

Review Article

Advancing biostatistics education in Tamil Nadu: a comprehensive review of academic programs and training opportunities

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ABSTRACT

Biostatistics, an applied branch of statistics, is integral to biomedical research and public health. It aids in analyzing and interpreting clinical and laboratory data, and its importance has grown with advancements in evidence-based medicine. Despite the increasing demand for skilled biostatisticians, the availability of specialized educational programs varies. This study aims to assess and list the institutions offering biostatistics courses in Tamil Nadu, India. A systematic search was conducted using Google to identify institutions in Tamil Nadu offering long-term courses in biostatistics and related fields. The search focused on program details including course name, institution, location, duration, eligibility, and mode of delivery. Short-term programs were excluded from the results. Data were compiled into a table summarizing the available programs. The study identified nine institutions in Tamil Nadu providing biostatistics education: one offers a PhD, seven offer Master of Science (M.Sc.) programs, and one offers a Post Graduate Diploma. Notable institutions include the National Institute of Epidemiology (PhD), Bharathiar University, Christian Medical College, and The Tamil Nadu Dr. MGR Medical University (M.Sc.), among others. The Tamil Nadu Dr. MGR Medical University offers a robust M.Sc. program with a low fee structure, emphasizing statistical theory, methodology, and practical experience through a practicum. Tamil Nadu's extensive and varied biostatistics programs address the growing need for trained professionals in health sciences. The combination of diverse program options and practical training ensures a well-prepared workforce. The state's educational framework supports the advancement of biostatistics, contributing significantly to biomedical research and public health.

Keywords: Biostatistics, Educational programs, Tamil Nadu, India

INTRODUCTION

Biostatistics, a branch of applied statistics, has evolved from the application of statistical methods to biological and biomedical fields. It provides essential tools for summarizing and understanding numerical laboratory and clinical data, including the critical reading and interpretation of biomedical literature. The discipline gained significant momentum in the twentieth century alongside the rapid advancement of medicine. Prior to the

mid-twentieth century, understanding human illnesses primarily involved studying anatomy and physiology, with case studies or series often used to validate treatments or identify causes of diseases. The integration of statistical reasoning into these analyses was initially slow due to differing opinions among physicians regarding its importance. However, the advent of evidence-based approaches underscored the necessity of biostatistical concepts, leading to their widespread adoption in health-related fields.

Globally, figures like Sir Ronald Fisher, Austin Bradford Hill, and Archie Cochrane have made remarkable contributions to the development of evidence-based medicine.¹ The past few decades have seen significant advancements in epidemiology and information technology, greatly enhancing the awareness, application, and computational capabilities of biostatistical methods in medical, clinical, and public health research. The International Clinical Epidemiological Network (INCLEN) consortium, in collaboration with the Rockefeller Foundation and United States Agency for International Development (USAID), has significantly contributed to the capacity building of biostatisticians in both developed and developing nations, including India.¹

Many institutions that offer statistics courses also include biostatistics in their curricula, though it often represents a smaller portion of the course content. The increasing number of health and pharmacy-related research projects has spurred a demand for trained biostatisticians. Consequently, there is a pressing need to provide comprehensive and practical training in biostatistics to individuals with appropriate backgrounds.

India's diverse and expanding healthcare sector includes many states contributing to public health and research. Special mention must be made of Tamil Nadu which stands out with its robust healthcare infrastructure, numerous research institutions, and a growing emphasis on public health initiatives.² The state's strong focus on education and research positions it as a significant contributor to the field of biostatistics. Given this background, this review aims to identify and list the various institutions in Tamil Nadu, India, that offer courses in biostatistics, medical statistics, or health statistics.

Importance of biostatistics in health research

Biostatistics is a critical field that bridges the gap between biology, medicine, and statistical analysis, providing invaluable insights and tools for understanding and addressing complex health-related issues. As the discipline that focuses on the application of statistical methods to biological and medical problems, biostatistics plays a crucial role in advancing scientific research, informing clinical decision-making, and improving public health outcomes.

One of the primary importance of biostatistics is its ability to help researchers design and evaluate scientifically rigorous studies. Proper statistical methods and sample size determination are essential for ensuring the validity and reliability of research findings, which in turn can lead to appropriate clinical recommendations and informed decision-making.³ Furthermore, biostatistical techniques are instrumental in the analysis and interpretation of research data, enabling researchers to extract meaningful insights from complex datasets and draw robust conclusions.⁴

The role of biostatisticians in health research

Biostatisticians are essential in applying statistical methods to health-related research, including medicine, epidemiology, and public health. They work alongside other public health professionals to develop outcome measures that evaluate the effectiveness of programs, using data from surveys, lab reports, and hospital discharge information. Their tasks include formulating scientific questions, determining sampling techniques and sample sizes, coordinating data collection and management, and conducting statistical analyses and interpretations. They are also key in preparing research material for publication.

In addition to their research roles, biostatisticians significantly influence public policy by advising policymakers on issues like risk factors for diseases and drug policies for combating infectious diseases. The demand for biostatisticians is rising, with an expectation that future professionals will be well-prepared for roles in academia, government, and industry. Training programs must integrate consultation skills, as biostatisticians often serve as consultants to other researchers.^{5,6}

Many research studies commence without biostatisticians and involve them only later, which can pose problems if issues arise late in the study. This emphasizes the need for biostatisticians to be involved from the beginning of research projects. Given the increasing demand for biostatistical expertise, it is crucial to train an adequate number of individuals in biostatistics, medical statistics, health statistics, and biometry.⁷

METHODS

The information on existing long-term teaching and training programs in biostatistics and related fields, such as medical statistics, health statistics, in Tamil Nadu, was gathered through systematic search strategies. The Google internet-based search engine was utilized to compile a list of institutions offering these courses.

Initially, relevant keywords for the search were identified, including "biostatistics", "medical statistics", and "health statistics". The search was specifically limited to courses offered within Tamil Nadu. The gathered information primarily focused on the course name, the institution offering the course, location, course duration, admission eligibility criteria, mode of delivery (regular full-time or correspondence), and, where available, the number of seats. Short-term programs with a duration of less than six months were excluded from the search results.

RESULTS

Table 1 provides a detailed overview of biostatistics educational programs available in Tamil Nadu, encompassing a total of 9 institutions. Among these, the National Institute of Epidemiology in Chennai offers a PhD in Biostatistics, which emphasizes advanced research

and specialization in the field. Additionally, 7 institutions offer Master of Science (M.Sc.) programs in Biostatistics, including Bharathiar University, Coimbatore; Christian Medical College, Vellore; National Institute of Epidemiology, Chennai; SDNB Vaishnav College for Women, Chennai; SRM Medical College, Chennai; Tamilnadu Veterinary and Animal Sciences University, Chennai; and The Tamilnadu Dr. MGR Medical

University, Chennai. Furthermore, Madurai Kamaraj University in Madurai provides a Post Graduate Diploma in Biostatistics. This distribution highlights the diverse range of educational opportunities available in Tamil Nadu, reflecting the state's strong commitment to advancing the field of biostatistics through comprehensive academic programs at various levels.

Table 1: Institutions offering biostatistics courses in Tamil Nadu.

Name of the university/institution	Government/private	Name of the course	Nature of program	Duration (years)	Eligibility	Reference
National Institute of Epidemiology, Chennai	Government	PhD in Biostatistics	Full-time	3-5	Post graduate degree with a minimum mark of 55% in the qualifying examination or a second class or equivalent in the qualifying post graduate degree	8
Bharathiar University, Coimbatore	Government	M.Sc. in Biostatistics	Full-time	2	B.Sc. in Biostatistics, B.Sc. in Mathematics, or B.Sc. in Mathematics with CA with Statistics as one of the papers	9
Christian Medical College, Vellore	Private	M.Sc. in Biostatistics	Full-time	2	Degree with Statistics as the main branch or degree in any subject with Statistics as ancillary/allied subject	10
National Institute of Epidemiology, Chennai	Government	M.Sc. in Biostatistics	Full-time	2	Bachelor degree in Statistics or any bachelor degree with statistics as ancillary/allied subject	11
SDNB Vaishnav College for Women, Chennai	Private	M.Sc. in Biostatistics	Full-time	2	B.Sc. in Statistics/B.Sc. in Mathematics	12
SRM Medical College, Chennai	Private	M.Sc. in Biostatistics and Epidemiology	Full-time	2	Graduates with mathematics at +2 level and a minimum of 60% marks	13
Tamilnadu Veterinary and Animal Sciences University, Chennai	Government	M.Sc. in Biostatistics	Full-time	2	Bachelor degree in Statistics	14
The Tamilnadu Dr. MGR Medical University, Chennai	Government	M.Sc. in Biostatistics	Full-time	2	Degree with Statistics as the main branch or degree in any subject with Statistics as ancillary/allied subject	15
Madurai Kamaraj University, Madurai	Government	Post graduate diploma in Biostatistics	Distance education	1	A degree in Science with Mathematics as one of the subjects in +2 (XII std.)	16

DISCUSSION

Biostatistics is a crucial interdisciplinary field that supports research in health sciences by providing essential tools for data analysis and interpretation. The data presented in Table 1 reflects the vibrant and growing landscape of biostatistics education in Tamil Nadu, demonstrating a

commendable commitment to developing expertise in this vital area.

The Table 1 reveals that Tamil Nadu hosts a diverse array of biostatistics programs across nine institutions, including one PhD program, seven Master of Science (M.Sc.) programs, and one Post Graduate Diploma. Notable

institutions such as the National Institute of Epidemiology, Bharathiar University, and SRM Medical College offer a range of courses, reflecting the state's strong focus on advancing biostatistical training. This broad array of educational opportunities underscores Tamil Nadu's proactive approach to addressing the need for trained biostatisticians. The presence of both government and private institutions highlights the collaborative efforts to provide comprehensive training. For example, the PhD program at the National Institute of Epidemiology emphasizes advanced research, while M.Sc. programs at other institutions offer specialized education tailored to various needs.

The emphasis on graduate-level education across multiple institutions demonstrates Tamil Nadu's dedication to cultivating a skilled workforce in biostatistics. This diverse range of programs, from M.Sc. courses to postgraduate diplomas, ensures that students have access to a variety of training opportunities that cater to different professional goals and backgrounds. The availability of such a wide range of biostatistics programs in Tamil Nadu positions the state as a leader in biostatistics education within India. The well-rounded educational offerings not only cater to the current demand for biostatisticians but also contribute to the overall growth and development of the field.

Why Tamil Nadu Dr. MGR Medical University for biostatistics?

The M.Sc. Biostatistics program at The Tamil Nadu Dr. MGR Medical University stands out due to its comprehensive and practical approach to biostatistics education. The primary objective of this program is to enhance knowledge in statistical theory, methodology, and epidemiology, equipping students with essential skills in statistical analysis, data management, and computer systems. A distinctive feature of this program is its practicum component, which facilitates hands-on experience by involving students in collaborative projects with health science professionals. The establishment and success of the department of epidemiology at Tamil Nadu Dr. MGR Medical University demonstrate a proactive approach towards addressing public health challenges, further reinforcing the program's relevance in the current health landscape. The department has completed over 150 research projects, with 30 ongoing and 6 PhD projects, covering areas like adolescent, mental, dental, maternal, and infectious health, as well as non-communicable diseases. Additionally, 20 external projects have been funded by organizations such as UNICEF, ICMR, and the World Bank. With over 250 publications and numerous conference presentations, these projects offer students invaluable opportunities to apply biostatistical methods to real-world data and collaborate with multidisciplinary teams.¹⁷

Students work closely under faculty supervision with investigators, gaining practical insights and real-world experience. Each student is paired with an academic

advisor, ensuring personalized guidance throughout their academic journey. Graduates of this program are well-prepared to pursue careers in pharmaceutical industries for drug and vaccine development or to take up positions as faculty or scientists in both national and international institutions.

Moreover, The Tamil Nadu Dr. MGR Medical University offers this high-quality education at a remarkably low fee compared to other institutions, making it an attractive option for those seeking specialized training in biostatistics. This affordability, combined with the program's robust curriculum and practical training, underscores the university's commitment to providing accessible and high-standard education in this crucial field.

CONCLUSION

This study highlights Tamil Nadu's significant role in advancing biostatistics education through its diverse and comprehensive array of programs. With offerings ranging from PhD to Master's and Post Graduate Diploma levels, the state effectively addresses the growing demand for skilled biostatisticians in health sciences. The presence of multiple institutions, both government and private, and the emphasis on practical training and real-world experience underscore Tamil Nadu's commitment to preparing professionals capable of contributing to critical research and public health initiatives. The high-quality education provided at competitive fees further enhances the accessibility and appeal of these programs. Overall, Tamil Nadu's robust educational framework positions it as a leader in biostatistics education, supporting the development of a skilled workforce essential for advancing biomedical research and public health.

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