

# Madhav Sankaranarayanan

## Curriculum Vitae

Cambridge, MA, USA

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## Education

Program	Institution	Year
<b>Doctor of Philosophy</b> <i>Biostatistics</i> Advisor: Rajarshi Mukherjee	<b>Harvard T.H. Chan School of Public Health</b> <i>Boston, MA, USA</i>	September 2021-present
<b>Masters of Statistics</b> <i>Specialization: Theoretical Statistics</i>	<b>Indian Statistical Institute</b> <i>Kolkata, WB, India</i>	July 2019-May 2021
<b>Bachelors of Statistics (Honours)</b> <i>Major: Statistics</i>	<b>Indian Statistical Institute</b> <i>Kolkata, WB, India</i>	July 2016-May 2019

## Research Interests

High Dimensional Inference • Random Matrix Theory • Causal Inference • Statistical Genetics

## Current Projects

- **Asymptotic Inference in High Dimensional Instrumental Variable models** (in preparation)  
*Madhav Sankaranarayanan, Rajarshi Mukherjee, Julien Chhor*
  - Study the estimation of signal-to-noise ratio in practical high dimensional IV models, such as Mendelian randomization models
  - Prove optimality of exact instrument recovery under a range of dimensional specifications
  - Improve the estimation of causal quantities under particular practically relevant sparsity conditions
- **Asymptotic Inference for Constrained Regression** (Submitting to *Biometrika*) [IISA Student Poster Award]  
*Madhav Sankaranarayanan, Rajarshi Mukherjee, Tamar Sofer, Yana Hrytsenko*
  - Study the association of genetic determinants of proteins with glycemic traits
  - Improve the estimation of these associations using the estimated genetic correlation between proteins and traits
  - Construct provably optimal estimators and algorithms, and study polygenic risk scores for these traits
- **Minimax Detection of the Number of Spikes in Large Wigner Matrices** (Submitted to COLT 2025)  
*Madhav Sankaranarayanan, Rajarshi Mukherjee, Soumendu Sundar Mukherjee*
  - Test presence of structure in spiked Wigner matrices
  - Deal with the bounded and unbounded dimensionality of spike sparsity and strength
  - Investigate asymptotic properties of various tests
- **Effect of Gabapentin Initiation on Readmission Rates for Medicare Beneficiaries** (in preparation)  
*Madhav Sankaranarayanan, Maria Donahue, Shuo Sun, Julianne Brooks, Lee Schwamm, Joseph Newhouse, John Hsu, Deborah Blacker, Sebastien Haneuse, Lidia Moura*
  - Investigate the effect of gabapentin and related drugs on rates of readmission in the elderly on a nationwide scale
  - Further look into related comorbidities in the Medicare dataset
  - Implement a semi-competing risks model with a matched cohort design
- **Benzodiazepine Initiation Effect on Mortality Among Medicare Beneficiaries Post Acute Ischemic Stroke** [[Pharmacoepidemiology and Drug Safety](#)]  
*Madhav Sankaranarayanan, Maria Donahue, Shuo Sun, Julianne Brooks, Lee Schwamm, Joseph Newhouse, John Hsu, Deborah Blacker, Sebastien Haneuse, Lidia Moura*
  - Investigate the effect of benzodiazepines on post-stroke mortality in the elderly on a nationwide scale
  - Extend methodology from studies on local hospital cohorts to Medicare dataset
  - Implement an emulated trial design to account for overlapping observation times

## Other Projects

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- **A Distribution-free Mixed-Integer Optimization approach to Hierarchical Modelling of Clustered and Longitudinal data** [[arXiv](#)][NESS Student Research Award]  
*Madhav Sankaranarayanan, Intekhab Hossain, Tom Chen*
  - Implement a mixed-integer optimization (MIO) approach for doing cluster-aware regression
  - Compare to linear mixed effects regression (LMEM) in terms of causal recovery and prediction
  - Establish framework for generalization to new data points using classification trees
- **Middle Meningeal Artery Embolization in adjunction to Surgical Evacuation for treatment of Subdural Hematomas: a Nationwide comparison of outcomes with Isolated Surgical Evacuation** [[Neurosurgery](#)]  
*Mirhojjat Khorasanizadeh, Seyed Farzad Maroufi, Rajarshi Mukherjee, Madhav Sankaranarayanan, Justin M. Moore, Christopher S. Ogilvy*
  - Investigate risk of surgical evacuation for chronic subdural hematomas
  - Investigate middle meningeal artery embolization (MMAE) as a novel treatment approach
  - Perform meta-analysis on multiple small sample studies from hospitals across the country
- **Quantitative Analysis of Polygenic Risk Scores in the Genes for Good Cohort**  
Summer Project as part of Genomics group in BDSI 2019, advised by Matthew Zawistowski and Brooke Wolford
  - Calculate polygenic risk scores for individuals in the GfG dataset, crowdsourced by the School of Public Health
  - Test for traits such as hypertension, rheumatoid arthritis, schizophrenia and left-handedness
  - Elucidate shortcomings of polygenic risk scores, and investigate potential improvements
- **An MCMC-free approach to Post-selective Inference**  
Project advised by Snigdha Panigrahi
  - Provide an approximation algorithm for selective inference, without using an MCMC sampling method
  - Construct confidence intervals which match the inferential power of previous methodologies
  - Extend to general models in randomized settings

## Presentations

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### Conferences

- **Benzodiazepine Initiation Effect on Mortality Among Medicare Beneficiaries Post Acute Ischemic Stroke**  
Poster Presentation at American Academy of Neurology Annual Meeting 2025
- **Asymptotic Inference in Genetic Association Studies using Genetic Correlations of Glycemic Traits**  
Presentation at ENAR Spring Meeting 2025
- **Asymptotic Inference in Genetic Association Studies using Genetic Correlations of Glycemic Traits**  
Poster Presentation at International Indian Statistical Association Conference 2024
- **Optimal Detection of the Number of Spikes with Application to Genetic Association Testing**  
Presentation at Joint Statistical Meetings 2024
- **Asymptotic Inference in Genetic Association Studies using Genetic Correlations of Glycemic Traits**  
Presentation at WNAR/IMS Meeting 2024
- **A Distribution-free MIO approach to Hierarchical Modelling of Clustered and Longitudinal data**  
Presentation at New England Statistics Symposium 2024
- **Asymptotic Inference in Genetic Association Studies using Genetic Correlations of Glycemic Traits**  
Presentation at Joint Statistical Meetings 2023
- **Quantitative Analysis of Polygenic Risk Scores in the Genes for Good Cohort**  
Poster at Symposium on Big Data, Human Health and Statistics 2019

### Seminars

- Keynote Speaker at StatStart 2024, July 2024
- **Mortality Analysis of Benzodiazepine Initiation**  
Harvard Biostatistics Student Seminar, Feb 2024
- **A Distribution-free MIO approach to Hierarchical Modelling of Clustered and Longitudinal Data**  
Harvard Biostatistics Student Seminar, Apr 2023

## Work Experience

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**Center for Value-Based Health Care and Sciences, Mass General Hospital**

**Boston, MA, USA**

*Research Assistant*

*July 2023 - Present*

Co-advised by Sebastien Haneuse and Lidia Moura

**University of Michigan School of Public Health**

**Ann Arbor, MI, USA**

*Summer Research Student*

*June 2019 - July 2019*

Part of the Big Data Science Initiative

**Institute of Mathematical Sciences**

**Chennai, TN, India**

*Visiting Researcher*

*May 2018 - July 2018*

Advised by Gautam Menon

## Teaching and Mentoring Experience

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- **Biostatistics Summer Preparatory Course** (August 2024)
  - Instructed classes in operational math (real analysis, linear algebra)
- **StatStart** (July 2023)
  - A one month summer intensive program intended for high school students from underrepresented backgrounds interested in data science and computing
  - Organized by the Department of Biostatistics, Harvard T.H. Chan School of Public Health
  - Instructed the Intro to Statistics and Probability classes
- **Summer Program in Biostatistics and Computational Biology** (June 2023 -July 2023)
  - A 6 week summer program, offering diverse undergraduate students a unique opportunity to learn about the use of quantitative methods for biological, environmental, and medical research alongside Harvard faculty, researchers, and graduate students.
  - Organized by the Department of Biostatistics, Harvard T.H. Chan School of Public Health
  - Mentored students as the Student Research Mentor for the research group advised by Rafael Irizarry
- **Qualifying Examination Preparation** (July 2023, July 2024)
  - Taught classes on probability (BIOSTAT 230) to Ph.D. students taking their qualifying exam
- **Teaching Assistant** (January 2023 - May 2023)
  - Statistical Inference 2 (BIOSTAT 241)
  - Instructed by Rajarshi Mukherjee
  - Received Certificate of Distinction in Teaching

## Technical Skills

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- Programming Language: R, Python, Julia
- Operating Systems: MacOS, Windows, Linux
- Tools:  $\text{\LaTeX}$ , Microsoft Excel, Microsoft Office, Photoshop

## Achievements

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- Received a Student Poster Award at International Indian Statistical Association Conference (2024)
- Received a Student Research Award at the New England Statistical Symposium (2024)
- Received Certificate of Distinction in Teaching from the Department of Biostatistics at Harvard T.H. Chan School of Public Health (2023)
- Recipient of Robert Balentine Reed Prize for Excellence in Biostatistical Science (2022)
- Secured Distinction in the B.Stat (Hons.) program at Indian Statistical Institute, Kolkata (2019)
- Awarded the Kishore Vaigyanik Protsahan Yojana scholarship (2017)

## Others

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- Hobbies: Puzzles, Quizzing, Badminton, Table Tennis, Dancing, Chess, Origami
- Languages: English, Tamil, Hindi, Bengali (working knowledge), Konkani (working knowledge)