Mary M Lucas

PhD Candidate (Information Science, expected 2026)

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PROFESSIONAL SUMMARY

PhD Candidate and Clinical AI Researcher with 10+ years of trauma and emergency nursing experience. Develops reliable, human-centered AI for high-stakes healthcare settings. Research spans algorithmic fairness and uncertainty quantification in predictive modeling, as well as prompting and evaluation strategies to improve the consistency and clinical reasoning performance of Large Language Models. Uses large-scale real-world evidence to bridge the gap between technical model performance and clinical utility.

RESEARCH EXPERIENCE

Graduate Research Fellow (PhD Candidate) - Drexel University | 2021-Present
Algorithmic Fairness, Uncertainty Quantification, Clinical NLP & LLMs

- Designed a fairness auditing framework for clinical risk prediction models across CKD, oncology, and SUD datasets; demonstrated limitations of standard fairness metrics in real-world healthcare data.
- Developed Ensemble Reasoning, an iterative prompting strategy improving clinical LLM performance on USMLE benchmarks (+3-5%) across GPT-4 and open-source models.
- Built LLM-assisted pipelines to extract study population metadata from biomedical literature, enabling scalable equity analysis across public health datasets.
- Created a Neighborhood-Adaptive Difficulty Score combining kNN topology with conformal prediction to distinguish model weakness from case complexity in clinical decision support.
- Led large-scale RWE analyses using VA CDW and AAO IRIS Registry (300k+ patients) to quantify racial and gender disparities in treatment pathways.

Research Assistant - Boston University Health Informatics Lab | 2019-2022

- Performed large-scale claims data modeling using IBM MarketScan claims data; built and optimized SQL pipelines for multi-million row healthcare datasets converted from SAS formats.

TECHNICAL SKILLS

Languages: Python, R, SQL
ML & AI: scikit-learn, PyTorch, XGBoost, Hugging Face (Transformers, PEFT/LoRA), Conformal Prediction (MAPIE), Fairness Auditing, Uncertainty Quantification
LLMs & Clinical NLP: Prompt engineering, evaluation frameworks, OpenAI / Hugging Face / Anthropic inference, clinical text processing
Health Data: OMOP CDM, FHIR, ICD-10/CPT/SNOMED, EHR and registry workflows
Tools: Docker, Git/GitHub, AWS, GCP

EDUCATION

PhD, Information Science - Drexel University (Expected 2026)
Certificate of Achievement, Medical Statistics - Stanford Center for Health Education, Stanford Medicine (Dec 2022)
MS, Computer Information Systems - Boston University (2021)
MPhil, Physics - Moi University (2000)

SELECTED PUBLICATIONS

- ***Mary M. Lucas***, Mario Schootman, Jonathan A. Laryea, Sonia T. Orcutt, Chenghui Li, Jun Ying, Jennifer A.

Rumpel, Christopher C. Yang (2024), "Bias in Prediction Models to Identify Patients With Colorectal Cancer at High Risk for Readmission After Resection", *JCO Clinical Cancer Informatics* **8**, e2300194(2024). https://doi.org/10.1200/CCI.23.00194

- ***Mary M Lucas***, Justin Yang, Jon K Pomeroy, Christopher C Yang (2024), "Reasoning with large language models for medical question answering", *Journal of the American Medical Informatics Association*, **31(9)**, 1964–1975, https://doi.org/10.1093/jamia/ocae131
- Julia A. Haller, Maurizio Tomaiuolo, **Mary M. Lucas**, Christopher C. Yang, Leslie Hyman, IRIS Registry Analytic Center Consortium (2024). "Disparities in Retinal Vein Occlusion Presentation and Initiation of Anti-VEGF Therapy: an Academy IRIS® Registry Analysis." *Ophthalmology Retina*, **8(7)**, 657–665. https://doi.org/10.1016/j.oret.2024.01.017
- **Lucas, M.M.**, Yang, C.C. (2025). A Collaborative Learning Approach for Fairness in Prediction of Substance Use Disorder Treatment Completion. In: Bellazzi, R., Juarez Herrero, J.M., Sacchi, L., Zupan, B. (eds) *Artificial Intelligence in Medicine. AIME 2025. Lecture Notes in Computer Science()*, vol 15735. Springer, Cham. https://doi.org/10.1007/978-3-031-95841-0_44

Full publication list: Google Scholar

CLINICAL DOMAIN EXPERTISE

Medical Content Reviewer & Clinical Advisor (Remote) - hims & hers | 2020-2024: Reviewed and validated patient-facing medical content for clinical accuracy against current scientific literature and standards of care. Provided evidence-based revisions and reference verification prior to medical director approval.

Clinical Precertification & Care Coordination RN - Independence Blue Cross | 2017-2022: Conducted clinical reviews for oncology and specialty infusion authorizations; evaluated longitudinal patient records against payer coverage policies and NCCN guidelines, bridging clinical nuance with claims adjudication logic.

Emergency Department RN / Nurse Educator | 2008–2019: High-acuity trauma and emergency care across US and New Zealand tertiary centers; deep familiarity with EHR workflows, clinical data generation, clinical documentation integrity, and acute care decision-making.

AWARDS AND FELLOWSHIPS

- Edith Peterson Mitchell, MD Health Equity Travel Scholarship - ECOG-ACRIN
- Research Fellowship - NIH AIM-AHEAD Consortium
- Excellence in Graduate Study - Boston University (2020)

TEACHING (SELECTED)

- Instructor of Record - Health Informatics Capstone, Drexel University; Graduate TA - Data Science, Health Informatics, Ethics, Information Systems (Boston University MET College, Drexel)

AFFILIATIONS

Professional Societies
American Medical Informatics Association (AMIA) • Association for Computing Machinery (ACM) • American Statistical Association (ASA) • Institute of Electrical and Electronics Engineers (IEEE)

Research Consortia & Networks
ECOG-ACRIN • Cancer and Aging Research Group (CARG)