Meghan R. Hutch

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in meghan-hutch; ⍾ meghutch

EDUCATION

Northwestern University, Chicago, IL   Sept 2019 - **Present**
Ph.D. Biomedical Informatics

Northwestern University, Chicago, IL   Sept 2022 - June 2023
Reflective and Effective Teaching Certificate

Sacred Heart University, Fairfield, CT   Sept 2013 - May 2017
B.Sc. Biology; Minor Chemistry, Honors

Relevant Coursework: Artificial Intelligence and Deep Learning, Machine Learning, Predictive Analytics, Data Mining, Analytic Value Chain, Intermediate Biostatistics, Databases and Informational Retrieval (SQL), Python and Java Programming, Fundamentals in Health Informatics, Methods in Health and Biomedical Informatics I-III, Advanced Bioinformatics, Research Ethics

EXPERIENCE

Northwestern University, Department of Preventative Medicine   Chicago, IL
Ph.D. Candidate   April 2020 - **Present**

- **Dissertation**: Trajectory Risk Modeling and Insights from COVID-19 and Traumatic Brain Injury Cohorts
- Implementing biostatistical and artificial intelligence methods to more precisely delineate the clinical trajectory of hospitalized patients
- Harmonized the electronic health record data of 6,619 hospitalized COVID-19 patients admitted to Northwestern Memorial hospital to lead and support Northwestern's involvement in 12 research studies within the multinational 4CE COVID-19 Consortium
- Designing a study to train machine and deep learning models to predict hematoma expansion after brain injury
- Contributed to 14 peer-reviewed and published research studies

Boston Medical Center, Stroke and Neurocritical Care Division   Boston, MA
Research Assistant   July 2018 - Aug 2019

- Coordinated tasks for hospital-based studies including: protocol development, institutional review board submission and maintenance, patient enrollment, data collection and analysis
- Led the acquisition and curation of a longitudinal dataset of pupillary measurements from critically ill patients in the intensive care unit. These efforts involved outreach with nurses to emphasize the importance of timely data collection, manually downloading patient data from recording devices, and programming with R to clean and organize data for downstream research studies

Brigham and Women's Hospital, Stroke and Neurocritical Care Division   Boston, MA
Research Trainee   May 2017 - Aug 2019

- Maintained and helped annotate a dataset of 1,359 radiology text reports in order to support efforts dedicated to developing natural language processing algorithms to detect salient stroke characteristics. These efforts have since led to 2 peer-reviewed and published research studies
- Conducted statistical analyses and hypothesis testing (t-test, wilcoxon-rank, correlation, and univariate, multiple, and mixed-effect linear/logistic regression models) with R to evaluate temporal relationships between pupil reactivity and brain swelling after brain injury

Sacred Heart University, Biology Department   Fairfield, CT
Student Research Assistant   Sept 2015 - May 2017

- Performed wet-lab experiments to quantify the molecular consequences of cadmium exposure in the American horseshoe crab, *Limulus polyphemus*
- Analyzed dose dependent survival curves and enzyme activity in cadmium treated horseshoe crabs

GRANTS, FELLOWSHIPS, AND AWARDS

T32 Predoctoral Grant, Biomedical Data Driven Discovery   Chicago, IL
National Library of Medicine   Sept 2020 - Sept 2021
Data Science Initiative Fellowship Award   Chicago, IL
Northwestern University sponsored award to support data science trainees   Sept 2019 - Sept 2020
Outstanding Poster Presentation   Wilks-Barre, PA
Eastern Colleges Science Conference   April 2017
Athletic Scholarship: Cross Country, Track and Field   Fairfield, CT

Sacred Heart University   Aug 2014 - May 2017
Thomas More Honors Scholar   Fairfield, CT
Sacred Heart University   Aug 2013 - May 2017
President's Excellence Award Scholarship   Fairfield, CT
Sacred Heart University   Aug 2013 - May 2017

RESEARCH PROJECTS

Multinational Cohort Study: Neurological Diagnoses in Hospitalized COVID-19 Patients   Chicago, IL
Project Link: covidclinical.github.io/Phase2.1NeuroAnalysis   Oct 2020 - **Present**

- **Summary**: Co-led and coordinated a multinational effort through the Consortium for Clinical Characterization of COVID-19 by EHR (4CE) to estimate the clinical trajectories of hospitalized COVID-19 patients with concurrent neurological illnesses. This effort seeks to quantify the risk and timing of poor health outcomes in a population hypothesized to be at a higher-risk for a poor disease course
- Collaboratively wrote and distributed an R package on Github that facilitated a federated approach to analyze the electronic health record data of hospitalized COVID-19 patients at 21 healthcare systems across 7 countries. This method ensured that confidential patient data was never shared across healthcare systems
- Applied survival analysis to delineate the clinical trajectories of 106,229 hospitalized COVID-19 patients
- Conducted a random-effects meta-analysis to quantify the risk and timing of poor clinical health outcomes (prolonged hospital stay, disease severity, and mortality) at each healthcare system and across healthcare systems

COVID-19 Trends Among Children and Adults in the United States   Chicago, IL
Project Link: meghutch.github.io/Hospitalization_Trends   Feb 2021 - July 2021

- **Summary**: By early 2021, the United States had just authorized the emergency use of COVID-19 vaccines for adults. At the time, questions remained as to the severity of COVID-19 in children and whether children might serve as vectors of disease transmission. We quantified and compared COVID-19 hospitalization rates of adults and children in the U.S. Such work underscored the need for continued monitoring of COVID-19 hospitalizations to guide public policies for vaccine distribution and for return to work and school
- Collected and analyzed 37 weeks of COVID-19 hospitalization data (August 2020 - April 2021) curated by the U.S. Department of Health and Human Services
- Integrated U.S. Census population estimates in order to estimate the weekly COVID-19 hospitalization rate and trends among pediatric and adult populations
- Performed a change point analysis on pediatric and adult hospitalization trends in order to identify and compare specific time points during the pandemic in which the mean hospitalization rate began to increase
- Quantified variation in the trends and changes in hospitalization rates both at the national and regional level, and across pediatric and adult populations

Prediction of Hematoma Expansion after Traumatic Brain Injury   Chicago, IL
Project Link: github.com/meghutch/traumaScanner   June 2022 - **Present**

- **Summary**: Patients who suffer a traumatic brain injury are at an increased risk of intracranial bleeding and subsequent life-threatening expansion of blood through the brain (hematoma expansion). Development of machine learning and deep learning models which can predict hematoma expansion will help optimize patient triage, prognosis, and personalized treatment strategies
- Applied text-mining techniques (regular expressions) with Python on a large corpus of nearly 130,000 unstructured radiology text reports in order to identify a cohort of patients with post-traumatic hemorrhage
- Constructed a computational pipeline to pre-process brain CT images (e.g. normalization, scaling to correct Hounsfield units) and to quantify the volume of hemorrhage after brain injury by deploying a previously developed Python-based deep learning model

SOAR: A Spatial Transcriptomics Analysis Resource   Chicago, IL
Project Link: soar.fsm.northwestern.edu   Sept 2021 - **Present**

- **Summary**: Spatial transcriptomics is an expanding set of techniques used to quantify gene expression within specific locations of a tissue sample. Such technology enables a more precise understanding of gene expression within specific cells and the interactions between cells
- Led website development for a collaborative team effort to deploy a R Shiny application that provides the scientific and research community access to a curated set of 304 spatial transcriptomic datasets with corresponding analyses of 2,785 tissue samples
- Created interactive modules for users to quickly investigate spatial variability of gene expression and cell-cell interactions across tissue samples
- Wrote bash scripts to facilitate large-scale data pre-processing, developed familiarity with web servers (Apache, Shiny), and the utilization of Git/Github for version control and semantic versioning
- Our application has had nearly 1,900 unique users from 40 countries

LEADERSHIP

Codeathon Team Leader — Sept 2023
Team lead of four-day sprint to develop predictive models of prolonged respiratory failure, Northwestern University — Chicago, IL
Data Science Initiative Scholars Journal Club — Jan 2021 - July 2021
Co-Founder of student led journal club, Northwestern University — Evanston, IL
Biomedical Informatics Data Science Student Group — Oct 2019 - Aug 2020
Leadership team, Northwesetern University — Chicago, IL
NCAA Division I Team Captain — Aug 2016 - May 2017
Co-captain Cross Country, Indoor & Outdoor Track and Field Teams, Sacred Heart University — Fairfield, CT

TEACHING

Reflective and Effective Teaching Certificate — Chicago, IL
Searle Center for Advancing Learning and Teaching, Northwestern University — Sept 2022 - June 2023

- Participated in a year-long sequence of 6 seminars focused on effective and inclusive pedagogical frameworks
- Designed a graduate level course: *Methods for reproducibility in biomedical informatics research*

BIOSTAT 302: Intro to Biostatistics, Teaching Assistant — Chicago, IL
MS Biostatistics Program, Northwestern University — Summer 2022, 2023

- Led 13 R programming laboratory sessions for 20 graduate students to demonstrate applications of biostatistical concepts and encourage best programming practices
- Graded and provided detailed feedback on 12 homework problem sets

BIOSTAT 306: R Programming, Teaching Assistant — Chicago, IL
MS Biostatistics Program, Northwestern University — June 2023 - Aug 2023

- Facilitated twice-weekly office hours for students to review programming concepts and debug assignments
- Graded and provided feedback on 5 assignments, one midterm exam, and one final exam for 13 graduate students

HBMI 442: Methods in Health & Biomedical Informatics, Guest Lecture — Chicago, IL
MS/PhD in Health and Biomedical Informatics Program, Northwestern University — Winter 2023

- Invited to prepare and teach a 1-hour lecture to introduce federated learning methods for electronic health record research
- Discussed my own applications of federated learning for COVID-19 research

HBMI 442: Methods in Health and Biomedical Informatics, Teaching Assistant — Chicago, IL
MS/PhD in Health and Biomedical Informatics Program, Northwestern University — Jan 2022 - Mar 2022

- Supervised the class research projects of 12 graduate students and met with students weekly to support questions involving Python programming and the application of machine and deep learning methods

MENTORING & COMMUNITY SERVICE

iMentor — Chicago, IL
Mentored a high school student through the college application and post-secondary career process — Sept 2020 - **Present**
ResearcHStart — Chicago, IL
Supervised a high school student's summer research, Northwestern University — June 2022 - Aug 2022
Panelist: Day in the Life of a Graduate Student — Chicago, IL
Shared my journey to and through graduate school with high school students — Aug 2023
Student-Assisted Mentoring Program (StaMP) — Chicago, IL
Mentored two first year Ph.D. students, Northwestern University — Sept 2021 - June 2023
EvanSTEM — Evanston, IL
Mentored middle schoolers during coding and engineering challenges, Evanston Public Library — Sept 2021 - Dec 2022
Science Fair Judge — Illinois
Reviewed Middle/High School science projects for the Illinois Junior Academy of Science — Mar 2021, 2022
A Day in the Life of a STEM-itist — Jan 2021-Nov 2021
Organized/moderated livestream events to expose middle schools to STEM — Evanston, IL
Ludlowe Center for Health and Rehabilitation — Sept 2014 - Aug 2016
Volunteered weekly to engage residents in recreational activities — Fairfield, CT

TEXTBOOK CHAPTERS

Hutch MR, Luo Y. "Applications and challenges of human computer interaction and AI interfaces for health care". Human Computer Interaction in Healthcare: The Role of Cognition (Second Edition). Springer Nature. Patel VL; (**In preparation, 2023**).

PUBLICATIONS

1. **Hutch MR**, Son J, Le TT, Hong C, Wang X, Shakeri Z, et al. "Neurological Diagnoses in Hospitalized COVID-19 Patients Associated With Adverse Outcomes: A Multinational Cohort Study." 2022. (**Status: Under review**)

2. Li Y, Dennis S, **Hutch MR**, Li Y, Broad MS, Zeng Z, Luo Y. "SOAR: a spatial transcriptomics analysis resource to model spatial variability and cell type interactions." bioRxiv 2022.04.17.488596; (**Status: Under review**)

3. Wang H, Li Y, **Hutch MR**, Kline AS, Otero S, Mithal L, Miller SE, Naidech A, Luo Y. "Patterns of diverse and changing sentiments towards COVID-19 vaccines: a sentiment analysis study integrating 11 million tweets and surveillance data across over 180 countries." J Am Med Inform Assoc. 2023;30(5).

4. Tan ALM, Getzen EJ, **Hutch MR**, et al. "Informative Missingness: What can we learn from patterns in missing laboratory data in the electronic health record?" J Biomed Info. 2023;139. doi:10.1016/j.jbi.2023.104306.

5. Moal B, Orieux A, Ferté T, **et al**. "Acute respiratory distress syndrome after SARS-CoV-2 infection on young adult population: international observational federated study based on electronic health records through the 4CE consortium." PLoS ONE 18(1):e0266985. doi:10.1371/journal.pone.0266985

6. Gutiérrez-Sacristán A, Serret-Larmande A, **Hutch MR**, et al. "Hospitalizations Associated With Mental Health Conditions Among Adolescents in the US and France During the COVID-19 Pandemic." JAMA Netw Open. 2022;5(12):e2246548. doi:10.1001/jamanetworkopen.2022.46548

7. Kline A, Wang H, Li Y, Dennis S, **Hutch M**, Xu Z, Wang F, Cheng F, Luo Y. "Multimodal machine learning in precision health: A scoping review." npj Digital Medicine. 2022;5(171). doi:10.1038/s41746-022-00712-8

8. Tan BWL, Tan BWQ, Tan ALM, Schriver ER, Gutiérrez-Sacristán A, Das P, Yuan W, **Hutch MR**, et al. "Long-term kidney function recovery and mortality after COVID-19-associated acute kidney injury: An international multi-centre observational cohort study." eClinicalMedicine. 2023 January;55:101724. doi:10.1016/j.eclinm.2022.101724

9. Hong C, Zhang HG, L'Yi S, **et al**. "Changes in laboratory value improvement and mortality rates over the course of the pandemic: an international retrospective cohort study of hospitalised patients infected with SARS-CoV-2." BMJ Open. 2022 June;12:e057725. doi:10.1136/bmjopen-2021-057725

10. Klann JG, Strasser ZH, **Hutch MR**, et al. "Distinguishing Admissions Specifically for COVID-19 From Incidental SARS-CoV-2 Admissions: National Retrospective Electronic Health Record Study." J Med Internet Res. 2022 May 18;24(5):e37931. doi:10.2196/37931

11. Wang X, Zhang HG, Xiong X, **et al**. "SurvMaximin: Robust federated approach to transporting survival risk prediction models." J. Biomed. Inform. 2022(134):104176; doi:10.1016/j.jbi.2022.104176

12. **Hutch MR**, Liu M, Avillach P, Luo Y, Bourgeois FT. "National Trends in Disease Activity for COVID-19 among Children in the US." Front. Pediatr. 2021. doi:10.3389/fped.2021.700656

13. Chan WP, Prescott BR, Barra ME, Chung DY, Kim IS, Saglam H, **Hutch MR**, Shim M, Zafar SF, Benjamin EJ, Smirnakis SM, Dupuis J, Greer DM, Ong, CJ. "Dexmedetomidine and Other Analgosedatives Alter Pupil Characteristics in Critically Ill Patients." Critical Care Explorations. 2022 May 13;4(5):e0691. doi:10.1097/CCE.0000000000000691

14. Miller, MI, Orfanoudaki A, Cronin M, Saglam H, Kim IS, Tzalidi M, Vasilopoulos K, Fanaropoulou G, Fanaropoulou N, Kalin J, **Hutch M**, Brush B, Benjamin EJ, Shin M, Mian A, Greer DM, Smirnakis SM, Ong CJ. "Natural Language Processing of Radiology Reports to Detect Complications of Ischemic Stroke." Neurocrit Care. 2022 May 9. doi:10.1007/s12028-022-01513-3

15. Prescott B, Saglam H, Duskin J, Miller M, Thakur A, Gholap E, **Hutch M**, Smirnakis S, Zafar S, Dupuis J, Benjamin E, Greer D, Ong C. "Anisocoria and Poor Pupil Reactivity by Quantitative Pupillometry in Patients With Intracranial Pathology." Critical Care Medicine, Publish Ahead of Print 2021. doi:10.1097/CCM.0000000000005272

16. Bourgeois FT, Gutiérrez-Sacristán A, Keller MS, **et al**. "International Analysis of Electronic Health Records of Children and Youth Hospitalized With COVID-19 Infection in 6 Countries." JAMA Netw Open. 2021 Jun 1;4(6):e2112596. doi:10.1001/jamanetworkopen.2021.12596. Erratum in: JAMA Netw Open. 2021 Jul 1;4(7):e2122388

17. Wang H, Li Y, **Hutch MR**, Naidech A, Luo Y. "Using tweets to understand how COVID-19 related health beliefs are affected in the age of social media." Journal of Medical Internet Research. 2021. doi:10.2196/26302

18. Klann JG, Estiri H, Weber GM, **et al**. "Validation of an internationally derived patient severity phenotype to support COVID-19 analytics from electronic health record data." J Am Med Inform Assoc. 2021 Jul 14;28(7):1411-1420. doi:10.1093/jamia/ocab018

19. Ong CJ, Zhang R, Orfanoudaki A, Pierre M Caprasse F, **Hutch M**, Liang M, Fard D, Balogun O, Miller MI, Minnig M, Sağlam H, Prescott B, Greer DM, Smirnakis S, Bertsimas D. "Machine learning and natural language processing methods to identify ischemic stroke, acuity and location from radiology reports." PLoS ONE 2020. doi:10.1371/journal.pone.0234908

20. Ong CJ, **Hutch M**, Barra M, Kim A, Zafar S, Smirnakis SM. "Osmotic therapy effects on pupil reactivity: Quantification using pupillometry in critically ill neurologic patients." Neurocrit Care 2018. doi:10.1007/s12028-018-0620-y

21. Ong CJ, **Hutch M**, Smirnakis SM. "The Effect of Ambient Light Conditions on Quantitative Pupillometry." Neurocrit Care 2018. doi:10.1007/s12028-018-0607-8

CONFERENCE PRESENTATIONS

1. **Hutch MR**, Ding J, Wang X, Rafiei A, Davis J, Gao C. "A multimodal approach to predicting prolonged respiratory failure: Clinical and molecular insights." Systems Biology Consortium for Infectious Diseases 2023 Annual Meeting. Chicago IL.
2. **Hutch MR**, Son J, Le TT, Hong C, Wang X, Shakeri Z, Visweswaran S, Cai T Luo Y Xia, Z. "Neurological Diagnoses in Hospitalized COVID-19 Patients Associated With Adverse Outcomes: A Multinational Cohort Study." American Medical Informatics Association (AMIA) Informatics Summit. Seattle, Washington. March 17, 2023.
3. **Hutch MR**, Bourgeois FT, Liu M, Avillach P, Luo Y. "National Trends in Disease Activity for COVID-19 among Children in the US." National Library of Medicine Informatics Training Conference. June 23, 2021.
4. **Hutch M**, Jenna L, Harris M, Deschenes S. "Assessment of Cadmium Tolerance and Oxidative Stress Response in Limulus Polyphemus." Eastern Colleges Science Conference, Wilkes-Barre, PA. April 2017. ***Award for excellence**.

ATHLETIC ACHIEVEMENTS

Chicago Marathon Finisher	Oct 2021
Northeast Conference Athlete of the Week	Oct 2016
All New England Honors	May 2016
4th place in New England Championship 10,000 meter run	
All Northeast Conference Honors - Second Team	May 2016
2nd place in Northeast Conference Championship 10,000 meter run	
Northeast Conference Cross Country All-Conference Team	Oct 2015
10th place in Northeast Conference Cross Country Championship	
Athletic Scholarship	Aug 2014 - May 2017
Tuition support received for athletic accomplishments	
NCAA Division 1 Student Athlete	Aug 2013 - May 2017
Cross Country, Indoor, & Outdoor Track and Field	