Theresa R. Sheets

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Data Scientist
Predict Division
Center for Forecasting and Outbreak Analytics
Centers for Disease Control and Prevention

EDUCATION

Doctor of Philosophy, **Mathematics**	Aug 2018 – Aug 2023
Department of Mathematics, University of Utah (UU)	
Dissertation: *Modeling Household Epidemics and Analysis of Links from Testing to Hospitalization*	

Bachelor of Science, **Mathematics**	Sept 2014 – May 2018
Department of Mathematics, University of Maryland, Baltimore County (UMBC)	
Minors: *Computer Science, Mathematical Biology*	

Bachelor of Arts, **Health Administration and Policy**	Sept 2014 – May 2018
Department of Public Health, UMBC	

RESEARCH FIELDS

Mathematical modeling, bayesian statistics, population dynamics, infectious disease epidemiology, immunology, data integration, health economics, health policy, demography, decision-support, population health, health disparities, social determinants of health, infectious disease forecasting, machine learning, deep learning, time-series analysis

SOFTWARE

R, **Python**, **SQL**, **C++**, C, **GIT**, Java, Matlab, **Microsoft office**, SAS, Stata, Unix

RELATED EXPERIENCE

Centers for Disease Control and Prevention, Data Scientist	Aug 2023 – Present
Supervisor: Dina Mistry	

- Designs, develops, simulates, and evaluates the output of mathematical models of infectious disease transmission using specialized quantitative tools including git, markdown, and a high-performance cluster for collaborative, reproducible code development and communication of findings.

- Compiles, cleans, integrates and analyzes data from a variety of sources using statistical methods to estimate parameters for mathematical models of infectious disease transmission.

- Contributed to the development of a agent-based model in Java to simulate the spread of infection, and subsequent interventions deployed in a congregate living setting which was later utilized in the 2024 Measles Response.

- **Leading** a collaboration between CFA and DHQP to model the effects of interventions on spread of infectious disease in nursing home populations including interactions between staff and residents.

- Developed code in Python to simulate and parameterize a metapopulation model of the spread of measles in subpopulations with differing contact, vaccination rates, and willingness to isolate. This code was deployed as a public facing simulator tool for the 2025 Measles Response.

- Developed visualizations to communicate statistical findings to relevant stakeholders with rapid turnaround in order to provide the scientific and quantitative basis for critical agency decisions, policy, and subsequent regulatory actions.

- Acted as statistical subject matter expert on the development of a user-friendly statistical model to estimate contact tracing resource requirements in excel to support localities in decision making for contact tracing and translated the excel tool into a R package including a user guide and summary of methods and assumptions.

Utah Department of Health and Human Services, Oct 2022 – August 2023
 Supervisor: <u>Abigail Collingwood</u>

- Met with multiple state-level stakeholders to understand the data, develop a project with impactful outputs, and contribute to decision support for the state of Utah.

- Developed a data pipeline to clean and link COVID-19 hospitalization data to testing (NEDSS), syndromic surveillance (ESSENCE), and wastewater(REDcap) data streams. Data to be analyzed comes from many sources and in a variety of structures that include computerized statistical files, manual or automated program reporting systems and program files, and ad hoc information obtained from internal and external sources.

- Built a tool forecasting hospitalizations at the state level and assessed model success over time and refactored forecast tool to increase real-time usability for state epidemiologists.

- Produced analytical reports and communicated the findings to UDHHS officials, and conference attendees.

UU, Division of Epidemiology March 2020 – August 2023
 Supervisor: <u>Lindsay Keegan, Damon Toth</u>

- Built a discrete space model of the spread of SARS-CoV-2 through the state of Utah in R to support state-level decision makers through scenario analysis and predictive modeling.

- During COVID-19 response identified trends, correlations, and causation within large datasets to provide a synopsis of emerging trends, challenges, and recommendations for change.

- Modeled the spread of SARS-CoV-2 through age-structured households to assess vaccination regimens.

- IRB approval for research study.

UU, **Department of Mathematics**   August 2018 – August 2023
  Supervisor: <u>Fred Adler</u>

- Built a recurrent neural net to explore cystic fibrosis and diabetes progression with Python.

- Developed an analytic solution to small epidemics to investigate the spread of infectious disease in households.

- Mentored multiple undergraduate and graduate students as they developed research projects modeling infectious disease systems.

- Utilized SQL queries to gather new dataset analyzing the trends of clients stay length, return, frequency, and duration.

UU, **Department of Pathology**   May 2019 – Aug 2019
  Supervisor: <u>Tracey Lamb</u>

- Statistically analyzing the relationship between Malaria and EBV co-infection on the immune response to Malaria to assess the antibody response to co-infection in R.

- Built a machine learning method to explore the differences in antibody response across infection categories.

- Presented workshop to lab group explaining the mathematical basis for principle component analysis.

ADDITIONAL RESEARCH EXPERIENCES

UMBC, **Eclipse Lab**   Jan 2017 – Sept 2018
  Project: A Dynamical Systems Model of Baroreflex Stress
  Supervisors: <u>Justin Brooks, Kathleen Hoffman</u>

- Conducted a literature review of models of the Baroreflex and dynamical systems models of physiological responses.

- Developed a pipeline to clean a large dataset of heart rate and blood pressure time series data.

- Built a model of stress as a dynamical system using previously established models of cardiovascular output in MATLAB.

- Produced a poster of results to present findings at the American Psychosomatic Society annual conference.

- Submitted a proposal to NSA GRFP for an independently proposed project which received an honorable mention.

National Institute for Mathematical and Biological Synthesis   May 2016 – July 2016
  University of Tennessee, Summer Research Fellow
  Project: A Discrete Age Structured Model of Hantavirus in
  a Rodent Reservoir in Paraguay
  Supervisor: <u>Suzanne Lenhart</u>

- Analyzed data using R to examine the relationship between hantavirus and leishmaniasis.

- Built a discrete math model for the spread of hantavirus in a Paraguay mouse reservoir population.

- Designed a simulation in Matlab to explore the relevance of the age structure in the population.

- Collaborated with team to design a poster and present a publication summarizing results.

UMBC, Department of Public Health   Aug 2016 – Nov 2017

Project: Links between fecundity and health outcomes in women
Supervisor: Jamie Trevitt

- Lead an independent project to clean and analyze a large international dataset (Generations and Gender Proggame).

- Analyzed data in Stata to examine the relationship between fecundity and health in older women.

Biostatistics and Epidemiology Summer Training Program,   May – July 2015

Columbia University, Mailman School of Public Health
Project: Relationship between anxiety and patient satisfaction in
patients with myocardial infarction
Supervisor: Siqin Ye

- Statistically explored the relationship between anxiety and patient satisfaction in patients with myocardial infarction using data from a nationally representative youGov survey to complete chisquares analyses and logistic regression in R.

- Utilized SAS and SQL queries to generate datasets and properly handle analyses of a 1500 survey participants.

- Collaborated with a partner to design and present a poster summarizing research findings at a Poster Symposium.

Chronic Kidney Disease in Children Cohort Study   May – July 2014

Johns Hopkins Bloomberg School of Public Health
Department of Epidemiology
Supervisor: Alvaro Munoz

- Analyzed the long term trends of kidney function in children with chronic kidney disease post-transplant using SAS and SQL.

- Utilized SAS to complete data management tasks to more effectively group participants.

GeneSTAR Study   June 2013 – August 2013

Johns Hopkins School of Medicine
Department of Internal Health
Supervisor: Diane Becker, MPH, ScD

- Evaluated the genetic influence on heart disease through a longitudinal cohort study.

- Cleaned data, entered data from study participants.

- Located study participants in order to schedule their study participation.

- Respectfully handled patient medical history with regard to their privacy.

PUBLICATIONS AND SCIENTIFIC REPORTS

PEER-REVIEWED PUBLICATIONS

4. Toth, D.J.A., **Sheets, T.R.**, Beams, A.B. et al. Model-based estimates of age-structured SARS-CoV-2 epidemiology in households. BMC Public Health 24, 2965 (2024). doi:10.1186/s12889-024-20308-z

3. [*In review*] Jay Love[*†], Cormac R. LaPrete[†], **Theresa R. Sheets**, George G. Vega Yon, Alun Thomas, Matthew H. Samore, Lindsay T. Keegan, Frederick R. Adler, Rachel B. Slayton, Ian H. Spicknall, Damon J.A. Toth (2023). Characterizing spatiotemporal variation in transmission heterogeneity during the 2022 mpox outbreak in the USA. doi: 0.1101/2023.05.10.23289580

2. Meredith, H.R., Arehart, E.[†], Grantz, K.H.[†], Beams, A., **Sheets, T.**, Nelson, R., Zhang, Y., Vinik, R.G., Barfuss, D., Pettit, J.C., McCaffrey, K., Dunn, A. C., Good, M., Frattaroli, S., Samore, M.H., Lessler, J., Lee, E.C., & Keegan, L.T. (2021). Coordinated strategy for a model-based decision support tool for coronavirus disease, Utah, USA. Emerging infectious diseases, 27(5), 1259-1265. doi: 10.3201/eid2705.203075

1. Igoe M.[*†], Moran E.J. [†], **Sheets T.**[†], DeSalu J.[†], Jonsson C.B., Lenhart S., Owen R.D., and Rúa M.A. "A Discrete Age Structured Model of Hantavirus in a Rodent Reservoir in Paraguay". Letters in Biomathematics, Vol. 7, no. 1, Sept. 2020, pp. 127–142, doi:10.30707/LiB7.1.1647875326.032252.

(*[*] Indicates corresponding author, [†] these authors contributed equally*)

MANUSCRIPTS IN PREPARATION

- **Sheets, TR**, Adler, F, Samore, MH, Keegan, LT, Toth, DA: Vaccination and Household Transmission of SARS-CoV-2.

- **Sheets, TR**, Adler, F, Samore, MH, Toth, DA, Keegan, LT: Forecasting COVID-19 Hospitalizations in a Changing Data Landscape with Public Health.

(*Manuscripts available upon request*)

CONTRIBUTED PRESENTATIONS

Joint Mathematics Meetings, *San Francisco, California*   January 2024
    Talk: Household epidemics and vaccination strategies
    Sheets, TS*

University of Utah Workshop, *Salt Lake City, Utah*   November 2023
    Talk: GAMs: An overview using mgcv, modeling for public health practitioners
    Sheets, TS*

Society for Mathematical Biology, *Columbus, Ohio* — July 2023
    Talk: Forecasting SARS-CoV-2 hospitalizations with multiple public health metrics
    Sheets, TS*

Infectious disease modeling for public health professionals, *Salt Lake City, UT* — April 2023
    Sheets, TS*
    Talk: Autoregressive Integrated Moving Average Models
    Talk: Generalized Additive Models Models

COVID-19 Symposium, *Salt Lake City, UT* — June 2021
    Sheets, TS*, Keegan, LT
    Poster: A Model-Based Decision Support Tool for Coronavirus Disease in Utah

American Psychosomatic Society, *Louisville, KY* — March 2018
    Sheets, TS*, Brooks, JR
    Poster: Modeling Autonomic Nervous System Activity to Predict Response to Fatigue

NIMBioS Undergraduate Research Conference, *Knoxville, TN* — Oct 2016
    Igoe, M*, **Sheets, TR***
    Talk: A Discrete Age Structured Model of Hantavirus Among Rodents in Paraguay

(** Indicates Presenter*)

FELLOWSHIPS AND AWARDS

RESEARCH AWARDS

CDC Directors Award for Collaboration — 2024
    CDC Nursing Home Public Health Response Network Team

CDC Time off Award — 2024
    Contributions to 2024 Mpox pre-response

NIH F31 NRSA Predoctoral Fellowship: (Score: **20**, not funded) — April 2022

COVID-19 Symposium Best Poster Award, *Salt Lake City, UT* — June 2021

Research Training Grant Fellowship — Aug 2018 – Aug 2020

National Science Foundation Graduate Research Fellowship (Honorable Mention) — April 2014

SCHOLARSHIPS AND FELLOWSHIPS

Department of Mathematics Summer Training Grant — June – Aug 2020, 2021

Department of Mathematics Research Training Fellowship — Aug 2018 – Aug 2019

Meyerhoff Scholarship — June 2014 – May 2018

National Security Agency Scholarship — Aug 2014 – May 2018

Barbera E Burkman HAPP Scholarship   Dec 2017

TRAVEL AWARDS

Summer Institute in Biostatistics Travel Scholarship   July 2023

Meyerhoff Travel Scholarship   Jan 2017, 2018

NIMBioS Travel Scholarship   Oct 2016

TEACHING EXPERIENCE

Vector Calculus and Partial Differential Equations (MATH 3150, UU)
Teaching Assistant   Jan – May 2020
Differential Equations and Linear Algebra (MATH 2250, UU)
Teaching Assistant   Aug – Dec 2019
Pre-Calculus (MATH 150, UMBC)
Teaching Assistant   May – July 2018
Multivariable Calculus (MATH 251, UMBC)
Teaching Assistant   Aug – Dec 2017
Data Structures (CS 341, UMBC)
Teaching Assistant   Aug – Dec 2017
Computer Science 2 (CS 202, UMBC)
Teaching Assistant   Jan – May 2017
Bio-mathematics (MATH 355, UMBC)
Grader   Jan – May 2017
Calculus and Analytic Geometry II (MATH 152, UMBC)
Teaching Assistant   Jan – May 2017
Calculus and Analytic Geometry I (MATH 151, UMBC)
Teaching Assistant   Jan – Dec 2016
Learning Resource Center (UMBC)
Tutor   Jan 2015 - Dec 2016
Pre-Calculus (MATH 150, UMBC)
Teaching Assistant   Aug – Dec 2015
Linear Algebra (MATH 221, UMBC)
Grader   Aug – Dec 2015

MENTORING EXPERIENCE

Society for Mathematical Biology Mentor   July 2023
Mathematics Peer Mentor (UU)   Aug 2020 – Aug 2023
Cormac R. LaPrete (UU)   Jan 2020 – August 2023
    Modeling Infectious Disease
Pre-REU Graduate Mentor (University Utah)   May – Aug 2020
    Symmetry, Randomness, and Computation
Meyerhoff Peer Mentor (UMBC)   Aug 2016 – Aug 2018

SELECTED WORKSHOPS, PROFESSIONAL ORGANIZATIONS, AND ACADEMIC SERVICE

SELECTED WORKSHOPS, TRAININGS, AND OTHER RESEARCH ACTIVITIES

Emory Summer Institute in Statistical Modeling   July 2024
Simulation Based Inference

Prevention Effectiveness Fellowship trainings   2023-2024
Cost effectiveness in public health, decision modeling, cohort-state transition models

University of Washington (UW) Summer Institute in Statistical Genetics   July 2023
Fundamentals in Population Genetics

UW Summer Institute in Modeling for Infectious Diseases   July 2023
Stochastic Epidemic Models with Inference

National Science Foundation, Research Experience for Undergraduates   May – July 2016

Biostatistics and Epidemiology Summer Training Program   May – July 2015

PROFESSIONAL ORGANIZATION MEMBERSHIP

Association for Women in Mathematics

Society of Industrial and Applied Mathematics

Society of Mathematical Biology

ACADEMIC SERVICE

Math Biology Journal Club, co-organizer   Aug 2021 – May 2022

Markov Chain Monte Carlo Reading Course, co-organizer   Aug 2022 – May 2023

REFERENCES

Lindsay Keegan, Ph.D.	lindsay.keegan@utah.edu
Frederick Adler, Ph.D.	adler@math.utah.edu
Damon Toth, Ph.D.	toth@utah.edu
Randon Gruninger, MPH	rjgruninger@utah.gov