Theresa R. Sheets

sheetstheresa@gmail.com

Prevention Effectiveness Fellow
Predict Division
Center for Forecasting and Outbreak Analytics
Centers for Disease Control and Prevention

Highest Grade: GS-12: Step 4   09/2023-present
Job Type: Indefinite
Work Schedule: Full time

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, population dynamics, infectious disease epidemiology, immunology, health economics, homeless and unhoused populations, households, health policy, demography, decision-support, population health, health disparities, social determinants of health, infectious disease forecasting

SOFTWARE

R(expert), Matlab(expert), C(intermediate), C++(advanced), Python(intermediate), Stata(intermediat Java(advanced), SAS(intermediate), SQL (intermediate), Unix (intermediate), Microsoft office (expert)

RELATED EXPERIENCE

Centers for Disease Control and Prevention	Aug 2023 – Present
Data Analyst	January 2025 – Present
Prevention Effectiveness Fellow	Aug 2023 – January 2025

Supervisor: <u>Beau Bruce</u>, 40 hours per week: *full-time*
Regular Duties:

- 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.

- Reviews and synthesizes infectious disease transmission modeling studies relevant to CFA goals and develops new project proposals in support of CFA goals and strategic plans.
- Compiles, cleans, integrates and analyzes data from a variety of sources using statistical methods to estimate parameters such as the secondary attack rate for infectious diseases in congregate settings to mathematical models of infectious disease transmission.
- Works with multidisciplinary governmental and academic teams to provide analytic tools ready to be utilized in emergency response.
- Active participant in multiple emergency responses contributing to timely communication of findings to key stakeholders and decision-makers.
- Contributed to the development of a Java-based modeling tool to simulate the spread of infection, and subsequent interventions deployed in a congregate living setting.
- Serves as a subject matter expert consulting with a range of stakeholders on best practices, project design, data analysis, modeling methods, and study interpretation.
- Developed methodology for evaluating the correlation between various measures of hospital strain in time and across multiple geographical delineations utilizing the NHSN dataset.
- Recently contributed to the development of an agent-based model of congregate living settings which was later utilized in the response for the 2024 Measles Response.
- Currently **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.

Duties on Emergency Response for Mpox Pre-response:

- Coordinated with CDC stakeholders on the Modeling response task force including participants from NCHHSTP and CFA on goals, scope, and communication of deliverables.
- 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.
- Translated the excel tool into a R package including a user guide and summary of methods and assumptions.
- Developed code (R) to generate visualizations summarizing Mpox network model simulation results.

Duties on H5N1 Emergency Response:

- Provided code review for the development of an interactive tool to show explore the effects of selected parameter ranges in trade-offs for choices between the use of rapid antigen tests and PCR tests with variable test accuracy.

- Validated the mathematical assumptions for a statistical model.

- Collaborated to refactor Python code in GIT as multiple contributors updated and contributed to the project code repository.

- Developed visualizations to effectively communicate statistical findings to relevant stakeholders with rapid turnaround.

Duties on Measles 2025 Emergency Response:

- Collaborated to refactor Python code in GIT as multiple contributors updated and contributed to the project code repository.

- Developed code in Python to simulate, parameterize a metapopulation model of the spread of measles in subpopulations with differing contact, vaccination rates, and willingness to isolate.

- Developed visualizations to communicate statistical findings to relevant stakeholders with rapid turnaround.

- Developed queries to be asked externally to inform modeling efforts.

- At the behest of incident management developed modeling tool and visualizations of modeling results in order to provide the scientific and quantitative basis for critical agency decisions, policy, and/or subsequent regulatory actions.

Utah Department of Health and Human Services, Oct 2022 – August 2023
Supervisor: Abigail Collingwood, 20 hours per week: *part-time*
Duties:

- 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.

- Evaluated the efficacy of state-level datastreams to identify those which lead increases in hospital admissions.

- Built a tool hospitalizations at the state level and assess success forecast success over time.

- Refactored forecast tool to increase real-time usability for state epidemiologists.

- Consulted with state officials on potential of data streams to provide new insights into state-level disease prevention.

- Developed analytics, measures, and metrics to help foster performance towards service targets, objectives and goals in order to influence UDHHS public health decisions.

- Evaluates and interprets data extracts and reports from various systems assessing relevant data sources validity and reliability to meet project needs to aid stakeholders in understanding and utilizing analytical reports.
- Produces analytical reports and communicates the findings to UDHHS officials, and conference attendees.

UU, **Division of Epidemiology** March 2020 – August 2023

Supervisor: Lindsay Keegan, Damon Toth, 20 hours per week: *part-time*

Duties:

- 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.
- Submitted Grant application for NIH F31 NRSA modeling the spread of SARS-CoV-2 in a system of linked homeless shelters and emergency housing.
- Develops and implements dynamic data visualizations and interactive reporting to provide meaningful insight from the data to be shared with public health officials and summarize thesis work.
- Prepared multiple manuscripts documenting research findings for peer-reviewed publication. (See publication list)

UU, **Department of Mathematics** August 2018 – August 2023

Supervisor: Fred Adler, 20 hours per week: *part-time*

Duties:

- Built a recurrent neural net, a deep learning algorithm 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.
- Utilizsed Julia to calculate probabilistic equations for disease spread within households.
- Submitted a proposal to NSA GRFP for an independently proposed project.
- Mentored multiple undergraduate and graduate students as they developed research projects modeling infectious disease systems.
- Learned and implemented a variety of quantitative analyses, data research tools and techniques, and other appropriate quantitative methodologies in order to draw meaningful conclusions on a variety of projects and research questions.

- Utilized SQL queries to gather new dataset analysing the trends of clients stay length, return, frequency, and duration.
- Through thesis write-up, paper publication, thesis defense, and conference proceedings prepared appropriate and necessary documentation required by the project.
- Prepared comprehensive technical reports of completed studies, assuring adequate correlation of data, integration of all pertinent considerations, and substantiation of conclusions.

UU, **Department of Pathology** — May 2019 – Aug 2019

Supervisor: <u>Tracey Lamb</u>, 40 hours per week: *full-time*
Duties:

- 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
Supervisor: <u>Justin Brooks, Kathleen Hoffman</u>, 20 hours per week: *part-time*
Duties:

- 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 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>, 40 hours per week: *full-time*
Duties:

- 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, 10 hours per week: *part-time*

Supervisor: Jamie Trevitt, 10 hours per week

- 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, 40 hours per week: *full-time*

Duties:

- Statistically explored the relationship between anxiety and patient satisfaction in patients with myocardial infarction.

- Utilized SAS and SQL queries to generate datasets.

- Utilized data management methods to properly handle analyses of a 1500 survey participants.

- Analyzed nationally representative youGov survey using R to complete chisquares analyses and logistic regression.

- 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 2015

Johns Hopkins Bloomberg School of Public Health

Department of Epidemiology

Supervisor: Alvaro Munoz, 40 hours per week: *full-time*

Duties:

- 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.

- Developed visualizations to convey findings to study administration.

GeneSTAR Study June 2013 – August 2013

Johns Hopkins School of Medicine
Department of Internal Health
Supervisor: <u>Diane Becker, MPH, ScD</u>, 40 hours per week: *full-time*
Duties:

- 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.

- Aided file preparation for IRB.

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, Keegan, LT, Toth, DA: Vaccination and Household Transmission of SARS-CoV-2.

(*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

Relevant Coursework

Graduate

Ordinary Differential Equations
Basic Immunology
Analysis of Numerical Methods I
Mathematical Biology I
Machine Learning
Partial Differential Equations

Analysis of Numerical Methods II
Mathematical Biology
Topics in Statistics: Deep Machine Learning Host-Pathogen Interactions
Mathematical Biology II
Social Determinants of Health Inequities
Health Economics
Time Series Analysis

Undergraduate

Computer Science I
Calculus and Analytic Geometry I
Basic Concepts in Sociology
Race, Science, and Society
Calculus and Analytic Geometry II
Discrete Structures
Social Bases of Public and Community Health
Introduction to Linear Algebra
Introduction to Differential Equations
Computer Science II
Global Issues in Health
Multivariable Calculus
Probability and Statistics for Science and Engineering
Technical Communication
Population and Repoductive Health
Biomathematics
Research Methods in Health
Molecular and General Genetics
Epidemiology
Alcohol and Drug Policy in the US
Continuous Dynamical Systems
Data Structures
Health Administration and Policy Internship
Discrete Dynamical Systems
Health Care Organization and Delivery
Intro to Partial Differential Equations I
Computational Mathematics and C Programming
Bifurcation Theory
Design and Analysis of Algorithms
Intro Calculus of Variations
Health Regulation and Quality Improvements

References

Beau Bruce, MD, Ph.D.	lue7@cdc.gov
Dina Mistry, Ph.D.	uqx8@cdc.gov

Frederick Adler, Ph.D.   adler@math.utah.edu

Lindsay Keegan, Ph.D.   lindsay.keegan@utah.edu

Damon Toth, Ph.D.   toth@utah.edu

Abigail Collingwood, MPH   abigail.collingwood@utah.gov