Mohammad Mihrab Uddin Chowdhury

Visiting Assistant Professor, Department of Mathematics, Virginia Tech
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RESEARCH INTERESTS

Mathematical Biology, Mathematical Modeling, Dynamical Systems, Differential Equations, Ecological Modeling, Invasive Species, Epidemiology (Communicable and Non-Communicable Diseases), Addiction and Mental Health, Public Health, Data-Driven Modeling, Machine Learning, Wastewater Surveillance,

EDUCATION

Ph.D. Applied Mathematics, May 2024

Texas Tech University, Lubbock, TX, USA
Advisor: Dr. Angela Peace
Dissertation: Data-Integrated Mathematical Modeling Approaches to Explore the Complexities of Amphibian Fungal Transmission Dynamics

M.S. Applied Mathematics, May 2021

Texas Tech University, Lubbock, TX, USA

M.S. Mathematics, 2018

University of Dhaka, Dhaka, Bangladesh

B.S. in Mathematics, 2015

University of Dhaka, Dhaka, Bangladesh

PROFESSIONAL EXPERIENCE

- **Visiting Assistant Professor** Sept. 2025 - Continued
  Department of Mathematics, Virginia Tech
  - Developing a temperature-dependent vector-host model to examine how climate-driven shifts in competition between *A. aegypti* and *A. albopictus* influence disease dynamics, spatial distribution, and control effectiveness.
  - Exploring key factors and developing a predictive model using Youth Risk Behavior Surveillance System (YRBSS) data to assess suicide risks across diverse demographics, aiming to enhance targeted prevention strategies.
- **Post Doctoral Fellow** June 2024 - Sept. 2025
  Centre for Public Health Modeling and Response,
  Department of Public Health, Clemson University
  - Developing a mathematical model to assess the impact of mobile health clinics on reducing hospitalizations due to infectious diseases.
  - Leveraged wastewater-based epidemiology to forecast COVID-19 hospitalizations using SARS-CoV-2 RNA concentrations in wastewater, analyzing data from six wastewater treatment plants and 43 ZIP codes in South Carolina. Employed Poisson regression and random forest to achieve predictive accuracies up to 87.18% treatment plant and 74.5% zipcode level.
  - Developed a two-step methodology combining traditional estimation techniques(EpiEstim, EpiFilter, EpiNow2) with a Bayesian INLA spatial model to estimate the effective reproductive number of infectious disease (Covid - 19) at geographic regions with sparse data.

- **Graduate Research Assistant** Jan. 2020 - May 2024

  Texas Tech University

  1. **Fungal Pathogen and Amphibians**
     - Developed a compartmental model to study the transmission dynamics of Batrachochytrium salamandrivorans (Bsal) in eastern newts, factoring in life stages and environmental factors such as temperature and population density. This research provides insights into the disease's spread and potential impact, highlighting the susceptibility of eastern newt and the importance of environmental factors.
     - Developed a novel dose-dependent infectious disease model that integrates multiple transmission pathways. Applied as a case study on Batrachochytrium salamandrivorans (Bsal) and eastern newt, this model aids in understanding dose-dependent transmission dynamics. The approach has broader implications for managing exposure-dependent diseases across diverse biological systems.
  2. **Disease in Humans**
     - Developed a simulation-based study to evaluate COVID-19 transmission under evolving variants, incorporating time-varying transmissibility and vaccination rates to assess the combined impact of vaccine efficacy and non-pharmaceutical interventions on future outbreak scenarios.
     - Evaluated the CDC's COVID-19 vaccine allocation strategy using a compartmental model, highlighting areas of near-optimal performance and suggesting improvements for future vaccine distribution based on age, comorbidities, occupation, and living conditions.
     - Developed a machine learning approach to assist in diabetes risk prediction using Behavioral Risk Factor Surveillance System (BRFSS) data, incorporating data augmentation techniques to manage imbalanced datasets. The model considers health and socio-economic factors to improve the reliability of identifying individuals who may be at risk.

JOURNAL PUBLICATIONS

- **Published**

1. **Mohammad Mihrab Chowdhury**, Matthew J. Gray, Edward Davis Carter, Julia A. McCartney, Douglas C. Woodhams, James G. Surles,K McKensie Nelms, Hao Gan, Angela Peace, *Fungal pathogen transmission dynamics in North American salamanders: Mathematical insights for disease management*, *journal=Ecological Modelling*, *volume=501*, *pages=111028*, *year=2025*, *publisher=Elsevier*
2. Md Sakhawat Hossain, Ravi Goyal, Natasha K Martin, Victor DeGruttola **, Mohammad Mihrab Chowdhury**, Christopher McMahan; Lior Rennert, *A flexible framework for local-level estimation of the effective reproductive number in geographic regions with sparse data.* BMC Med Res Methodol 25, 73 (2025). https://doi.org/10.1186/s12874-025-02525-1.
3. **Mohammad Mihrab Chowdhury**, Ragib Shahariar Ayon, Md Sakhawat Hossain, *An Investigation of Machine Learning Algorithms and Data Augmentation Techniques for Diabetes Diagnosis Using Class Imbalanced BRFSS Dataset*, *journal=Healthcare Analytics*, *volume = 5*, *pages = 100297*, *year = 2024*, *publisher = Elsevier*.
4. **Mohammad Mihrab Chowdhury**, Md Rafiul Islam, Md S. Hossain, Nusrat Tabassum, Angela Peace, *Incorporating the mutational landscape of SARS-COV-2 variants and case-dependent vaccination rates into epidemic models*, journal = Infectious Disease Modelling, volume=7,number=2,pages=75-82,year=2022,publisher=Elsevier
5. Md Rafiul Islam, Tamer Oraby, Audrey McCombs, **Mohammad Mihrab Chowdhury**, Mohammad Al-Mamun, Michael G. Tyshenko, Claus Kadelka, *Evaluation of the United States COVID-19 vaccine allocation strategy*. PLoS ONE 16(11): e0259700. https://doi.org/10.1371/journal.pone.0259700

- **Submitted/In Preparation**

1. Nusrat Tabassum, **Mohammad Mihrab Chowdhury**, Christopher S McMahan, Stella Self, Mirza Isanovic, Karlen Correa-Velez, Sarah Sellers, Sean Norman, Lior Rennert, *Granular Insights: A Wastewater-Based Machine Learning Approach for Localized COVID-19 Hospitalization Forecasting* (Submitted)
2. Mohammad Miftah Chowdhury, **Mohammad Mihrab Chowdhury**, Nusrat Tabassum, Abu Hossain Md Moinul Ahsan, Farjana Tanni, Bijoy Krishna Das, *Risk Factors for Non-Syndromic Cleft Lip and Palate in Bangladesh: A Cross-Sectional Study* (Submitted).
3. **Mohammad Mihrab Chowdhury**, E. Davis Carter, Matthew J. Gray, Angela Peace, *A mechanistic Model of Bsal Dynamics in Adult Eastern Newts: Viral Loads and Micro-Predators.* (In Preparation)
4. Nusrat Tabassum, **Mohammad Mihrab Chowdhury**, *Mosquito Population Dynamics and Disease Spread: A Comparative Study of Ae. aegypti and Ae. albopictus.*(In Preparation)
5. **Mohammad Mihrab Chowdhury**, Aakash Pandey, Nusrat Tabassum, Lior Rennert, *Precision Public Health: Optimizing Mobile Health Clinic Allocation Leveraging EHR Data.* (In Preparation)
6. Ragib Shahariar Ayon, Abdullah Al Safi, Vaseem Ahmed, **Mohammad Mihrab Chowdhury**, *A Data-Driven Approach to Understanding Suicide Risk Across Diverse Youth Populations in USA*,(In Preparation)

7. **Mohammad Mihrab Chowdhury**, Miftah Chowdhury, Nusrat Tabassum, *Evolution of Dengue Dynamics in Bangladesh: Risk Factors and Spatial Trends Over the Year*,(In Preparation)

PRESENTATIONS

- Talk
  1. *Granular Insights: Wastewater-Based Modeling for Localized COVID-19 Predictions*, Seminar Talk, Center for Public Health Modeling and Response, Clemson University, 2025.
  2. *Predicting COVID - 19 hospitalization trends using SARS-CoV2 RNA copies in wastewater*, Seminar Talk, Center for Public Health Modeling and Response, Clemsonm University, 2024.
  3. *Amphibian Fungal Pathogen: Unravelling the BSal Epidemic Across the Life Stages of Salamanders*, Sectional Meeting of SIAM TXLA - 2023, Louisiana, Nov. 3-5, 2023 **(Invited)**.
  4. *Understanding Bsal Transmission Dynamics to Safeguard North American Salamander Populations*, Annual Conference of Society of Mathematical Biology, Columbus, Ohio, July 15-21, 2023 **(Invited)**.
  5. *Coupling discrete and continuous time scales to investigate the impact of an emerging fungal pathogen in amphibian populations*, International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems October 28-30, 2022 University of Louisiana at Lafayette, Louisiana, USA **(Invited)**.
  6. *Coupling Intra-Season Disease Dynamics and Annual Population Demography with a Hybrid Model of Batrachochytrium Salamandrivorans in Amphibian Populations.* First Global Amphibian and Reptile Disease Conference, Knoxville, Tennessee, USA, August 4 -10, USA **(Invited)**.
- Poster
  1. *Revolutionizing COVID-19 Surveillance Through Wastewater-Based Epidemiology (WBE)*, 2025 Postdoc Research Symposium, Clemson University, Clemson, SC, USA.
  2. *Mitigating Losses of COVID-19 through Incorporating Mutational Landscape and Case-Dependent Vaccination Rates into Epidemic Model*, 22nd Annual Graduate Student Research Poster Competition, Texas Tech University, Lubbock, Texas, USA.
  3. *Influence of Birth Pulse on Disease Transmissibility in Amphibians*, Society for Mathematical Biology, Annual Meeting - 2021, University of California Riverside, Riverside, California, June 13-17, 2021.
  4. *Mitigating the Losses of COVID-19 Variants' Breakthrough Following Vaccination*, Red Raider Minisymposium -2021, Texas Tech University, Lubbock, Texas, August 20-21, 2021.

WORKSHOP AND MINI-SYMPOSIUM

- **Organized**
  1. *Mathematical and Statistical Modeling in Biomedical and Public Health Research*, Mini-symposium in SIAM TX-LA 2025, TX, USA (Co-Organizer).
  2. *Novel Perspectives on Infectious Diseases Modeling* , Mini-symposium in SIAM TX-LA 2024, TX, USA (Co-Organizer).
  3. *Dynamics of Mathematical Models in Biology*, Mini-symposium in SIAM TX-LA 2023, Louisiana, USA (Co-Organizer).
  4. *Feedback between infectious disease and ecosystems*, Mini-symposium in Annual Conference of Society of Mathematical Biology 2023, Ohio, USA (Co-Organizer and Session-Chair).
  5. *Infectious Disease Modeling of Amphibian Populations*, First Global Amphibian and Reptile Disease Conference 2022, Knoxville, Tennessee, USA (Co-Organizer).
- **Attended**
  1. SMB MathEduEpi 2025, Virtual Mini-symposium.
  2. Introduction to Machine Learning for ID Modeling, SISMID 2024, Emory University, GA.
  3. Statistics and Modeling with Novel Data Streams, SISMID 2024, Emory University, GA.
  4. Pathogen Evolution, Selection and Immunity, SISMID 2024, Emory University, GA.
  5. Spatial Statistics in Epidemiology and Public Health, SISMID 2024, Emory University, GA.
  6. Early Career Workshop, SMB 2023, Columbus, Ohio.
  7. Responding to Feedback on Academic Writing by GWC of Texas Tech
  8. Data Management for Researchers by Texas Tech University

TEACHING EXPERIENCE

Instructed, graded, and oversaw courses utilizing a variety of teaching modalities, including face-to-face, online, and hybrid as a graduate part-time instructor. Effectively managed classes of varying sizes, ranging from 49 to 110 students, across each modality. As a graduate teaching assistant worked as a grader for a course.

- **Visiting Assistant Professor** Sep 2025 - Cont.
  Virginia Tech
  1. MATH - 2214 (2 sections), Introduction to Differential Equations, Fall 2025

- **Graduate Part-Time Instructor** Jan. 2019 - Dec. 2021, Aug. 2022 - Dec. 2022, Aug. 2023 - May 2024
  Texas Tech University
  1. MATH - 1451, Calculus I with Applications, Fall 2021
  2. MATH - 1550, Precalculus, Fall 2021, Spring 2021
  3. MATH - 1321, Trigonometry, Summer 2021
  4. MATH - 1320, College Algebra, Fall 2023, Fall 2022, Summer/Spring 2020, Fall/Summer/Spring 2019

- **Graduate Teaching Assistant** Aug. - Dec. (2018)
  Texas Tech University
  1. Differential Equations I

SKILLS

- Programming Languages: MATLAB, Python, R, MAPLE, SQL, MATHEMATICA, FORTRAN
- Documentation: Latex, R Markdown, Microsoft Word, and Microsoft PowerPoint

AWARDS

- **Halloran Scholar, SISMID 2024** ($2485)
  Awarded a competitive scholarship by the Summer Institute in Statistics and Modeling in Infectious Diseases to attend three specialized modules and cover travel expenses.
- **SIAM TXLA - 2023 Travel Award**($500)
  Competitive Travel Award by SIAM for oral presentation and organizing a mini-symposium at the 6th Sectional Meeting of Society for Industrial and Applied Mathematics, Louisiana, 2023.
- **Graduate School Travel Award** ($450)
  Competitive Travel Award by Texas Tech University for oral presentation and organizing a mini-symposium at the Annual Meeting of Society for Mathematical Biology, Ohio, 2023.
- **Landahl Travel Award** ($450)
  Competitive travel award for oral presentation and organizing a mini-symposium at the Annual Meeting of Society for Mathematical Biology, Ohio, 2023.
- **Dr. Shelby Hildebrand Graduate Math Fellowship** ($10000)
  In recognition of excellent research and academic performance by the Department of Mathematics and Statistics, Texas Tech University.
- **ICMA Travel Award** ($850)
  For oral presentation at the 8th International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems, 2022.
- **Create Possible Scholarship - 2021** ($750)
  In recognition of excellent academic standing by the Graduate School, Texas Tech University.
- **Hildebrand Scholar - 2021** ($1500)
  A competitive scholarship awarded by the Department of Mathematics and Statistics, Texas Tech University, for my excellent academic standing.
- **Bangladesh Sweden Trust Fund** (Travel Grant - $390)
  Secured funding from the Government of the Republic of Bangladesh to pursue a Ph.D. at Texas Tech University.

PROFESSIONAL CERTIFICATES

- Google Data Analytics Professional by Grow With Google Verify
- Amazon Web Services Machine Learning - Specialty Verify

- Amazon Web Services Solutions Architect, Associate Verify
- Amazon Web Services Cloud Practitioner Verify

PROFESSIONAL MEMBERSHIP

- Member, Society for Industrial and Applied Mathematics (SIAM)
- Society for Mathematical Biology
- American Mathematical Society
- Bangladesh Mathematical Society
- University of Dhaka, Mathematics Alumni Association

SERVICE ACTIVITY

- **Ad Hoc Journal Reviewer**

  Ecological Modelling, Healthcare Analytics, Mathematical Bioscience and Engineering, Heliyon etc.
- **Professional and Community Service**
  1. Judge, iGRads - Graduate research and discovery symposium, 2025, Clemson University.
  2. Judge, Graduate School 3-minute Thesis Competition, 2022.
  3. Vice President, Association of Bangladeshi Students and Scholars at Texas Tech University
  4. Treasurer, Association of Bangladeshi Students and Scholars at Texas Tech University