
HONGRU DU

(+1) 443-808-7381 ◊ hdu9@jhu.edu ◊ [Google Scholar](#)

Department of Civil & Systems Engineering
Johns Hopkins University, Baltimore, MD 21211

RESEARCH INTERESTS

My research bridges the fields of **Systems Engineering** and **Public Health**, where I develop **computational and artificial intelligence methods** to tackle broader societal challenges. Specifically, my research focuses on:

- **Data-Driven Decision-Making**
- **Multimodal Machine Learning for Public Health**
- **Modeling Human Behavior in Complex Systems**

EDUCATION

Johns Hopkins University, Baltimore, MD, USA *Sept. 2019 - Present*
Ph.D. Systems Engineering *Expected: May 2025*
Advisor: Professor Lauren Gardner
Dissertation: From Data to Decisions: Engineering Approaches to Equitable and Resilient Public Health Systems

University of Wisconsin-Madison, Madison, WI, USA *Sept. 2017 - Jan. 2019*
M.Sc. Industrial Engineering
Advisor: Professor Vicki Bier

University of Edinburgh, Edinburgh, UK *Sept. 2015 - May 2017*
B.Sc. Material Chemistry

Tianjin University, Tianjin, China *Sept. 2013 - May 2015*
B.Eng. Chemical Engineering

AWARDS

- **INFORMS 2024 Poster Competition Second Place Award** *2024*
INFORMS Annual Meeting, Seattle, WA, USA
- **Best Demonstration Project Award** *2024*
Data Science and AI Institute, Johns Hopkins University, Baltimore, MD, USA
- **Graduate Student Teaching Award Nominee** *2023*
Johns Hopkins University, Baltimore, MD, USA
- **ESRI Making a Difference Award** *2020*
ESRI, Redlands, CA, USA
- **Richard D. Hickman Fellowship** *2019*
Johns Hopkins University, Baltimore, MD, USA
- **Tianjin Environmental Protection Science and Technology Award** *2016*
Tianjin Environmental Science Society, Tianjin, China
- **International Student Scholarship** *2015*
University of Edinburgh, Edinburgh, UK

PUBLICATIONS

Under Reviewed Journal Articles:

1. **Du, H.***, Zahn, M.*, Loo, S., Alleman, T., Truelove, S.A., Patenaude, B., Gardner, L.M., Pageorge, N. and Hill, A.L., 2024. Modeling dynamic disease-behavior feedbacks for improved epidemic prediction and response. *medRxiv*, pp.2024-11.
2. Xu, S., **Du, H.**, Dong, E., Wang, X., Zhang, L. and Gardner, L.M., 2025. A Multi-pathogen Hospitalization Forecasting Model for the United States: An Optimized Geo-Hierarchical Ensemble Framework. *medRxiv*, pp.2025-01.

Peer Reviewed Articles:

3. **Du, H.***, Zhao, J.*, Zhao, Y.*, Xu, S., Lin, X., Chen, Y., Gardner, L.M. and Yang, H., 2024. Advancing Real-time Pandemic Forecasting Using Large Language Models: A COVID-19 Case Study. arXiv preprint arXiv:2404.06962, 2024. (Accepted in Principle *Nature Computational Science*.)
4. Rankin, N., Saiyed, S., **Du, H.** and Gardner, L.M., 2025. A multi-city COVID-19 categorical forecasting model utilizing wastewater-based epidemiology. *Science of The Total Environment*, 960, p.178172.
5. Hamilton, A., Haghpanah, F., Tulchinsky, A., Kipshidze, N., Poleon, S., Lin, G., **Du, H.**, Gardner, L. and Klein, E., 2024. Incorporating endogenous human behavior in models of COVID-19 transmission: A systematic scoping review. *Dialogues in Health*, p.100179.
6. **Du, H.**, Saiyed, S. and Gardner, L.M., 2024, Association between vaccination rates and COVID-19 health outcomes in the United States: a population-level statistical analysis. *BMC Public Health*, 24(1), pp.1-14.
7. Badr, H.S., Zaitchik, B.F., Kerr, G.H., Nguyen, N.L.H., Chen, Y.T., Hinson, P., Colston, J.M., Kosek, M.N., Dong, E., **Du, H.** and Marshall, M., ..., Gardner, L.M., 2023. Unified real-time environmental epidemiological data for multiscale modeling of the COVID-19 pandemic. *Scientific Data*, 10(1), p.367.
8. **Du, H.**, Dong, E., Badr, H.S., Petrone, M.E., Grubaugh, N.D. and Gardner, L.M., 2023. Incorporating variant frequencies data into short-term forecasting for COVID-19 cases and deaths in the USA: a deep learning approach. *eBioMedicine*, 89.
9. Dong, E., Ratcliff, J., Goyea, T.D., Katz, A., Lau, R., Ng, T.K., Garcia, B., Bolt, E., Prata, S., Zhang, D., Murray, R.C., Blake, M.R., **Du, H.**, ..., Gardner, L.M., 2022. The Johns Hopkins University Center for Systems Science and Engineering COVID-19 Dashboard: data collection process, challenges faced, and lessons learned. *The Lancet Infectious Diseases*.
10. Badr, H.S., **Du, H.**, Marshall, M., Dong, E., Squire, M.M. and Gardner, L.M., 2020. Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. *The Lancet Infectious Diseases*, 20(11), pp.1247-1254.
11. Dong, E., **Du, H.** and Gardner, L., 2020. An interactive web-based dashboard to track COVID-19 in real time. *The Lancet infectious diseases*.
12. Bier, V.M., Zhou, Y. and **Du, H.**, 2019. Game-theoretic modeling of pre-disaster relocation. *The Engineering Economist*, pp.1-25.
13. Kou, H., Luo, H., **Du, H.**, Du, P., Lang, F., and Lin, B., 2016. Effects of inlet water temperature of air source carbon dioxide heat pump on system performance under low-temperature climate conditions. *CIESC Journal*, 67(S2), p.378.

Articles Under Preparation:

14. Ma, C.*, **Du, H.***, Luan, S., Gardner, L.M., and Gernay, T., A Comprehensive Data-Driven Study on Fire Risk: Occurrences and Consequences.
15. **Du, H.**, Xu, S., Rankin, N., and Gardner, L.M., The Unequal Impact of COVID-19 on Population Lifestyle: A Timeseries Clustering Analysis of Activities Across the United States.
16. Hou, A., **Du, H.**, Wang, Y., Zhang, J., Liang, P., Khashabi, D., Gardner, L.M., and He, T., Simulate Vaccination Attitude with Generative Agents.
17. Wang, P., Zhao, Y., Zhao, Y., **Du, H.**, and Yang, H., Customizing Data-centric Large Language Models for Traffic Crash Event Learning and Factor Attribution

Patent:

18. Lang, f., **Du, H.**, Yan, Y., Ding, W., Du, P., 2016. Carbon dioxide heat pump system for improving heating efficiency by utilizing gas-liquid two-phase separator. CN Patent 105485951A.

INVITED TALKS

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| 1. <i>Department of Systems and Information Engineering, University of Virginia</i> | 2024 |
| 2. <i>Department of Industrial Engineering, Tsinghua University</i> | 2024 |
| 3. <i>Tuanshan Hill Anti-XID Forum, China CDC, Online</i> | 2024 |
| 4. <i>Applied Micro Brownbag Seminar, Department of Economics, Johns Hopkins University</i> | 2024 |
| 5. <i>Biostatistics first-year seminar, Bloomberg School of Public Health</i> | 2024 |
| 6. <i>Johns Hopkins Alumni virtual weekend, Baltimore, MD, USA</i> [link] | 2021 |
| 7. <i>2021 ABET SYMPOSIUM, Online</i> Closing Keynote Speaker. [link] | 2021 |
| 8. <i>Johns Hopkins Biomedical Engineering Spring Speaker Series, Baltimore, MD, USA</i> | 2020 |

CONFERENCE ACTIVITY

Presentations:

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| 1. <i>MIDAS Annual Meeting, DC, USA</i> Incorporate Human Behavior into Infectious Disease Modeling. | 2024 |
| 2. <i>INFORMS Annual Meeting, Seattle, WA, USA</i> Invited talk for section "Integration of Human, Knowledge and Systems for Quality". Modeling dynamic disease-behavior feedback for improved epidemic prediction and response. | 2024 |
| 3. <i>Data Science and AI Institute, Baltimore, MD, USA</i> Advancing Real-time Pandemic Forecasting Using Large Language Models: A COVID-19 Case Study. Best Demonstration Project Award. | 2024 |
| 4. <i>INFORMS Annual Meeting, Phoenix, AZ, USA</i> Association Between Vaccination Rates and Covid-19 Health Outcomes in the United States: A Population-level Statistical Analysis. | 2023 |
| 5. <i>Epidemics 8 Conference, Online</i> A Deep Learning Approach to Forecast Short-Term COVID-19 Cases and Death in the US. | 2022 |
| 6. <i>INFORMS Annual Meeting, Pheonix, AZ, USA</i> Game-theoretic modeling of pre-disaster relocation. | 2018 |

Posters:

7. *APHA Annual Meeting, Minneapolis, MN, USA* 2024
Advancing Real-time Pandemic Forecasting Using Large Language Models.
8. *INFORMS Annual Meeting, Seattle, WA, USA* 2024
Poster competition: Advancing Real-time Pandemic Forecasting Using Large Language Models.
Second Place Award.
9. *IDM Annual Symposium, Seattle, WA, USA* 2024
Advancing Real-time Infectious Disease Forecasting Using Large Language Models.
10. *MIDAS Annual Meeting, Atlanta, GA, USA* 2023
Association Between Vaccination Rates and Covid-19 Health Outcomes in the United States: A Population-level Statistical Analysis.
11. *Ecology and Evolution of Infectious Diseases, University Park, PA, USA* 2023
Association between vaccination rates and severe COVID-19 health outcomes in the United States: a population-level statistical analysis.
12. *IDM Annual Symposium, Seattle, WA, USA* 2023
Incorporating variant frequencies data into short-term forecasting for COVID-19 cases and deaths in the USA: a deep learning approach.
13. *AI in Healthcare Symposium, Baltimore, MD, USA* 2019
Data-driven Vehicle-routing Approach to Connect Chronically-ill Patients.

RESEARCH MENTORSHIP EXPERIENCES

- Samee Saiyed, Ph.D. Candidate, Johns Hopkins University 2022 to now
Infectious Disease Forecasting and Human Mobility.
- Naomi Rankin, Ph.D. candidate, Johns Hopkins University 2023 to now
Infectious Disease Forecasting and Statistical Inference.
- Shaochong Xu, Ph.D. candidate, Johns Hopkins University 2023 to now
Real-time Flu Forecasting and Timeseries Clustering.
- Xianglong Wang, Graduate student, Johns Hopkins University 2023
Real-time Flu Forecasting.
- Liyue Zhang, Graduate student, Johns Hopkins University 2024 to now
Vaccine Hesitancy.

TEACHING EXPERIENCE

Applied Modeling for Public Health 2023 Workshop October, 2023
Johns Hopkins International Vaccine Access Center, Baltimore, MD
Instructor

EN.560.653 An Introduction to Network Modeling Fall 2020, 2021, 2022
Teaching Assistant
Responsibilities: Design homework, exams, and weekly labs. Giving formal lectures.

MEDIA

- **Effects of varying COVID-19 vaccination rates on population-level health outcomes across variant waves in the U.S.**
News Medical Life Sciences [\[link\]](#) 2024

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- **Behind the Johns Hopkins University coronavirus dashboard**
Nature Index [\[link\]](#) 2020
 - **Chinese overseas PhD students help map out pandemic situation**
People's Daily Online [\[link\]](#) 2020
 - **Who has the most high-profile COVID-19 tracking map**
CGTN [\[link\]](#) 2020
 - **Chinese students behind globally-shared COVID-19 data map**
ecns.cn [\[link\]](#) 2020

PROFESSIONAL SERVICE

Peer Review

Journals:

- BMC Public Health
- JMIR Public Health and Surveillance
- PLOS ONE
- BMJ Public Health
- Wellcome Open Research
- Virus Evolution
- Dialogues in Health
- Journal of Public Health Policy

Conferences:

- Models of Infectious Disease Agent Study (MIDAS) 2024
- American Public Health Association (APHA) 2024
- Transportation Research Board (TRB) 2023

To University

- *Representative*, Civil and Systems Engineering Graduate Association 2021 to 2022
- *Communication Coordinator*, Center for Systems Science & Engineering 2022 to now

To Community

- FluSight real-time influenza forecasting, CDC 2023 to now
- Forecast Hub real-time COVID-19 forecasting, CDC 2021 to 2023

PROFESSIONAL ASSOCIATIONS

- Member, American Public Health Association 2023 to present
- Member, Models of Infectious Disease Agent Study 2021 to present
- Member, Institute for Operations Research and the Management Sciences 2019 to present