Board of ISMS Bulletin!

The Editorial Board of ISMS Bulletin have great privilege of releasing the first issue of ISMS Bulletin in the year 2025. We have constituted a new Editorial Board this year and tried to bring a few innovative contents like Book reviews and Students corner in the current release of the Bulletin.

As you all know, the Society Bulletin serves as a newsletter mainly focusing on various events related to statistics/biostatistics held during the period as well as such future planned events in various institutes across the country. In addition, the Bulletin publishes statistics/biostatistics technical notes received from our esteemed members. We request all members for their full cooperation and support in releasing future issues of ISMS Bulletin and request for contributions with respect to news, events, book reviews, students corner, and technical notes.

I take this opportunity to express my deep sense of gratitude to the ISMS Secretariat and the Editorial Board members for their wholehearted support and for taking the time to volunteer to publish this issue of the ISMS Bulletin.

Dr. Binu. V.S, Ph.D

Editor, ISMS Bulletin

Editorial Board Members – ISMS Bulletin

Dr. Binu.V.S is currently working as Associate Professor, Department of Biostatistics at National Institute of Mental Heal and Neurosciences (NIMHANS), Bengaluru. Master in Statistics from the University of Kerala, Trivandrum, and obtained Ph.D from Manipal University, Manipal in 2012. He has 25 years of research and teaching experience in the field of biostatistics and epidemiology and has more than 100 research publications in various national & international journals. He was the gold medalist for UG statistics program of the University of Kerala in 1996. He was the treasurer of the International Biometric Society Indian Region from 2015-2023.

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Dr. Amrutha Jose is a Scientist C (Biostatistics) at the Indian Council of Medical Research – National Institute of Immunohaematology (ICMR-NIIH), Mumbai. She earned her PhD in Biostatistics from the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru. With over a decade of teaching and research experience, she has served at CHRIST (Deemed to be University), NIMHANS, Amrita Institute of Medical Sciences, and ICMR-NCDIR. Her expertise includes multilevel modeling, survival analysis, clinical trials, epidemiological methods, and statistical applications in mental health, hematological, and global health research. She has authored more than 25 peer-reviewed publications and several book chapters in reputed journals and books. Recognized with the IBS-IR Young Biometrician Award (2023) and multiple best paper awards, she also serves as Executive Member of the International Biometric Society (Indian Region) and actively contributes to professional associations in biostatistics**.**

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Rules for Professor C M Pandey Award

This Award, instituted in the year 2024, will be started from the year 2025 with an endowment received from the family of Late Dr. C M Pandey, Former Professor & Head, Department of Biostatistics & Health Informatics, SGPGI, Lucknow (UP), a Senior Fellow & Past President of the Society, IEA President and an eminent biostatistician. Dr. C M Pandey who left us for his heavenly abode in the year 2023, had contributed tremendously in biostatistics (including epidemiology) and also to the ISMS and this Society, in his honor, decided to start this Award.

Purpose of the Award:

This Award is given once a year to a young scientist (including an early career researcher) who is first author of the best published paper – out of those submitted for the Award in that year, in Biostatistics, Epidemiology & Health Informatics – focusing on statistical modelling, application of newer bio-statistical or epidemiological methods, digital health and advancement of bio-statistical specialty.

Eligibility for the Award:

The applicant should fulfill following requirements.

1. He / she should be below 45 years of age (on 31 March of the Conference year).
2. He / She should be a Life Member of the Society.
3. He / She should be the first author of the published paper, submitted for the Award.
4. The submitted paper for the Award, should have been published in a peer-reviewed journal (PubMed or Scopus), within 3 years, excluding the year of the Conference.
5. The submitted published paper should not have received any other Award earlier.

Submission of Entries for the Award:

Entries for the Award should be submitted online, through an e-mail, addressed to the Chair - Awards Committee of the ISMS with a copy to its General Secretary. Entries should reach the Society before the deadline, set by the General Secretary for the purpose in its Circular for that year. The application for the Award, must accompany following documents as scanned copies in form of attachments.

1. A copy of applicant's Brief Biodata (1 page).
2. Life Membership no. (LM no.) of ISMS or any other evidence towards Membership of the Society.
3. High School Certificate / Birth Certificate as proof of the age.
4. Published paper.
5. A 'No Objection Certificate' from co-authors of the paper.
6. A Certificate, duly signed by the applicant, that the submitted paper has not received any other award earlier and that, it was not submitted to the Society for this Award earlier.

Criteria for Evaluation:

All valid entries, received for the Award, shall be evaluated by the Awards Committee – using some objective criteria, for the purpose. Based on the recommendations of the Awards Committee, Governing Council of the Society will take a final decision on the paper for the Award, subject to the ratification by the General Body. If no suitable entry is received or no paper is found worthy for the Award by the Awards Committee, the Award shall not be given in that year. Further, a paper - found not suitable for this Award in a year by the Awards Committee, cannot be resubmitted ever for this Award.

Conferment of the Award:

This Award carries a cash prize (in form of Demand Draft / Multi-City Cheque) for Rs. 25,000/= along with a Certificate of Honor and a token of Memento. Final decision on the winning entry for the Award is taken in the ISMS Business Meetings, to be held during the Annual Conference of the Society for that year, but the Award is presented to the candidate during the Inaugural Function of the next year's Annual Conference, where the candidate would come to attend the Conference and receive the Award at his/her own cost.

Sample Size Estimation in Rare Disease Research: A Practical Framework for Indian Researchers

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Abstract

Sample size estimation in rare disease research is a critical methodological challenge, particularly in low- and middle-income countries like India, where data paucity, resource limitations, and heterogeneity of conditions pose significant barriers. Traditional statistical methods often fall short due to small patient populations and complex clinical presentations. This article provides a comprehensive and practical framework focusing to Indian researchers, emphasizing innovative approaches such as Bayesian methods, simulation-based estimation, adaptive designs, and the use of external controls. Key regulatory and ethical considerations are discussed within the context of Indian guidelines, along with the role of emerging national registries and hospital-based data sources. A decision-tree model is proposed to aid researchers in selecting context-appropriate sample size methodologies based on study objectives, data availability, and methodological feasibility. The article underscores the importance of early biostatistical involvement, transparent reporting, and multi-center collaborations to enhance study validity and ethical integrity. By contextualizing global best practices within India's unique landscape, this framework seeks to support more effective and credible rare disease research that can inform policy and improve patient outcomes.

Keywords: Rare diseases; Sample size estimation; Bayesian methods; Adaptive designs; Indian research; Biostatistics framework

1. Introduction

Sample size estimation is a fundamental aspect of biomedical research, directly influencing the validity, reliability, and ethical integrity of study outcomes. An appropriately calculated sample size ensures that a study has sufficient power to detect meaningful effects, thereby enhancing the validity and reliability of its findings. Conversely, an inadequately sized sample can lead to inconclusive results, ethical concerns, and resource wastage. Recent literature underscores the critical role of sample size determination across various study designs, including cross-sectional surveys, case-control studies, and cohort studies (Sadiq et al., 2025).

In the realm of rare diseases, sample size estimation presents unique challenges. The inherently low prevalence of these conditions leads to limited patient availability, making it difficult to recruit sufficient participants for statistically robust studies. Additionally, the heterogeneity of rare diseases – manifested through diverse genetic, phenotypic, and clinical presentations – complicates the standardization of study protocols. These factors collectively hinder the application of conventional statistical methods, necessitating innovative approaches to study design and analysis.

In India, the challenges are further compounded by systemic issues. The absence of comprehensive rare disease registries, limited awareness among healthcare professionals, and infrastructural constraints hinder research efforts. The National Policy for Rare Diseases (2021) acknowledges these hurdles and emphasizes the need for a structured approach to rare disease

research (Ministry of Health and family Welfare, 2021). However, there remains a lack of practical frameworks adapted to the Indian context, leaving researchers without clear guidance on methodological best practices.

This article aims to bridge this gap by providing a user-friendly, methodologically sound guide for planning sample size in rare disease studies, with a focus on the Indian research landscape. By addressing the unique challenges posed by rare diseases and considering the specific needs of Indian researchers, this article seeks to facilitate more effective and ethical research practices in this critical area of public health.

2. What Makes Rare Disease Research Unique?

Rare diseases are characterized by their low prevalence, diverse clinical manifestations, and complex diagnostic and therapeutic challenges. Understanding their unique attributes is essential for designing effective research studies, particularly in countries like India where data and resources may be limited. Globally, a rare disease is often defined as a condition affecting fewer than 1 in 2,000 individuals. This definition is widely adopted by organizations such as the World Health Organization (WHO) and Orphanet, a European reference portal for information on rare diseases (Wang et al., 2024; World Health Organization, 2025). In India, the National Policy for Rare Diseases (NPRD) 2021 acknowledges the absence of a precise prevalence-based definition due to limited epidemiological data. Instead, the policy categorizes rare diseases into three groups based on factors like treatment availability and disease severity, rather than specific prevalence thresholds (Ministry of Health and family Welfare, 2021).

Researching rare diseases presents several challenges. 1) The low prevalence of rare diseases makes it difficult to recruit sufficient participants for statistically robust studies. 2) Many rare diseases are genetic in origin, leading to significant heterogeneity in clinical presentation and progression, complicating the standardization of study protocols. 3) The lack of established diagnostic criteria and treatment guidelines for many rare diseases can hinder the design and approval of clinical studies. These factors necessitate innovative research methodologies, such as adaptive trial designs and international collaborations, to effectively study rare diseases.

India faces a significant burden of rare diseases, including: Inherited Bone Marrow Failure Syndromes which is a group of disorders caused by genetic mutations affecting blood cell production, Inborn Errors of Metabolism which are genetic conditions resulting in metabolic pathway disruptions, leading to various health issues, and Hemoglobinopathies which are disorders like β-thalassemia and sickle cell anemia, prevalent in certain Indian populations, particularly among tribal communities (Ghosh et al., 2015; Sheth et al., 2024). Recognizing and addressing these unique challenges is crucial for advancing rare disease research in India. Tailored strategies that consider the country's specific context are essential for improving diagnosis, treatment, and patient outcomes.

3. Statistical Challenges in Sample Size Estimation

Designing clinical studies for rare diseases presents unique statistical challenges, primarily due to the limited availability of participants and the inherent variability of these conditions. Traditional sample size estimation methods often fall short in this context, necessitating alternative approaches to ensure robust and reliable results (Margolis, 2018).

3.1. ***Small Population Size:*** The rarity of diseases means that the pool of eligible participants is inherently small. This limitation makes it difficult to achieve the sample sizes typically required for conventional statistical analyses, which rely on large-sample approximations. As a result, studies may lack the statistical power to detect meaningful effects, increasing the risk of Type II errors (false negatives) (Hilgers et al., 2016; Serdar et al., 2021).

3.2. ***Impact of Effect Size Assumptions:*** In small-sample studies, the estimation of effect sizes becomes particularly challenging. Overestimation of effect sizes can lead to underpowered studies, while underestimation may result in unnecessarily large and potentially unfeasible sample size requirements. This uncertainty necessitates careful consideration and, where possible, the use of prior data or pilot studies to inform effect size estimates (Zhang et al., 2013).

3.3. ***Overcoming Type I and II Errors:*** The balance between Type I (false positive) and Type II (false negative) errors is delicate in rare disease research. Small sample sizes increase the variability of estimates, which can inflate the risk of both error types (Shreffler & Huecker, 2023). Adaptive trial designs, such as group sequential designs or sample size re-estimation methods, offer flexibility by allowing modifications based on interim data, thereby helping to maintain appropriate error rates (Pallmann et al., 2018).

3.4. ***Missing Data and Dropouts:*** Missing data and participant dropouts have a more pronounced impact in rare disease studies due to the already limited sample sizes. Each missing data point represents a significant loss of information, potentially biasing results and reducing statistical power (Kang, 2013). Implementing strategies such as over-recruitment to account for anticipated dropouts, employing robust data imputation methods, and ensuring rigorous follow-up protocols are essential to mitigate these issues (Woods et al., 2024).

4. Practical Approaches and Methods

Designing clinical studies for rare diseases necessitates innovative statistical methodologies to address challenges such as small sample sizes, heterogeneity, and ethical considerations. Below are practical approaches that researchers can employ:

4.1. ***Use of Exact Methods and Bayesian Approaches:*** Bayesian methods are particularly advantageous in rare disease trials due to their ability to incorporate prior information and expert opinion, thus enhancing statistical power even with limited data. For instance, Bayesian adaptive designs have been successfully applied in rare disease studies to reduce sample sizes and improve trial efficiency. Bayesian approaches are preferred when prior information is available, and the sample size is too small for reliable frequentist inference (Brus et al., 2022; Kidwell et al., 2022). They are also beneficial when interim analyses and adaptive modifications are anticipated.

4.2. ***Simulation-Based Methods:*** Simulation-based methods are particularly useful for sample size estimation when traditional analytical solutions are complex or intractable. Techniques such as Monte Carlo simulations or bootstrapping enable researchers to model various scenarios and assess the likelihood of achieving specific outcomes under different conditions. The process begins by clearly defining the study objectives and endpoints,

followed by specifying key parameters such as the expected effect size, variability, and significance level (Morris et al., 2019). Simulations are then conducted across a range of sample sizes to evaluate the power of the study to detect the desired effect. By analyzing these outcomes, researchers can determine the minimum sample size required to achieve adequate statistical power, thereby enhancing study efficiency and ensuring robust design, especially in complex or rare disease settings.

4.3. ***Use of External Controls or Historical Data:*** The use of external controls or historical data can be a valuable strategy in clinical trials where recruiting a concurrent control group is either unethical or impractical, such as in the case of rare diseases (Ghadessi et al., 2020; Khachatryan et al., 2023). By using previously collected data as a comparator, researchers can enhance the feasibility of trials and reduce the burden on patients. However, the successful implementation of this approach requires careful attention to several factors. First, the historical data must be of high quality and sufficiently comparable to the current study population in terms of demographics, disease characteristics, and treatment settings. Second, appropriate statistical adjustments, such as propensity score matching, should be employed to minimize the impact of confounding variables and enhance the validity of comparisons. Finally, it is essential to predefine the use of historical controls in the study protocol and engage in early discussions with regulatory authorities to ensure compliance and acceptability of the approach.

4.4. ***Adaptive Designs:*** Adaptive designs offer a flexible approach to clinical trials, allowing for modifications to the trial design or statistical procedures after initiation without compromising the validity or integrity of the study (Kaizer et al., 2023; Mahajan & Gupta, 2010). One key feature is the ability to perform interim analyses and sample size re-estimation based on accumulating data, which helps ensure adequate statistical power while optimizing the use of resources. These designs are increasingly accepted by regulatory agencies such as the U.S. Food and Drug Administration (FDA), provided that adaptations are pre-specified in the trial protocol and the overall scientific rigor is maintained (US Food and Drug Administration, 2019). Transparent and proactive communication with regulatory bodies is crucial to ensure that adaptive methods comply with regulatory expectations and maintain the credibility of trial outcomes.

4.5. ***Alternative Designs:*** Alternative study designs such as N-of-1 trials, crossover designs, and case-control studies can be particularly advantageous in the context of rare diseases, where traditional randomized controlled trials may be challenging due to small sample sizes. N-of-1 trials involve individual patients undergoing multiple treatment periods while serving as their own control, making them especially valuable in situations with high between-subject variability (Defelippe et al., 2023). Crossover designs, wherein participants sequentially receive multiple treatments, allow for within-subject comparisons and increase statistical power by reducing variability. Case-control studies offer an efficient approach to investigating rare outcomes by comparing individuals with the disease (cases) to those without (controls). These alternative designs are especially relevant in single-centre studies or when leveraging existing patient registries, where the number of available participants is limited but long-term follow-up is possible, thus enabling robust and meaningful insights despite smaller sample sizes.

5. Indian Context: Resources, Constraints, and Opportunities

India, with its vast and diverse population, presents both unique challenges and emerging opportunities in the field of rare disease research. Effective sample size estimation in this context requires consideration of the country's regulatory environment, data infrastructure, and collaborative potential.

5.1. Regulatory and Ethical Considerations

Rare disease research in India is governed by a dual regulatory framework involving the Central Drugs Standard Control Organization (CDSCO) and Indian Council of Medical Research (ICMR). The ICMR's National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (Indian Council of Medical Research, 2017) provide essential guidance for protecting participants in studies with small sample sizes and higher uncertainty – typical of rare disease research. The CDSCO has also endorsed adaptive designs and conditional approvals for orphan drugs, recognizing the need for flexible evidence requirements in such contexts (Central Drugs Standard Control Organization, 2019).

India's recently updated NPRD (Ministry of Health and family Welfare, 2021) emphasizes research and development, including support for epidemiological studies and the creation of diagnostic and therapeutic guidelines. It also supports compassionate use and waiver of local clinical trial requirements for approved orphan drugs, providing regulatory pathways that can be strategically used to design small, pragmatic studies.

5.2. Data Availability: RDCRN, ICMR Rare Disease Registry, Hospital-Based Registries

A critical constraint in India is the paucity of structured epidemiological data for most rare diseases. However, several initiatives are improving this scenario:

- *ICMR Rare Disease Registry:* Launched to create a comprehensive national database for rare diseases, aiding both patient care and research planning (Ministry of Health and Family Welfare; Government of India, n.d.).
- *Rare Disease Clinical Research Network (RDCRN):* Modeled on the global RDCRN, it aims to support collaborative clinical research and data harmonization (Lumsden & Urv, 2023).
- *Hospital-Based Disease Registries:* Tertiary care centers and research organizations maintain local registries for conditions like inherited bone marrow failure syndromes (IBMFS), hemoglobinopathies, and inherited platelet disorders (IPDs), which are valuable for sample size planning in focused studies.

Given the low prevalence of rare diseases, single-center studies often fail to achieve sufficient power. Multi-center collaborations across public and private institutions allow pooled data collection and enhance generalizability. Collaborative grants from DBT, ICMR, and DST also support cross-institutional research with harmonized protocols and joint sample size determination.

6. Decision Tree for Indian Researchers

Designing studies in rare disease settings requires a balance between scientific rigor and the pragmatic constraints of limited sample size, sparse data, and funding. This section presents a decision tree to help Indian biomedical researchers choose appropriate sample size estimation methods based on three primary domains: study objective, data availability, and methodological fit.

Step 1: Define the Study Objective

Start by identifying the primary goal of the study:

- Estimating a prevalence or rate → Proceed to Step 2a
- Testing a hypothesis (e.g., treatment effect, association) → Proceed to Step 2b
- Exploring a biological mechanism or conducting early-phase trials → Proceed to Step 2c

Step 2a: For Prevalence or Rate Estimation

- Is there existing data from Indian registries (e.g., ICMR Rare Disease Registry)?
    - Yes → Use exact binomial methods or Bayesian approaches with prior information.
    - No → Consider pilot studies or use broad credible intervals with conservative assumptions.

Step 2b: For Hypothesis Testing (e.g., two-group comparison)

- Are comparable historical or registry-based controls available?
    - Yes → Consider Bayesian methods with informative priors or use of external controls with adjustment.
    - No, but you can simulate scenarios → Use Monte Carlo simulation or bootstrapping.
- Are adaptive elements possible (e.g., interim checks)?
    - Yes → Implement adaptive designs with sample size re-estimation.
    - No → Consider sequential or crossover designs with small samples.

Step 2c: For Mechanistic or Early Exploratory Studies

- Single or small number of participants per condition?
    - Yes → Use N-of-1 trials, case series, or single-arm exploratory designs.
- Can data be aggregated from similar sites or centers?
    - Yes → Opt for multi-center collaborative studies with centralized biostatistical planning.

7. Conclusion

Accurate sample size estimation is a cornerstone of scientifically robust rare disease research. Given the inherent challenges such as low prevalence, patient heterogeneity, and limited data availability, Indian researchers must adopt innovative, flexible, and methodologically sound approaches tailored to their unique research environments. This article emphasized the importance of transparent planning, appropriate method selection (including exact, Bayesian, simulation-based, and adaptive designs), and ethical considerations aligned with regulatory frameworks like ICMR and CDSCO.

A key takeaway is the necessity for early and ongoing engagement with statisticians and methodologists to ensure the feasibility and validity of sample size calculations. Transparent reporting of assumptions, limitations, and analytic strategies in protocols and publications will enhance the credibility and reproducibility of rare disease studies. Moreover, promoting institutional support through dedicated training programs, capacity building in advanced statistical techniques, and facilitating collaborations across centers can greatly amplify research quality and impact.

In the Indian context, leveraging existing registries, promoting multi-center studies, and encouraging adaptive and innovative designs are practical strategies to overcome sample size

constraints while adhering to ethical and regulatory standards. Ultimately, these recommendations aim to empower researchers to generate meaningful, generalizable evidence that can improve patient care and health policy for rare diseases in India and beyond.

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Biostatistics at the Crossroads: Opportunities, Skills, and Challenges for the Future of Healthcare

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Abstract:

Biostatistics is rapidly evolving with the growth of health data, artificial intelligence, and genomic medicine. This article outlines the key opportunities, essential skills, and major challenges shaping the future of the discipline. Strengthening technical expertise, fostering collaboration, and addressing ethical and reproducibility concerns will be central to ensuring biostatistics continues to drive progress in healthcare.

Keywords: Biostatistics; Healthcare; Artificial intelligence; Genomic medicine; Data challenges; Future skills

1. Introduction

Biostatistics today stands at a defining crossroads. The discipline is being reshaped by rapid advances in digital technology, unprecedented expansion of health data, and growing demands for personalized healthcare. As the boundaries between medicine, data science, and informatics overlap, biostatisticians are becoming indispensable drivers of innovation - yet they also face complex new challenges. From analyzing the flood of genomic data to ensuring the ethical application of artificial intelligence, the role of biostatisticians is evolving at remarkable speed (Informatics Magazine 2025). This article explores the transformative trends shaping the field, the skills needed to thrive in the next decade, and the challenges that must be addressed to sustain scientific rigor and impact.

2. The evolving landscape of Biostatistics

2.1 The surge of health data

Healthcare and life sciences are now among the most data-intensive sectors. From electronic health records and wearable devices to imaging platforms and genomic sequencing, the sheer scale of health data is unprecedented. Projections suggest that healthcare data will expand at a staggering 36% annually - faster than nearly any other industry (Gore 2024). Biostatisticians play a central role in transforming this raw data into meaningful knowledge: uncovering disease mechanisms, predicting patient outcomes, and informing public health policies. Without rigorous statistical modeling and interpretation, this flood of data risks remaining an underutilized resource (Gore 2024; Informatics Magazine 2025).

2.2 Integration of artificial intelligence and machine learning

Artificial intelligence and machine learning are revolutionizing biomedical research. These methods can identify intricate patterns in data, predict health outcomes, and automate analyses once restricted to traditional statistical frameworks (Choudhury & Goel 2025). Applications range from genomics to electronic registries, where predictive models are transforming diagnosis, treatment optimization, and health system planning. Yet, artificial intelligence is not a replacement for biostatistics - it is a partner. Biostatisticians must acquire new competencies in algorithm development, validation, interpretability, and ethical oversight to ensure these technologies are applied responsibly.

2.3 Rise of bioinformatics and genomic medicine

The fusion of biostatistics and bioinformatics has become essential for interpreting genomic, proteomic, and metabolomic datasets. This partnership drives the promise of precision medicine, where treatments and preventive strategies are tailored to individuals based on genetic and molecular profiles (Gore 2024). By applying statistical tools to sequence data, biostatisticians identify disease-associated genes, model protein structures, and enable customized therapies.

2.4 From clinical trials to real-world evidence

Traditional clinical trials remain a cornerstone of biomedical science, but the rise of real-world evidence is broadening the scope of inference. Using patient registries, insurance claims, and digital health data, real-world evidence complements clinical trials by providing insights into how interventions perform in diverse, everyday settings (Gore 2024; LinkedIn 2025). Biostatisticians now design adaptive trials, analyze longitudinal data, and interpret observational evidence - all while ensuring adherence to evolving regulatory standards.

2.5 Collaborative and cloud-based analytics

Cloud computing platforms have democratized data access, enabling global collaborations and scalable analyses. Biostatisticians can now work seamlessly across continents, but this convenience also raises pressing issues of data privacy and cybersecurity (Informatics Magazine 2025). Ensuring safe yet open data ecosystems is becoming a vital professional responsibility.

3. Essential skills for future biostatisticians

To remain at the forefront, biostatisticians must expand beyond traditional training and cultivate a multidisciplinary skillset:

3.1 Technical proficiency

Expertise in statistical programming (R, Python, SAS) and database management (SQL) is essential. Familiarity with workflow automation (Airflow, Snakemake) and containerization (Docker) ensures reproducible, portable research pipelines (Informatics Magazine 2025; LinkedIn 2025).

3.2 Advanced analytics

Skills in machine learning, deep learning, and big data techniques are increasingly required to analyze high-volume, high-variety datasets, especially in genomics and population studies (Informatics Magazine 2025; O'Brien 2022).

3.3 Visualization and communication

Tools such as ggplot2 and Tableau enable complex results to be conveyed clearly to clinicians, regulators, and policymakers. Strong writing and presentation skills remain critical for translating statistics into actionable insights (MMS Holdings 2024; Slade et al. 2023).

3.4 Clinical and epidemiological expertise

Understanding study design, adaptive trials, and longitudinal methods is essential. Equally important is knowledge of global regulatory frameworks (GDPR, HIPAA) and research ethics (MMS Holdings 2024).

3.5 Collaboration and project management

Biostatistics is increasingly team-driven. Skills in interdisciplinary collaboration, project management, and leadership of open science initiatives are essential to drive large-scale studies (Slade et al. 2023).

4. Key challenges ahead

While the opportunities are vast, biostatistics faces pressing obstacles that demand innovation and resilience:

4.1 Data complexity and integration

Healthcare data is multi-modal - spanning electronic health records, genomic platforms, imaging, and wearables. Integrating these diverse sources into analysis-ready formats is technically demanding and requires advanced programming and data engineering capabilities (Gore 2024; Informatics Magazine 2025).

4.2 Data privacy, security, and ethics

Protecting sensitive health data is a central concern. The widespread adoption of cloud analytics and data sharing raises risks around privacy breaches, insecure storage, and unauthorized access. Biostatisticians must balance open science with the protection of sensitive patient data, ensuring compliance with ethical and legal standards (Choudhury & Goel 2025).

4.3 Algorithmic bias and model validation

Artificial Intelligence models can perpetuate biases present in training data, leading to inequities in healthcare delivery. Biostatisticians must ensure fairness, transparency, and interpretability in models that increasingly inform clinical care and policy decisions (Informatics Magazine 2025).

4.4 Workforce shortages and training gaps

The demand for biostatisticians is outpacing supply worldwide. By 2031, workforce shortages may limit the pace of innovation in health analytics and clinical research. Many academic biostatistics programs struggle to keep curricula up-to-date with the latest computational methods, leaving gaps in practical training (Gharibvand 2025).

4.5 Reproducibility and standardized issues

Inconsistencies in analytic protocols and data pipelines can limit reproducibility and reliability - a fundamental requirement for scientific progress. Harmonizing standards and implementing reproducible workflows is a major challenge as research collaborations become larger and more global (Kohrs, 2023).

4.6 Continuous upgrading and lifelong learning

Rapid advances in tools and analytic methods create a perpetual learning curve and professional development. Biostatisticians must commit to lifelong learning, actively updating their knowledge of emerging methods, technologies, and regulatory landscapes (Coursera 2025; Kirch,2025).

5. Conclusion

Biostatistics stands at an exciting yet demanding juncture. The profession is central to advancing precision medicine, real-world evidence, and global health collaboration. The future biostatistician is not only a statistician but also a programmer, communicator, collaborator, and ethics advocate - bridging the worlds of health, technology, and society. To fully realize this potential, the field must embrace innovation while safeguarding scientific rigor and equity. Technical mastery, adaptability, and continuous learning will be vital. Yet just as important are qualities of curiosity, resilience, and integrity. The road ahead is challenging, but for those ready to lead, biostatistics offers unparalleled opportunities to shape a smarter, healthier future for all.

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A Bite of Biostatistics

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In the quest to make biostatistics more approachable, we often underestimate the power of metaphor. The following is a playful, pedagogical fusion of Indian cuisine and statistical reasoning, a flavorful approach designed to demystify core concepts. Whether used as a teaching tool, a workshop icebreaker or simply a light-hearted reflection on the role of data in our lives, this piece aims to make biostatistics not just understandable but enjoyable.

Welcome to the Biostatistics Cafe a warm, inviting space where clinical insights are served piping hot with a generous sprinkle of statistical flavor and power. Your host, Prof. Goel, believes that grasping biostatistics should be as simple, easy and enjoyable as ordering your favorite snack.

The Menu: Statistics Served Fresh

Here at the Biostatistics Cafe, every dish on the menu is a tasty twist on a fundamental concept. Let's walk through the menu:

- ***p-value Paratha*:**

A crispy golden delight that is too often misunderstood. Just because it is below 0.05 does not mean it represents the full story. Best enjoyed with Confidence Interval (CI) chutney.

Lesson: A p-value indicates how likely your results are under the assumption that the null hypothesis is true but it does not reveal the practical significance of the effect size.

- ***Regression Risotto***:

Rich, creamy and delightfully complex, this dish harmoniously blends multiple ingredients (variables) to craft the perfect outcome. Depending on your analytical appetite, customize it with your choice of linear, Logistic, or Cox Proportional Hazards seasoning.

Lesson: Regression models help control for confounding factors and reveal the true relationship between variables, providing a clearer picture of effect size and direction.

- ***Type I Error Tikka:***

Looks tasty but deceives. You thought there was an effect such as chicken but it was tofu all along. A classic false positive.

Lesson: A Type I Error (α) occurs when we reject the null hypothesis even though it is actually true, thereby indicating an effect that doesn't genuinely exist.

- ***Type II Error Idli:***

Soft and subtle, so subtle you might miss it completely! You failed to detect a real flavor hiding within. This is your classic false negative.

Lesson: A Type II Error (β) happens when we fail to reject the null hypothesis even though it is actually false, missing a real effect that does exist.

- ***Confidence Interval Curry:***

Served in a 95% bowl, this dish is a comforting classic. Most of the time, it captures the true flavor (mean) but once in a while, it does not. Nonetheless, it is still among the most reliable items on the statistical menu.

Lesson: A confidence interval (CI) provides a plausible range within which the true effect or parameter likely lies, providing more context than a single point estimate.

- ***Power Pakoras:***

Crispy on the outside, packed with strength on the inside, these golden bites help you uncover what is really cooking. The higher the power, the better your chances of detecting a true effect when it exists.

Lesson: Statistical power, defined as Power = 1−β, is the probability of accurately rejecting a false null hypothesis and ensuring that you detect genuine signals in your data.

- ***Null Hypothesis Naan:***

It is simple, unassuming, yet absolutely essential. Served at the start of every meal but rarely the star of the show. It is the foundation on which everything else is built.

Lesson: The null hypothesis assumes no effect or difference, it serves as the baseline against which we test our data, subtly setting the stage for statistical exploration.

- ***Standard Deviation Sambar:***

Hot, spicy and tangy, this dish represents how spread out the flavors are in your sample. The greater the variation, the more robust the flavor!

Lesson: Standard deviation (SD) quantifies the variability or dispersion around the mean, showing how much individual data points differ from the average.

- ***Mean-Median Masala Dosa:***

A dish that is perfectly balanced and elegant, providing both symmetrical and skewed variations. With a filling that conforms to your preferences, it is the standard for assessing central tendency.

Lesson: Use the mean for normally distributed data and the median for skewed data, both measure central tendency but each offers a unique perspective depending on the shape of the data.

- ***Interquartile Range Idiyappam:***

Delicately sliced between Q1 and Q3, this dish captures the middle 50% of the data providing a smooth and balanced flavor. A non-parametric favorite, perfect for those who prefer the essentials.

Lesson: The interquartile range (IQR) measures the spread of data, resistant to outliers, making it ideal for skewed distributions.

- ***Epi Evidence Espresso:***

A strong and bold shot of evidence from well-brewed cohort or case-control studies. Sharp, insightful and ensured to invigorate your comprehension.

Lesson: Study design matters! Good evidence requires good brewing (sampling, matching, adjusting), ensuring the best outcome.

- ***Bias Biryani:***

Aromatic and inviting but beware the hidden biases may be lurking beneath the surface. Is it selection bias, information bias, or a blend of both?

Lesson: Bias distorts your results. Always stir the pot, check the layers and ensure you are not overlooking hidden flaws in your data.

- ***Sampling Samosa:***

Perfectly triangular and crisp, when your sample is representative, it is crunchy with insights. But when it is not, it becomes soggy with error.

Lesson: Proper sampling techniques are essential for ensuring that your results are generalizable and reflect the true population.

- ***Multiple Testing Thali:***

A grand brimming platter of tests. But be cautious, the more tests you run, the higher your chance of finding something just by chance.

Lesson: Adjusting for multiple comparisons is crucial to avoid inflating the risk of Type I errors and ensure your findings are truly meaningful.

- ***Forest Plot Falooda:***

A layered delight of meta-analyses, sprinkled with confidence intervals and topped with effect sizes; a cool, colorful and visual treat for lovers of evidence synthesis.

Lesson: Forest plots visually combine results from multiple studies, making it easier to interpret overall effects and compare consistency across research in a single visual summary.

- ***Funnel Cake of Publication Bias:***

Deceptively sweet but watch for imbalance, if the shape looks lopsided, some results may be missing, often the negative or non-significant ones.

Lesson: Funnel plots help detect publication bias by revealing asymmetry in reported studies, reminding us that not all data makes it to print.

- ***Garbage-In Gulab Jamun:***

Warm and syrupy on the outside but if you started with spoiled ingredients (poor data), no amount of sugar (analysis) can save it.

Lesson: Garbage In, Garbage Out (GIGO) reminds us that flawed input data will always yield flawed conclusions, no matter how sophisticated the analysis is.

Takeaway Tips from Prof. Goel

Like cooking, good research needs the right ingredients (variables), technique (methods), and tasting (validation). Biostatistics helps turn data into decisions, from sample size samosas to power calculation pakoras.

Don’t be afraid of math. Most of biostatistics is logical thinking dressed in numbers.

Why It Matters

Biostatistics isn’t just for academic papers or polished presentations. It is the engine behind vaccine rollouts, epidemic predictions, surgical improvements and lifesaving decisions. Like a welcoming cafe, it opens its doors to all, whether you are a beginner or already a seasoned analyst.

Scientifically speaking, simplifying complex concepts without trivializing them is a challenge that educators constantly face. By weaving statistical tools into a relatable context, we may lower the entry barrier and enhance long-term retention.

Philosophically, food and data are not so different: both nourish, both require careful preparation and both can be ruined with poor technique or inattention. In a world overflowing with information, learning to cook and critique, our biostatistics is more vital than ever.

I hope this Cafe finds a place on your syllabus, your seminar slides, or simply in your smile.

Transforming Medical Research Funding: A Paradigm-Shifting Workshop on Statistical Excellence in Grant Writing

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India's medical research landscape faces a critical bottleneck where exceptional clinical insights fail to secure funding due to inadequate statistical communication and methodological presentation. Over 70% of promising medical research proposals in India fail not due to lack of scientific merit, but due to poor statistical presentation, inadequate sample size justification, and weak methodological frameworks. This represents a massive loss of research potential and innovation capacity for Indian healthcare, creating an urgent need for transformative intervention in research communication excellence.

On February 23, 2025, AIIMS New Delhi orchestrated a revolutionary solution through a comprehensive workshop on "**Grant Writing for Extra-Mural Funding**" that redefined standards for statistical excellence in research proposals. Supported by premier organizations RIPPSCON and IAPS, this groundbreaking initiative established new benchmarks for research communication by bringing together 180 participants who maintained 95% attendance throughout the intensive 8-hour program—virtually unheard of for online statistical workshops. The exceptional engagement demonstrates the workshop's transformative power and critical relevance to India's medical research community.

The workshop introduced revolutionary methodological frameworks that transform abstract clinical questions into statistically robust, fundable research architectures. The groundbreaking "4D Compass" methodology enables researchers to navigate complex statistical landscapes with unprecedented precision, while the innovative "Power Triangle" approach addresses the most common failure points in medical research proposals—inadequate sample size calculations and weak effect size justifications, particularly critical in surgical and clinical research contexts. Most significantly, the workshop pioneered the first-of-its-kind integration of artificial intelligence tools specifically designed for biostatistical proposal development, representing a quantum leap in research methodology presentation and analysis sophistication.

The workshop assembled an elite consortium of statistical minds and funding decision-makers, including masters from AIIMS New Delhi, PGI Chandigarh, and St. John's Medical College, alongside funding agency directors from ICMR, DST, DHR, BIRAC, and NBE providing insider perspectives. CSIR statistical scientists contributed cutting-edge analytical approaches, creating an unparalleled knowledge transfer opportunity that bridges the critical gap between statistical theory and funding reality.

The workshop's statistical excellence framework systematically transformed clinical questions into bulletproof research designs by addressing selection bias elimination through advanced randomization strategies, confounding control via sophisticated statistical modelling approaches, missing data handling using state-of-the-art imputation methods, and survival analysis optimization for time-to-event outcomes. Strategic financial planning components maximized statistical power per rupee invested, ensuring cost-effective research designs that appeal to funding agencies focused on value maximization. The comprehensive approach covered advanced methodological components while maintaining practical applicability for immediate implementation in research proposals.

Measurable outcomes validation revealed that 100% of participants reported enhanced confidence in grant presentation, participants felt equipped to handle advanced statistical sections independently, and expressed readiness to mentor others in statistical grant writing. The workshop's projected long-term impact includes a significant increase in statistically sound proposals from participating institutions and improvement in funding success rates within 12 months. These metrics demonstrate the workshop's transformative potential for India's medical research ecosystem.

The workshop's strategic significance extends beyond individual skill development to catalyze a comprehensive statistical support ecosystem featuring regional statistical consultation networks, AI-powered grant writing assistance platforms, continuous statistical methodology updates, and international collaboration facilitation. By addressing the critical statistical knowledge gap, this initiative unlocks billions of rupees in research funding potential while elevating the quality of Indian medical research to international standards. This workshop transcends traditional educational boundaries, representing a statistical revolution in Indian medical research that combines methodological rigor with strategic funding insights to create a new generation of statistically empowered researchers capable of competing globally for research excellence.

Indian Society for Medical Statistics Conference-2024

The 2024 edition of Indian Society for Medical Statistics (ISMS) conference, organized by the Department of Statistics at Banaras Hindu University (BHU), on 21st-23rd November 2024, commenced with grandeur and reverence. The pre-conference workshop was organized on 20th November; it featured two sessions with distinguished speakers. The program commenced with a warm welcome by Prof. Brijesh Pratap Singh, the organizing secretary of ISMSCON-2024, who greeted both the delegates.

In the first session, Dr. Faizan Danish delivered an engaging talk on "Artificial Intelligence in Medical Sciences", with a focus on Melanoma, a type of skin cancer that originates in melanocytes. He explored the role of artificial intelligence in diagnosing and treating melanoma, highlighting its transformative potential in the medical field.

The second session was led by Prof. S. N. Dwivedi. He delivered an informative session on "Statistics in Evidence-Based Clinical Practice." His discussion provided a deep dive into the application of statistical methods in clinical settings, emphasizing how data-driven approaches enhance the effectiveness and reliability of medical treatments.

The opening ceremony of the ISMSCON began with a floral tribute to the founder of BHU, Madan Mohan Malviya ji, followed by the lighting of the ceremonial lamp and the rendition of the *Kulgéet*, setting a solemn and celebratory tone for the event. The program officially began with a welcome address by Prof. G. P. Singh, Head of the Department of Statistics at BHU. He warmly welcomed the delegates, presenters, and guests, highlighting the significance of the conference in the field of statistical sciences. Following his remarks, Prof. Brijesh Pratap Singh, provided an overview of the conference, outlining its objectives and the importance of fostering collaboration among statisticians globally. The inaugural session continued with the presidential address by Prof. S. N. Dwivedi, the President of the Indian Society for Medical Statistics (ISMS), who emphasized the role of statistics in advancing research and decision-making processes in various fields. Dr. B. Binukumar, General Secretary of ISMS, presented the ISMS activities report, reflecting on the organization's ongoing initiatives and achievements.

Key highlight of the opening ceremony was the inaugural speech by Prof. D. C. Nath, former Vice Chancellor of Assam University, who inspired the audience with his insights on the evolving role of statistics in academia and industry. Prof. Abhay Indrayan, a distinguished statistician, delivered the keynote address, providing a thought-provoking perspective on the future of statistical research and its applications. The cultural richness of the conference was further showcased when Prof. S. M. Singh, Dean of the Faculty of Science at BHU, released the conference souvenir, marking a symbolic moment of connection between the scientific and cultural realms.

The first day of ISMSCON-2024 was packed with intellectually enriching sessions, starting with the **Prof. S. K. Bhattacharya Oration** and the **Prof. P. P. Talwar Lecture**, both of which paid tribute to the legacy of legendary statisticians. The **Plenary Session in Memory of Prof. Arvind Pandey** was also a moving tribute to a pioneer in the field, with insightful presentations on the latest advancements in statistical methodology. A special invited talk by Prof. Sanjay Rai was another highlight, offering valuable perspectives on the intersection of statistics and healthcare. The day concluded on a high note with a cultural program, which brought a sense of joy and camaraderie, boosting the spirits of all participants.

Day 2 of ISMSCON-2024 continued to be an enriching experience for all attendees, with a series of thought-provoking discussions and sessions aimed at deepening the understanding of statistical applications in health and other research fields.

The day kicked off with an engaging **Panel Discussion on "Understanding the Importance of Statistics in Public Health"**, featuring esteemed experts such as **Prof. Gyaneshwar Chaubey**, **Dr. Raghav Mishra**, **Dr. Sameer Singh**, and **Dr. Akhtar Ali**. The panelists delved into the critical role statistics plays in shaping public health policies, health data analysis, and decision-making processes. Their insights highlighted the growing need for robust statistical frameworks to address health challenges effectively. A key highlight of the day was the **Invited Talk by Prof. S. K. Singh**, the former Director of the International Institute for Population Sciences (IIPS), who captivated the

audience with his presentation on the significant contributions of the **National Family Health Survey (NFHS)** in strengthening India's health data ecosystem. His talk underscored how NFHS has become a cornerstone for health policy-making and evidence-based decisions in India.

The day also saw the **Award Presentations** dedicated to the late **Prof. R. N. Srivastava** and **C. M. Pandey**, two legendary figures in the field of statistics, recognizing their immense contributions to the field and inspiring future generations of statisticians and researchers. The **Invited Talk session** brought further depth to the day's discussions, with talks from **Prof. K. K. Jose**, **Prof. C. B. Tripathi**, **Dr. Faizan Danish**, and **Prof. Anil Mathew**. These experts shared valuable insights on a range of topics, focusing on the application of advanced statistical techniques in health research and offering practical guidance to young researchers looking to enhance their knowledge and skills.

The final day of the ISMSCON 2024 ended on a high note, filled with joy and memorable moments. The day began with a plenary and technical sessions, where experts presented cutting-edge research and innovations in medical statistics. These sessions set the stage for an engaging and insightful conclusion to the conference.

The Valedictory Function, the highlight of the day, began with the introduction of the Chief Guest, Prof. M. K. Singh, an esteemed Ophthalmologist and Vice Chancellor of Gopal Narayan Singh University, Rohtas, Bihar, by the Director of the conference, Prof. K. K. Singh. Prof. M. K. Singh addressed the gathering with great enthusiasm and shared a soulful doha from the *RamCharit Manas*, leaving the audience deeply moved and mesmerized. In his concluding remarks, Prof. S. N. Dwivedi, commended the efforts of the organizing committee and expressed his gratitude to all participants and speakers. The General Secretary of ISMS reflected on the success of the conference and honored the Organizing Secretary, Prof. Brijesh Pratap Singh, in recognition of his outstanding contributions to the event. Prof. N. Sreekumaran Nair, President-Elect of ISMS, gave an inspiring "way forward" for the society, emphasizing future collaborations and initiatives in the field.

The moment everyone had eagerly awaited finally arrived with the announcement of the winner of the prestigious C. M. Pandey Memorial Award. Dr. Prafulla Swain was recognized for his exceptional contributions to the field of medical statistics, marking a fitting end to the conference.

Throughout the Conference, participants were engaged in **Technical Sessions and Poster Presentations**, where young researchers shared their work and exchanged ideas on various statistical methodologies applied to health, data science, and other domains. Delegates and scholars presented their research through oral and poster sessions, contributing to a vibrant exchange of ideas.

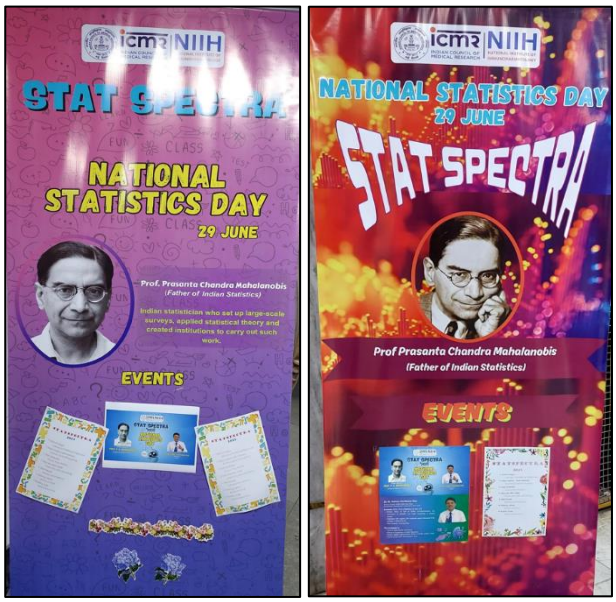
The event concluded with heartfelt applause and a sense of fulfilment as attendees expressed their gratitude for the enriching experience. The ISMSCON-2024 was hailed as a resounding success, leaving everyone excited for future events and collaborations.

National Statistics Day Celebrations - 2025 at ICMR-NIIH, Mumbai

Date: June 19th and 27th, 2025

Venue: Seminar Hall, ICMR-National Institute of Immunohaematology (ICMR-NIIH), Mumbai

The ICMR–National Institute of Immuno-haematology (ICMR–NIIH), Mumbai, com-memorated ***National Statistics Day*** through a vibrant two-day celebration held on **June 19 and June 27, 2025**. The event was themed around acknowledging the **indispensable role of statistics** in biomedical research and public health, while also creating an engaging and participatory environment for scientists, scholars, and staff across disciplines.



ICMR-NIIH Statistics Day celebrations – 2025

Spread across two days, the celebrations featured a dynamic blend of activities – including a thought-provoking keynote lecture and a series of interactive, statistics-themed stalls. The event witnessed enthusiastic participation from over 100 individuals, including scientists, technical personnel, PhD scholars, and administrative and accounts staff. By integrating both theoretical insights and hands-on experiences, National Statistics Day celebrations – 2025 proved to be a meaningful and memorable occasion that left a lasting impression on all attendees.

Day 1: June 19, 2025 | Academic Insights and Thought Leadership

The first day of celebration began with a special address by *Dr. Babu Rao Vundinti*, Scientist G and Chairperson of Academics at ICMR–NIIH. He emphasized the pivotal role of statistical thinking in translational research and clinical decision-making. Dr. Vundinti highlighted how biostatistical methods form the backbone of experimental design, data interpretation, and evidence-based healthcare innovation.

This was followed by the keynote lecture by *Dr.M.Vishnu Vardhana Rao*, Former Director, ICMR–National Institute of Medical Statistics (ICMR–NIMS), New Delhi.

Invited talk by the Chief guest, Dr. M. Vishnu Vardhana Rao, Former Director, ICMR–NIMS

In his talk titled ***"Artificial Intelligence in Medical Research"***, Dr. Rao elaborated on the synergy between artificial intelligence and statistical methodologies, showcasing their application in modern healthcare systems. Drawing from real-world examples, he illustrated how AI-powered analytics and statistical frameworks are transforming precision medicine, epidemiological modeling, and public health policy.

The lecture was attended by over **100 participants**, including scientists, technical staff, and PhD scholars. The talk was highly appreciated for its clarity, depth, and relevance, and it sparked meaningly discussions on the evolving landscape of data-driven healthcare.

The program concluded with a Vote of Thanks, expressing sincere appreciation to the guest speaker, participants, volunteers, and the organizing team for their enthusiastic contributions to the success of the event.

Day 2: June 27, 2025 | Interactive Stalls: Where Statistics Meets Play

The second day of celebrations transformed the ICMR–NIIH Seminar Hall into a lively learning hub with a series of **interactive statistics-themed stalls**, designed to promote statistical thinking through hands-on participation.

Inauguration: Statistics Day celebrations-2025 by Dr. Manisha R. Madkaikar, Director, ICMR-NIIH

The session was inaugurated by *Dr. Manisha R. Madkaikar***,** Director, ICMR–NIIH, Mumbai, who emphasized the importance of statistical literacy in research and public health practice. The activities conducted during the day included:

- *Stat-O-Magic:* This engaging stall used coins, dice, and playing cards to introduce participants to real-world probability. Through mini-challenges – like tossing coins or drawing cards – players intuitively explored concepts such as randomness, outcome space, and event probability, making statistics both magical and meaningful.
- *Mean-Median-Mode Madness:* Participants were given small datasets and challenged to calculate the mean, median, and mode within a limited time. This stall reinforced the foundational statistical concepts of central tendency while promoting quick thinking and mental math under pressure.
- *Stat Word Scramble & Riddles:* Blending fun with brainwork, this stall featured scrambled statistical terms and logic riddles. Participants decoded terms and solved puzzles, encouraging vocabulary recall, critical thinking, and pattern recognition – all essential skills in statistical problem-solving.
- *Spin-the-Stat Wheel:* A lively and interactive quiz-based stall where participants spun a wheel to receive questions from a variety of topics, including basic mathematics, probability, logic, statistics, and scrambled terms. The activity made learning spontaneous and exciting, appealing to all knowledge levels.
- *Stat-Decode:* Participants were presented with logic puzzles involving object-based equations (e.g., book + book = 60). Solving these symbolic equations introduced them to basic algebra and logical deduction, drawing parallels to statistical modeling and problem structuring.
- *Memory Game:* This fast-paced game challenged participants to correctly reorder scrambled sets of numbers or alphabets. It tested short-term memory, sequence recognition, and attention to detail – skills crucial in data handling, sorting, and quality control in statistical practice.
- *Rubik's Cube Challenge:* Participants attempted to solve 3×3 Rubik's Cubes within a time limit, promoting spatial awareness,

algorithmic thinking, and strategy – all of which resonate with the logical structuring and pattern recognition involved in statistical analysis.

- *Stacking the Cups:* This physical coordination game required participants to stack and unstack 21 cups in a pyramid formation within 30 seconds. It highlighted precision, timing, and structure – mirroring the accuracy and methodical approach essential in statistical computation and data management.

From 2:00 PM to 5:00 PM, participants eagerly engaged in these activities, which encouraged collaboration and hands-on learning in an informal yet educational setting. The wide range of activities fostered a fun learning environment, making statistics more approachable and memorable.

Closing Remarks: A Celebration of Statistics

The ***National Statistics Day 2025*** *celebrations* at ICMR–NIIH successfully blended academic rigor with interactive engagement, providing participants with a comprehensive platform to deepen their understanding of statistics – from theory to application. The event was marked by high energy, collaborative spirit, and an enduring emphasis on data-driven inquiry.

With over 100 attendees across both days and strong participation from all departments, the event showcased the integral role of statistics in health research and reaffirmed ICMR–NIIH's commitment to fostering statistical excellence. The organizing team's efforts were pivotal in making the event a success, setting a strong precedent for future celebrations that bridge the gap between science, data, and society.

ICMR–NIIH National Statistics Day Celebrations: Day 1 (June 19, 2025)

Welcoming the Chief Guest

Address by Dr. Babu Rao Vundinti

Guest lecture by
Dr M. Vishnu Vardhana Rao

Audience Engagement during the Session

Fun activities: Statistical word search

The Gathering

ICMR–NIIH National Statistics Day Celebrations: Day 2 (June 25, 2025)

Inauguration of the Stalls by Dr. Manisha R. Madkaikar

The Organizing Team

Stat-O-Magic

Mean-Median-Mode Madness

Stat Word Scramble & Riddles

Spin-the-Stat Wheel

Stat-Decode

Memory Game

Rubik's Cube Challenge

Stacking the Cups

Selfie point

Feedback

Workshop Conducted

Organised Two- day Workshop on "Advanced Tools and Techniques in Biomedical Research" at ICMR-CRMCH (ICMR-NIIH), Chandrapur, Maharashtra

Date: 17th - 18th July 2025
No. of Participants: 45
Mode: Physical
Venue: Seminar Hall, 2nd floor, ICMR-CRMCH, Chandrapur

Brief description of the workshop:

ICMR-CRMCH, Chandrapur, successfully conducted a two-day workshop on "***Advanced Tools and Techniques in Biomedical Research***" from ***17th – 18th July 2025***. The workshop focused on providing hands-on training and theoretical insights into ***Biostatistics, Bioinformatics, and Research Methodology*** relevant to biomedical research. The workshop brought together around ***45*** participants from diverse academic backgrounds, including medical and life science students, PhD scholars, and faculty members. Workshop participants represented various universities, medical colleges, and research institutes across Maharashtra (Gondia, Akola, Nagpur, Chandrapur, Gadchiroli, Mumbai) and other states like Madhya Pradesh and Rajasthan. This interdisciplinary gathering fostered an engaging and enriching learning environment, reflecting our commitment to advancing capacity building in biomedical research.

Convenor: Dr Manisha Madkaikar (Director, ICMR-NIIH and CRMCH).

Organizing team and faculty (ICMR-CRMCH)

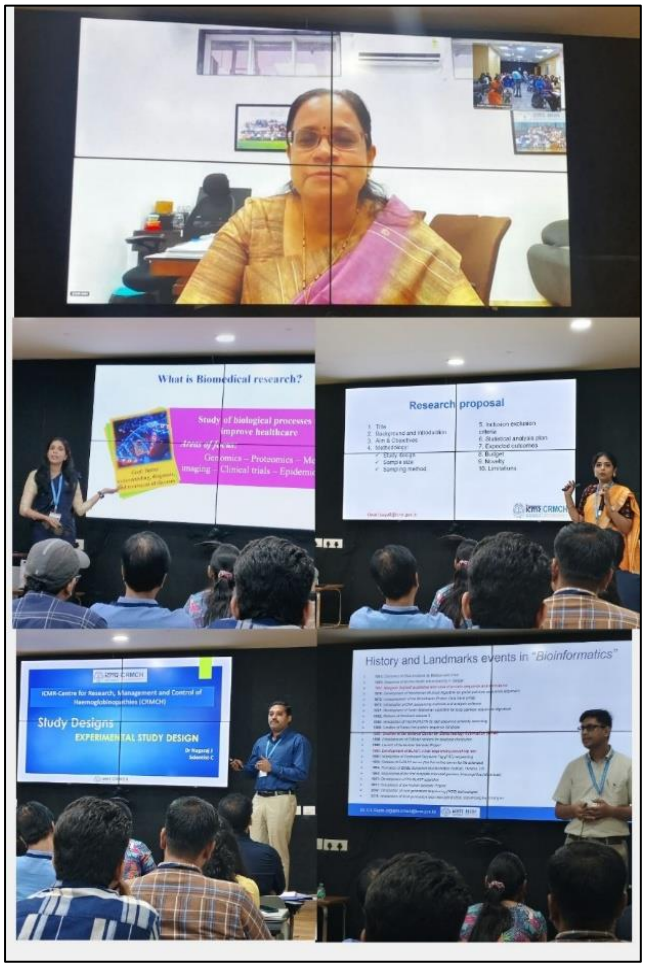
Dr. Nagaraj J, Scientist-C (Biostatistics)
Dr. Chhedi Lal Gupta, Scientist-C (Bioinformatics)
Dr. Sayali Tiwari, Scientist-C (Medical)

External Faculty:

Dr. Amrutha Jose, Scientist-C (Biostatistics), ICMR-NIIH, Mumbai
Dr. Sandeep Kumar, Scientist-C, ICMR-NICPR, Noida

ICMR-Centre for Research, Management and Control of Haemoglobinopathies, Chandrapur

Workshop on **"Advanced tools and techniques in Bio-medical Research"**
(17-18th July 2025)



Book Review: Model-based Geostatistics for Global Public Health - Methods and Applications

Authors: *Peter J. Diggle and Emanuele Giorgi*
Publisher: *Chapman & Hall/CRC Press, 2019;* ***ISBN:*** *978-1-13-873235-3*

As someone who had the privilege of working with both Peter Diggle and Emanuele Giorgi during my postdoctoral research at Lancaster University, I can attest that this book perfectly captures their unique ability to bridge complex statistical theory with real-world public health challenges. *Model-based Geostatistics for Global Public Health* is not just a comprehensive textbook, but a platform showing how spatial statistics can directly inform solutions to reduce disparities in health outcomes globally.

Why This Book Matters

Having observed Peter and Emanuele's collaborative approach first-hand, I recognize in this book the same methodical rigor and practical wisdom that defines their approach to research. The book emerges from decades of research and applied work in global health, where the authors have consistently demonstrated that geostatistical methods can yield actionable insights for disease control programs.

The idea that geographical variation in health outcomes can be modelled and predicted using probability models may seem obvious to statisticians, but the author's real achievement is making these methods accessible to public health practitioners who need them most. What sets this book apart from traditional geostatistics texts is its focus on health applications. Every concept is illustrated through real public health challenges: mapping malaria prevalence in Sub-Saharan Africa, assessing river blindness elimination programs, or modelling childhood malnutrition risk. The basic idea is straightforward. Health problems do not happen randomly across geography, they follow patterns. Proper modelling can predict where they are likely to occur and help health programs and interventions direct resources to where they will have the greatest impact.

Structure and Approach

The book follows a logical progression from foundational concepts through increasingly sophisticated applications. The initial chapters cover What spatial correlation means, How to measure it and Why it matters for health data, followed by chapters on building models for count data, prevalence data, and the messy realities of health surveys. Anyone who has worked with real field data know that it is never as clean as textbook examples. These authors have spent years dealing with incomplete surveys, biased sampling, and all the other challenges of real-world research. The book presents essential theory and technical concepts wherever necessary without oversimplifying, yet it remains accessible to professionals from applied fields.

One chapter that stands out covers "preferential sampling", the problem that data is not randomly collected but comes from places that are easier to reach or more likely to have problems. Peter coined this term, and seeing how they handle it in practice was one of the most valuable parts of my postdoc experience.

PrevMap R package

The book's practical strength comes from its integration with the *PrevMap* R package, primarily developed by Emanuele. Having used *PrevMap* extensively in my postdoctoral research, I can confirm that it transforms the book from a theoretical approach into a practical toolkit. The reproducible examples provide working templates that researchers can immediately adapt to their own problems. Every analysis can be replicated, and the book includes a page with links to the

supplementary datasets online. These datasets, reflecting the quality and structure of data encountered in global health research, are provided so readers can apply the *PrevMap* package and replicate the example analyses presented in the book.

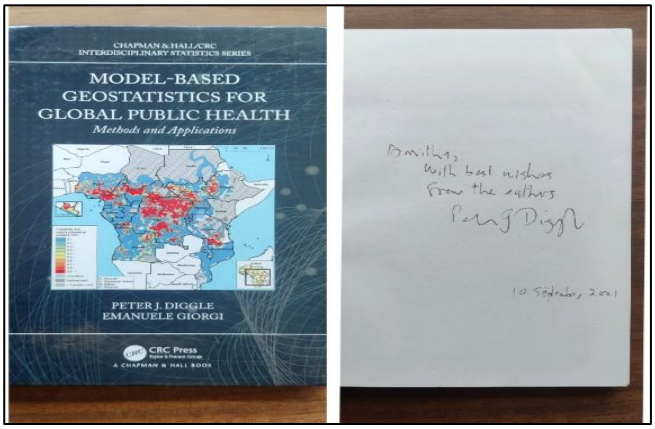
Who Should Read This

If you work in the field of spatial epidemiology, infectious disease surveillance, or environmental health, this book should be on your shelf. Graduate students will find it approachable without being oversimplified, while experienced researchers will appreciate the practical insights. Public health professionals may skip some technical details but will gain a clear understanding of what geostatsitcal methods can accomplish.

Final thoughts

Model-based Geostatistics for Global Public Health serves as both a textbook and a practical reference. It offers sophisticated tools for medical statistics professionals and provides statistical methods for those in global and public health research that can directly inform program decisions and policy development. The book demonstrates how advanced statistical thinking can improve human health and equity, making it essential reading for anyone working with complex spatial data and global health challenges.

With Peter Diggle (left) and Emanuele Giorgi (right)



Front page of *Model-based Geostatistics for Global Public Health* with a signed message from Professor Peter Diggle

Dr. Amitha Puranik is a Senior Biomedical Statistician at the Department of Cardiovascular Sciences, University of Leicester, United Kingdom

Young Biostatistician's Insights

My Journey in Biostatistics

Looking back, two chapters stand out in my academic journey-my Master's degree at Manipal and my PhD years. Both were very different in character, but together they shaped my path as a Biostatistician. I arrived at the Department of Statistics at Manipal with curiosity but without a clear vision of where statistics could take me. Those two years gave me not just courses and grades but something more valuable: a way of thinking. I learnt that statistics is not simply about formulas or methods, but about asking the right questions and interpreting information carefully. The faculty in the department created an environment where we were encouraged to think deeply and not settle for surface-level answers. My classmates were an equally important part of the experience. We worked together, debated, made mistakes, and learned from one another. That sense of community gave me both knowledge and confidence. When I completed my Masters, I carried with me not just technical training but also the belief that I could take on research challenges.

I began my PhD in Bayesian methods! Although the topic had been covered during my Master's program, I had little practical understanding of it when I started. Stepping into Bayesian methods felt like starting from zero. The mathematics was demanding, the computing even more so, and I often felt overwhelmed. The first two years of the PhD were the toughest part of my academic life. I cried often, frustrated at how slow my progress was. There were days when I doubted whether I would be able to finish at all. What made the difference was the support I received. My supervisor believed in me even when I was unsure of myself, and that quiet faith gave me the courage to continue. My friends also lifted me up- keeping me motivated and reminding me that struggles are normal in research. Slowly, things began to change. I started to appreciate the beauty of these methods-the flexibility, the ability to bring external/prior knowledge into analysis, and the role these tools play in biostatistics. With each step forward, my confidence grew. By the end of the PhD, I had not only finished my thesis but had also learnt that perseverance and support can turn an uncertain beginning into a meaningful achievement.

If I could share one lesson with other researchers, it would be this: do not mistake struggle for failure. Every researcher feels lost at some point, especially in the beginning. What matters is staying the course, seeking guidance, and not being afraid to lean on mentors and peers for support. Biostatistics in particular offers exciting opportunities to make a difference. From clinical trials to public health research, the field connects statistical methods with real-world problems that affect people's lives. To work in this space is both challenging and rewarding. I remain grateful to my faculty at Manipal, my PhD supervisor, and my friends who encouraged me at every stage. Their role in my journey has been as important as my own efforts. As I continue in my career, I hope more statisticians will take up the challenge of research with enthusiasm. Statistics is not just a subject to be studied; it is a way of contributing to knowledge and to society.

Dr. Melissa Glenda Lewis is working as Scientist-C (Biostatistics/ Statistics) at ICMR-National Institute for Research in Bacterial Infections (ICMR - NIRBI) Kolkata, West Bengal

ALL INDIA INSTITUTE OF MEDICAL SCIENCES
MANGALAGIRI, ANDHRA PRADESH

ISMSCON - 2025

43rd ANNUAL CONFERENCE OF THE INDIAN SOCIETY FOR MEDICAL STATISTICS

Theme

Reforming Biostatistics in Clinical Research in Concurrent with Advancing AI

Pre conference Workshop

(Parallel Sessions)

- Demarcate: Non-inferiority, Superiority & Equivalence Trials
- Time-to-event data: A Hands-on workshop on Survival Analysis

Symposium & Invited Talks

- Modelling count data in Epidemiological studies
- Challenging Issues in conduct of Randomized Clinical Trials
- Future of data analysis/data analyst with AI
- Spatial analysis of Disease Patterns
- Issues/Methods in Systematic Reviews
- Longitudinal data analysis
- Genetic Epidemiology: Statistical Methods & Analysis
- Addressing the unanswered questions
- Analysis of Complex Data

Highlights

- **Eminent International Speakers, Speakers from various INI's, Medical Research Institutions & International organizations**
- **Awards to Best oral presentation each Contributed Session & Poster Presentation Awards**

NOVEMBER 19-22, 2025

ORGANISED BY

DEPARTMENT OF BIOSTATISTICS, AIIMS MANGALAGIRI

ABOUT ISMS

The Indian Society for Medical Statistics (ISMS), established in 1983 at Jhansi in Uttar Pradesh is a Society,registered under Societies Registration Act XXI of 1860. It is a scientific body consisting of biostatisticians,medical teachers, researchers, demographers, public health professionals and scientists from other related disciplines. This society of scientists working in the medical field is the only society of its kind in the South EastAsia region. Society provides a common platform for medical researchers, statisticians and computer specialists to interact and benefit mutually towards sharing the developments and applications of statistical techniques. ISMS is also making efforts at the level of various Councils to augment the training of bio-statistical methods in both medical and para-medical education to improve the quality of education and research in Modern medicine,Dentistry, Pharmacy, Homeopathy, Indian medicine (Ayurveda) and Nursing. Since its inception, the society has been organizing a conference every year in conjunction with its annual meeting at different universities and academic institutes in the country

ABOUT AIIMS MANGALAGIRI

AIIMS Mangalagiri is one of the AIIMS healthcare institutes being established by the Ministry of Health & Family Welfare, Government of India under the Pradhan Mantri Swasthya Suraksha Yojna (PMSSY). From 2018, AIIMS, Mangalagiri started functioning. There are more than 43 departments including super speciality and 26 post graduate, 4 super speciality and 2 post doctoral certificate courses are conducted. AIIMS Mangalagiri in collaboration with various other AIIMS, INI's, IIT Madras & IISc Bangalore involved in various research activities.

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Accommodation and Local Transportation

Participants will have to make their own arrangements for accommodation and transportation. However, the organizing committee provided the detail list of hotels located near to AIIMS Mangalagiri and in Vijayawada on the conference website. For research scholars/ PG students attending Conference limited number of free accommodation in the students hostel, AIIMS Mangalagiri will be provided on first come first serve basis.

Registration fee

Category	upto 15 Oct 2025	16th - 25th oct 2025	After 25 Oct 2025
ISMS MEMBER	₹ 6000	₹ 6500	₹ 7000
Non Member	₹ 6500	₹ 7000	₹ 7500
Student (Medical PG and Ph.D.)	₹ 3000	₹ 3500	₹ 4000
Student (PG student other than medical)	₹ 2000	₹ 2500	₹ 3000
Foreign Delegates	US $ 175	US $ 200	US $ 225
Accompanying Person	₹ 4000	₹ 4000	₹ 5000
Pre-Conference Workshop (Max. 40 participants)	₹ 1000	₹ 1500	₹ 2000
Only Pre-conference (Max. 40 participants)	₹ 2000	₹ 2000	₹ 2500

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Account Number:
43476183572
IFSC Code:
SBIN0061485
Branch:
SBI, AIIMS Mangalagiri branch

N.B.: All the participants including Invited Speakers, Accompanying Person(s) etc. should register for the conference and pay the registration fee.
Registration fee covers Conference kit and food, doesn't include accommodation.
Accompanying persons will not be given conference kit.

REGISTER HERE

Call for Abstracts

The Organizing Secretariat of ISMSCON-2025 is pleased to invite delegates and scholars to submit their abstracts for the presentations from the domain of theoretical, methodological and applied areas of Statistics

- Medicine
- Epidemiology
- Stochastic modeling of demographic processes
- Public health
- Genetics & Bioinformatics
- Inverse probability modeling and estimation
- Survival analysis & Competing risk
- Artificial intelligence
- Neural networking & Machine learning
- Drug research
- Data science
- Large scale surveys & Sampling methodology
- Domain estimation
- Longitudinal data analysis
- Meta-analysis
- Other related areas

Important Dates

Starting date for submission of Abstracts: 1st August, 2025
Last date for submission of Abstracts: 15th September, 2025
Last date for submitting registration fee to the conference: 31st October, 2025

N.B.: It is mandatory to register before submitting abstracts. All those who wish to present papers must mail to the email (ismsaiimsmg2025@gmail.com)

For any Queries, Please contact :

Dr.M.Rajeswari,
Organising Secretary
Ph:9976788491

Mr.Saidaiah Ikkurthi,
Treasurer
Ph:8688897106

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Bhavani Island


Kanaka Durga Temple


Prakasam Barrage


Undavalli Caves

website address: https://www.aiimsmangalagiri.edu.in/event-details/?id=9

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