Deepak Nag Ayyala

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Experience

2022–Present **Senior Manager**, *Takeda Pharmaceuticals*, Statistics and Quantitative Sciences, Oncology, Boston, MA.
Develop protocol and SAP as study-level statistician for Phase I/II clinical trials in oncology; develop statistical methodology in innovative trial design and hybrid analysis using real-world evidence; build computational models to incorporate AI/ML methods in trial design and decision-making; develop reference material and provide training to cross-functional teams on statistical methodology relevant to oncology trials

2017–2022 **Assistant Professor (Tenure-track)**, *Augusta University*, Medical College of Georgia, Department of Population Health Sciences, Augusta, GA.
Developed methodology in high dimensional inference and computational models for genomics data; taught graduate level statistics courses; served as co-investigator on NIH funded clinical trials; primary member of IRB, reviewing study protocols for statistical accuracy and regulatory compliance; collaborated on several epidemiological studies in COVID prevalence, cancer care and smoking cessation.

2015–2017 **Postdoctoral Associate**, *The Jackson Laboratory for Genomic Medicine*, Farmington, CT.

2013–2015 **Postdoctoral Researcher**, *The Ohio State University*, Department of Statistics, Columbus, OH.

2007–2013 **Graduate Teaching Assistant/Instructor**, *University of Maryland, Baltimore County*, Department of Mathematics and Statistics, Baltimore, MD.

Education

2013 **Doctorate of Philosophy in Statistics**, *University of Maryland, Baltimore County*.

2009 **Master of Science in Statistics**, *University of Maryland, Baltimore County*.

2007 **Bachelor of Mathematics (Honors)**, *Indian Statistical Institute*, Bangalore, India.

Certifications

2022 Deep Learning Specialization – Coursera
Courses completed: Sequence Models, Neural Networks and Deep Learning, Structuring Machine Learning Projects, Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization, Convolutional Neural Networks

Computer skills

Expert in R; Proficient in Python and MATLAB. Fluent in Julia, SAS and C/C++.

Operating Systems: Linux, Windows. Proficient in command-line interface computing.

Knowledgeable in building and maintaining linux-based high-performance computing (HPC) servers.

Research Interests

Develop new computational models for incorporating RWE in clinical trials; understand statistical and logistical challenges in seamless Phase II/III designs

Building high-dimensional statistical models and deep learning models for studying complex data sets in transcriptomics, epigenomics and metagenomics.

Packages

CRAMP Covariance matrix testing using RAndom Matrix Projection
https://github.com/dnayyala/cramp

prepr Pre-pivoting root based test statistic for comparing mean vectors of two populations in high dimensional data sets
https://github.com/dnayyala/prepr

DIMER Differential methylation of RNA transcripts
https://github.com/jiananlin/DIMER

MethylCapSig Detection of Differentially Methylated Regions using MethylCap-Seq Data
https://cran.r-project.org/web/packages/MethylCapSig/index.html

GrammR Graphical Representation and Modeling of Metagenomic Reads
http://cran.r-project.org/web/packages/GrammR/index.html

Scientific and professional memberships

Member, American Statistical Association

Member, Institute of Mathematical Statistics

Member, International Indian Statistical Association

Scholastic Activities (Include Offices Held)

Journal review

2020 – 2023 Statistical Editor
Emerging Themes in Epidemiology

2017 – Reviewer
Bioinformatics; Communications in Statistics – Simulation and Computation; MDPI - Mathematics; Communications in Statistics - Theory and Methods; BMJ Open; Technology in Cancer Research & Treatment; Frontiers in Pharmacology

Please click here for Publons profile:
https://publons.com/researcher/3526248/deepak-nag-ayyala/peer-review

Awards and Honors

2009, 2013 Outstanding graduate teaching assistant in the field of statistics
College of Natural and Mathematical Sciences, UMBC

2010 First prize - Student poster competition
Probability and Statistics Day, University of Maryland, Baltimore County

2004–2007 Grant for Bachelor of Mathematics,
Ministry of Statistics and Programme Implementation, Government of India

Teaching

At Augusta University

Statistical Models and Methods, Advanced Computational Methods, Advanced Statistical Inference, Modern Methods of Multivariate Analysis

At University of Maryland, Baltimore County

Introduction to Probability for Scientists and Engineers, Probability for Actuarial Science, Environmental Statistics, Applied Statistics for Business and Economics.

Others

September 2015 — Omics Data Analysis workshop
Introductory workshop on R language and basic analysis tools for clinical research faculty in the College of Medicine, The Ohio State University.

Funding support

2019–2022 — NIH/NIDDK (1R01DK121003-01)
Translumbosacral Neuromodulation Therapy for Fecal Incontinence: Randomized Trial
PI: Dr. Satish Rao. Role: Biostatistician (12% FTE)

2019–2020 — National Security Agency
AU-Fort Gordon Teaching Contract (Theoretical foundations for Machine Learning, and Machine Learning for Data Science)
Role: Co-Investigator (20% FTE)

2018–2020 — Georgia School of Orthodontics
Statistical support for Orthodontics Resident Program
Role: Biostatistician (10% FTE)

Conference presentations

2024[a] — Internation Symposium on Biopharmaceutical Statistics, Baltimore MD
Title: Penalized logistic regression model for improved propensity score estimation in unbalanced treatment arms

2023[c] — Joint Statistical Meetings, Toronto
Title: Statistical modeling for information borrowing from external cohorts in oncology trials for rare population

2023[b] — Joint Statistical Meetings, Toronto
Title: Penalized logistic regression model for improved propensity score estimation in unbalanced treatment arms

2021[a] — Workshop: Advanced Statistical Methods and Dynamic Data Visualizations for Mental Health Sciences
National Institute of Mental Health (https://www.didvizandstats.org/)
Title: Adjusting for confounders in cross-correlation analysis of resting state networks

2018[a] — Georgia Statistics Day, University of Georgia, Athens GA
Title: Penalized multivariate count models for genomic data

2018[a] — Statistics Colloquium, University of Maryland, Baltimore County
Title: Penalized multivariate count models for genomic data

2017[a] — International Conference on Statistics for 21st Century , University of Kerala, India
Title: Discrete multivariate models for genomic count data

2015[a] — SAMSI Beyond Bioinformatics - Transition workshop, Research Triangle Park, NC
Title: 3D Chromatin Reconstruction using TAD-Penalized Models.

2015[a] — University of Nebraska, Lincoln, NE
Title: Graphical representation and feature selection in metagenomic count data

2015[a] — University of Massachusetts, Lowell.
Title: Mean vector testing for high dimensional dependent observations.

a - Invited talks, b - Poster presentations, c - Contributed talks

2015[a] SAMSI Beyond Bioinformatics - Epigenetics workshop, Research Triangle Park, NC
Title: Statistical methods for detecting differentially methylated regions based on MethylCap-seq data.

2014[a] Probability and Statistics Day, UMBC
Title: Graphical representation of microbial community subpopulations using penalized Kendall's distance.

2014[b] Algorithms for Threat Detection Program Review, Boulder, CO
Title: Graphical representation of microbial community subpopulations using penalized Kendall's distance.

2012[b] Maryland Neuroimaging Retreat, Baltimore, MD
Title: Investigation of experimental factors in resting state networks.

2011[b] IISA Conference on Probability, Statistics and Data Analysis, Raleigh, NC
Title: Testing for mean vector in high dimensional Gaussian time series.

2011[c] Joint Statistical Meetings, Miami, FL
Title: Testing equality of correlation matrices at lag zero for time-dependent observations.

2010[c] Probability and Statistics Day, UMBC, Baltimore, MD
Title: A new test for the mean vector for *l*arge p, small n problem.
First prize for Best Student Presentation

2010[c] International Conference on Statistics, Probability, Operations Research, Computer Science and Allied Areas, Visakhapatnam, India
Title: Estimation of the proportion of exponential signals.

2009[c] Joint Statistical Meetings, Washington D.C.
Title: Estimation of the proportion of exponential signals.

Publications

Book Chapters

[1] **D. N. Ayyala**. *Chapter 6 - High-dimensional statistical inference: Theoretical development to data analytics*, volume 43 of *Handbook of Statistics*. Elsevier, 2020.

Articles

[2] A. Hudgi, Y. Yan, **D. N. Ayyala**, and S. S. C. Rao. Accuracy of patient-reported bowel symptoms for fecal incontinence: Historical recall versus prospective evaluation. *Neurogastroenterology & Motility*, 36(2), 2024.

[3] Y. Yan, K. Tennekoon, A. Eubanks, A. Herekar, D. Shimoga, **D. N. Ayyala**, C. McLeod, J. A. Kurek, J. C. Morgan, S. S. C. Rao, and A. Sharma. Evaluation of bidirectional gut-brain axis and anorectal function in Parkinson's disease with constipation. *Neurogastroenterology & Motility*, 36(3), 2024.

[4] G. W. Horde, **D. N. Ayyala**, P. Maddux, A. Gopal, W. White, and A. E. Berman. Creation and Validation of an Algorithm for Predicting the Recurrence of Atrial Fibrillation Following Pulmonary Vein Isolation by Utilizing Real-World Data and Ensemble Modeling Techniques. *Cureus*, 15(8):e43234, 2023.

[5] C. Rice, **D. N. Ayyala**, and others. Sex and racial differences in systemic lupus erythematosus among U.S. adults in the All of Us Research Program. *Arthritis Care and Research*, 2023.

[6] **D. N. Ayyala**, S. Ghosh, and D. F. Linder. Covariance matrix testing in high dimension using random projections. *Computational Statistics*, 37(3):1111–1141, 2022.

[7] **D. N. Ayyala**, J. Lin, and Z. Ouyang. Differential RNA methylation using multivariate statistical methods. *Briefings in Bioinformatics*, 23(1), 2022.

[8] S. Coughlin, **D. N. Ayyala**, J. Stewart, and J. Cortes. Social Needs and Health-related Quality of Life among Hematologic Cancer Survivors. *Supportive Care in Cancer*, 2022.

[9] C. A. Hamilton, **D. N. Ayyala**, and others. Small Towns, Big Cities: Rural and Urban Disparities Among Hospitalized Patients With COVID-19 in the Central Savannah River Area. *Open Forum Infectious Diseases*, 9(3), 2022.

[10] A. S. Newsome, **D. N. Ayyala**, M. E. Rech, S. Blackwell, and others. Impact of Pharmacists to Improve Patient Care in the Critically Ill: A Large Multicenter Analysis Using Meaningful Metrics With the Medication Regimen Complexity-ICU (MRC-ICU). *Critical Care Medicine*, 2022.

[11] S. S. Coughlin and **D. N. Ayyala**. Symptoms associated with comorbid diabetes among breast cancer survivors. *Breast Cancer Research and Treatment*, 189:781–786, 2021.

[12] S. S. Coughlin, **D. N. Ayyala**, and J. E. Cortes. Problems in Living among Breast Cancer Survivors. *Current Cancer Reports*, 3(1), 2021.

[13] S. S. Coughlin, **D. N. Ayyala**, and et al. A Health Survey of African American Men Seen at an Academic Medical Center in the Southern United States. *Journal of Community Medicine*, 4(1), 2021.

[14] S. S. Coughlin, **D. N. Ayyala**, J. Luque, and J. X. Moore. Predictors of Prostate Cancer Screening among African American Men Seen at an Academic Medical Center in the Southern United States. *Current Cancer Reports*, 3(1), 2021.

[15] S. Ghosh, **D. N. Ayyala**, and R. Hellebuyck. Two-Sample High Dimensional Mean Test Based On Prepivots. *Computational Statistics and Data Analysis*, 163, 2021.

[16] B. Majeed, **D. N. Ayyala**, and S. S. Coughlin. Cigarette Smoking after Surviving Breast Cancer: A Pilot Study. *Current Cancer Reports*, 3(1):124–127, 2021.

[17] S. S. C. Rao, E. Coss-Adame, Y. Yan, A. Erdogan, J. Valestin, and **D. N. Ayyala**. Sensory Adaptation Training or Escitalopram for IBS with Constipation and Rectal Hypersensitivity: Randomized Controlled Trial. *Clinical and Translational Gastroenterology*, 12(7), 2021.

[18] S. S. C. Rao, X. Xiang, A. Sharma, T. Patcharatrakul, Y. Yan, R. Parr, **D. N. Ayyala**, and S. Hamdy. Translumbosacral Neuromodulation Therapy for Fecal Incontinence: A Randomized Frequency Response Trial. *The American Journal of Gastroenterology*, 116(1):162–170, 2021.

[19] S. S. C. Rao, Y. Yan, E. Erdogan, E. Coss-Adame, T. Patcharatrakul, J. Valestin, and **D. N. Ayyala**. Barostat or syringe-assisted sensory biofeedback training for constipation with rectal hyposensitivity: A randomized controlled trial. *Neurogastroenterology and Motility*, 2021.

[20] S. S. C. Rao, Y. Yun, X. Xiang, A. Sharma, **D. N. Ayyala**, and S. Hamdy. Effects of Translumbosacral Neuromodulation Therapy on Gut and Brain Interactions and Anorectal Neuropathy in Fecal Incontinence: A Randomized Study. *Neuromodulation: Technology at the Neural Interface*, 24(7):1269–1277, 2021.

[21] X. Xiang, A. Sharma, T. Patcharatrakul, Y. Yan, R. Parr, **D. N. Ayyala**, and S. S. C. Rao. Randomized Controlled Trial of Home Biofeedback Therapy versus Office Biofeedback Therapy for Fecal Incontinence. *Neurogastroenterology and Motility*, 2021.

[22] S. S. Coughlin, **D. N. Ayyala**, B. Majeed, L. Cortes, and G. Kapuku. Cardiovascular Disease among Breast Cancer Survivors. *Cardiovascular Disorder and Medicine*, 2(1), 2020.

[23] S. S. Coughlin, **D. N. Ayyala**, M. Tingen, and J. E. Cortes. Financial distress among breast cancer survivors. *Current Cancer Reports*, 2020(1):48–53, 2020.

[24] S. S. C. Rao, X. Xiang, Y. Yan, K. Rattanakovit, T. Patcharatrakul, R. Parr, **D. N. Ayyala**, and A. Sharma. Randomised clinical trial: linaclotide vs placebo—a study of bi-directional gut and brain axis. *Alimentary Pharmacology & Therapeutics*, 51(12):1332–1341, 2020.

[25] H. Whiteside, A. Nagabandi, K. Brown, **D. N. Ayyala**, and G. Sharma. Prevalence and clinical characteristics associated with left atrial thrombus detection: Apixaban. *Journal of the American College of Cardiology*, 11(2):84–93, 2019.

[26] **D. N. Ayyala**, A. Roy, J. Park, and R. P. Gullapalli. Adjusting for Confounders in Cross-correlation Analysis: an Application to Resting State Networks. *Sankhya B*, 80(1):123–150, 2018.

[27] **D. N. Ayyala**, J. Park, and A. Roy. Mean vector testing for high-dimensional dependent observations. *Journal of Multivariate Analysis*, 153:136–155, 2017.

[28] Z. Qin, B. Li, K. N. Conneely, H. Wu, M. Hu, **D. N. Ayyala**, Y. Park, V. X. Jin, F. Zhang, H. Zhang, L. Li, and S. Lin. Statistical Challenges in Analyzing Methylation and Long-Range Chromosomal Interaction Data. *Statistics in Biosciences*, 8(2):284–309, 2016.

[29] **D. N. Ayyala**, D. E. Frankhouser, J. Ganbat, G. Marcucci, R. Bundschuh, P. Yan, and S. Lin. Statistical methods for detecting differentially methylated regions based on MethylCap-seq data. *Briefings in Bioinformatics*, 17(6):926–937, 2015.

[30] **D. N. Ayyala** and S. Lin. GrammR: graphical representation and modeling of count data with application in metagenomics. *Bioinformatics*, 31(10):1648–1654, 2015.

[31] J. Park and **D. N. Ayyala**. A test for the mean vector in large dimension and small samples. *Journal of Statistical Planning and Inference*, 143(5):929–943, 2013.