Ziqi Xu

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Education

Washington University in St. Louis — **St. Louis, MO**
- Ph.D. in Computer Science; Advisor: Chenyang Lu — *May 2027 (Expected)*
- GPA: 4.0/4.0; Research: AI for Healthcare

Washington University in St. Louis — **St. Louis, MO**
- B.S. with double major in Computer Science and Mathematics — *May 2022*
- GPA: 3.99/4.0; Coursework: Machine Learning, Data Mining, Language Models

Research Interests

AI for Health Care, with a focus on **Multimodal Trustworthy AI** for clinical decision support and personalized interventions. My research integrates wearable and mobile sensing data, clinical text, and electronic health records (EHR) to develop uncertainty-aware predictive models of clinical outcomes that enable reliable, transparent, and human-centered decision-making in surgery and perioperative care.

Publications

Conference Proceedings

[1] **Z. Xu**, J. Zhang, S. Haroutounian, H. Liu, Z. Cao, G. R. Messner, H. B. Alaverdyan, S. Ahuja, R. Koshy, J. Hanns, M. Frumkin, T. L. Rodebaugh, C. Lu, "Incorporating Uncertainty in Predictive Models Using Mobile Sensing and Clinical Data: A Case Study on Persistent Post-Surgical Pain," *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (UbiComp)*, vol. 9, no. 2, 2025. doi:10.1145/3729488

[2] **Z. Xu**, J. Zhang, J. Greenberg, M. Frumkin, S. Javeed, J. Zhang, B. Benedict, K. Botterbush, T. L. Rodebaugh, W. Ray, C. Lu, "Predicting Multi-Dimensional Surgical Outcomes with Multi-Modal Mobile Sensing," *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (UbiComp)*, vol. 8, no. 2, 2024. doi:10.1145/3659628

[3] S. Wang, **Z. Xu**, C. Najjuuko, Y. Wu, C. Alba, C. Lu, "CURA: Clinical Uncertainty Risk Alignment for Language Model–Based Risk Prediction," Proceedings of the Annual Meeting of the Association for Computational Linguistics (ACL), 2026. Accepted.

[4] B. C. Warner, **Z. Xu**, S. Haroutounian, T. Kannampallil, C. Lu, "Utilizing Semantic Textual Similarity for Clinical Survey Data Feature Selection," *Findings of the Association for Computational Linguistics (ACL 2025)*, pp. 502–520, Association for Computational Linguistics. doi: 10.18653/v1/2025.findings-acl.27

[5] B. Xue, A. Said, **Z. Xu**, H. Liu, N. Shah, H. Yang, P. Payne, C. Lu. "Assisting Clinical Decisions for Scarcely Available Treatment via Disentangled Latent Representation", *ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD'23)*, August 2023. doi: 10.1145/3580305.3599774

Journal Articles

[1] V. P. Gupta*, **Z. Xu*** (*equal contribution), J. K. Greenberg, J. M. Strahle, G. Haller, T. Meehan, A. Roberts, D. D. Limbrick Jr., C. Lu, "Using Artificial Intelligence to Identify Three Presenting Phenotypes of Chiari Type-I Malformation and Syringomyelia," *Neurosurgery*, Nov. 18, 2024. doi: 10.1227/neu.0000000000003249

[2] J.K. Greenberg*, M. Frumkin*, **Z. Xu***(*equal contribution), J. Zhang, S. Javeed, J. Zhang, B. Benedict, K. Botterbush, S. Yakdan, C.A. Molina, B.H. Pennicooke, D. Hafez, J.I. Ogunlade, N. Pallotta, M.C. Gupta, J.M. Buchowski, B. Neuman, M. Steinmetz, Z. Ghogawala, M.P. Kelly, B.R. Goodin, J.F. Piccirillo, T.L. Rodebaugh, C. Lu, W.Z. Ray, "Preoperative Mobile Health Data Improve Predictions of Recovery from Lumbar Spine Surgery," *Neurosurgery*, 5(3):p 548-555, September 2024. doi: 10.1227/neu.0000000000002911

[3] C. Najjuuko, **Z. Xu**, S. Kizito, C. Lu, F. M. Ssewamala, "Patterns of Maternal and Child Health Services Utilization and Associated Socioeconomic Disparities in Sub-Saharan Africa," *Nature Communications*, vol. 16, 7840, 2025. doi: 10.1038/s41467-025-61350-8

[4] J. Zhang, R. Wang, **Z. Xu**, H. Liu, J. Rodriguez, H. Cos, R. Srivastava, L. Raper, D. Sanford, C. Hammill, C. Lu, "Addressing Cohort Variability with Adaptive Fusion of Wearable and Clinical Data: A Case Study in Predicting Pancreatic Surgery Outcomes," *ACM Transactions on Computing for Healthcare 7.2 (2026): 1-27.*, 2026. doi: 10.1145/3788681

[5] K. J. Holzer, H. Alaverdyan, **Z. Xu**, M. R. Frumkin, K. A. Frey, S. H. Gregory, T. L. Rodebaugh, C. Lu, C. R. King, D. Head, "Protocol for Personalised Prediction of Persistent Postsurgical Pain," BMJ Open, vol. 16, no. 2, e107055, 2026. doi: 10.1136/bmjopen-2025-107055

[6] C. Najjuuko, R. Brathwaite, **Z. Xu**, S. Kizito, C. Lu, F. M. Ssewamala, "Using Machine Learning to Predict Poor Adherence to Antiretroviral Therapy Among Adolescents Living with HIV in Low-Resource Settings," *AIDS*, vol. 39, no. 9, pp. 1204–1213, 2025. doi: 10.1097/QAD.0000000000004163

[7] M. R. Frumkin, J. Zhang, **Z. Xu**, S. Yakdan, B. Benedict, S. Javeed, J. Zhang, K. Botterbush, B. R. Goodin, C. Lu, W. Z. Ray, J. K. Greenberg, "Rethinking Measurement of Movement-Evoked Pain with Digital Technology," *The Journal of Pain*, 2025, 105643. doi: 10.1016/j.jpain.2025.105643

[8] N. Shah, B. Xue, **Z. Xu**, H. Yang, E. Marwali, H. Dalton, P.P.R. Payne, C. Lu, A.S. Said, ISARIC Clinical Characterisation Group. "Validation of Extracorporeal Membrane Oxygenation Mortality Prediction & Severity of Illness Scores in an International COVID-19 Cohort". *Artificial Organs*, 47: 1490–1502, 2023. doi: 10.1111/aor.14542

[9] M. R. Frumkin, G. R. Messner, K. J. Holzer, **Z. Xu**, T. L. Rodebaugh, H. Bernstein, K. Frey, C. Lu, S. Haroutounian, "Remote perioperative symptom monitoring via smartphone is feasible: Evidence from the Personalized Prediction of Persistent Postsurgical Pain (P5) study," British Journal of Anaesthesia, Accepted.

[10] S. Yakdan, J. Zhang, B. Benedict, **Z. Xu**, S. Javeed, J. K. Zhang, B. A. Steel, V. P. Gupta, K. Botterbush, J. F. Piccirillo, T. L. Rodebaugh, B. R. Goodin, J. M. Buchowski, B. Neuman, D. Hafez, M. Kelly, W. Z. Ray, C. Lu, M. R. Frumkin, J. K. Greenberg, "Multi-Domain Postoperative Recovery Trajectories After Lumbar and Thoracolumbar Spine Surgery," *The Spine Journal*, 2025. doi: 10.1016/j.spinee.2025.05.017

[11] R. Bhan, S. Yakdan, C. Diaz, J. Zhang, **Z. Xu**, K. Joseph, B. Plog, A. T. Yahanda, J. K. Zhang, S. Javeed, W. Z. Ray, M. Gupta, C. Lu, M. P. Kelly, J. K. Greenberg, B. Neuman, "Association Between Preoperative Activity Levels and Postoperative Complications in Adult Spinal Deformity Surgery," *Spine Deformity*, 2025. doi: 10.1007/s43390-025-01158-0

[12] S. Yakdan, J. Zhang, K. Botterbush, M. I. Kaleem, B. Benedict, **Z. Xu**, M. R. Frumkin, S. Javeed, J. K. Zhang, J. Ogunlade, C. Lu, B. Neuman, M. P. Steinmetz, W. Z. Ray, M. Gupta, J. K. Greenberg, "Sleep Physiology in Spine Disease: A Comparative Study of Cervical and Lumbar Patients," *Clinical Spine Surgery*, 2025. doi: 10.1097/BSD.0000000000001926

[13] J.K. Greenberg, S. Javeed, J.K Zhang, B. Benedict, M. Frumkin, **Z. Xu**, J. Zhang, T. Rodebaugh, C. Lu, M. Steinmetz, Z. Ghogawala, M. Bydon, W.Z. Ray, "Current and Future Applications of Mobile Health Technology for Evaluating Spine Surgery Patients: A Review," *Journal of Neurosurgery: Spine*, 2023. doi: 10.3171/2022.12.SPINE221302

Abstracts and Seminars

[1] S. Yakdan*, **Z. Xu*** (*equal contribution), J. Zhang, J. Piccirillo, T. Rodebaugh, G. Burel, B. J. Neuman, M. P. Steinmetz, W. Z. Ray, C. Lu, "Leveraging Preoperative Mobile Health Data to Predict 1-Year Recovery Outcomes After Lumbar Spine Surgery," Neurosurgery, vol. 72, no. Supplement 1, p. 43, 2026. doi: 10.1227/neu.0000000000003964_202

[2] J. Zhang, S. Yakdan, B. C. Benedict, J. Zhang, M. I. Kaleem, S. Javeed, K. S. Botterbush, M. Frumkin, **Z. Xu**, C. Lu, "Minimum Clinically Important Differences in Quantitative Objective Markers of Physical Function in Patients Undergoing Lumbar Spine Surgery," Neurosurgery, vol. 71, no. Supplement 1, pp. 99–100, 2025. doi: 10.1227/neu.0000000000003360_414

[3] S. Yakdan, K. Botterbush, **Z. Xu**, C. Lu, WZ. Ray, JK. Greenberg. "Machine learning and lumbar spondylolisthesis". *Seminars in Spine Surgery* 35 (3), 101048, 2023. doi: 10.1016/j.semss.2023.101048

Experience

Research Assistant, Washington University in St. Louis – St. Louis, MO — July 2022 – Present

AI for Health Institute; Advisor: Prof. Chenyang Lu

- Developed an uncertainty-aware multimodal machine learning framework to predict persistent post-surgical pain by integrating mobile sensing, ecological momentary assessment (EMA), and structured clinical data. Proposed view-specific uncertainty estimation and a global confidence score, improving predictive performance and model interpretability for clinical deployment.
- Designed a multitask, multimodal learning framework to predict surgical outcomes (pain interference, physical function, recovery quality) using wearable and EMA time-series data. Introduced dynamic task weighting to mitigate negative transfer, achieving performance gains over single-task and clinical baseline models.
- Built a large language model (LLM)-based framework for clinical outcome prediction from unstructured notes with uncertainty quantification. Incorporated variational inference and ensemble methods to identify low-confidence predictions and support human-in-the-loop decision making. Evaluated across MIMIC-IV and real-world clinical notes.
- Developed an unsupervised learning pipeline to identify clinically meaningful phenotypes of Chiari Type I malformation with syringomyelia. Combined Laplacian feature selection with expert-curated variables to enable interpretable clustering and support personalized treatment strategies.
- Contributed to machine learning models for improving antiretroviral therapy adherence among adolescents with HIV using a six-year longitudinal dataset. Applied unsupervised clustering to identify high-risk populations and inform targeted interventions in low-resource settings.

Software Engineer, ORKA Health Technology Co., Ltd – Shanghai, China May 2021 – July 2021

- Developed a mobile application for smart hearing aids serving 50+ users with clinically verified hearing impairments; implemented core features in Flutter, including authentication, mode control, and modular UI.
- Performed A/B testing and user behavior analysis using SQL-based event tracking, informing design improvements and enhancing accessibility and user engagement.

Awards

WashU Big Ideas Competition – $50K Research Award (Team Member). *Leveraging Machine Learning and Wearable Device Activity Patterns to Improve Prehabilitation and Surgical Outcomes.* 2025

Outstanding Reviewer – Awarded as from Journal of Digital Health 2025

Honors – Top 15-20% from WashU Periodic Review of Doctoral Students 2024, 2025

Dean's Select Ph.D. Fellowship – Awarded as a Dean's Select Ph.D. Scholar 2022

Summa Cum Laude – Latin Honor cumulative WashU GPA 2022

Dean's List – Academic Honor from WashU School of Engineering 2020, 2021, 2022

Teaching Experience

Guest Lecturer, *PHS 5100-01: Development, Validation and Application of Risk Prediction Models* Spring 2026

Assistant Instructor, *CSE 419A: Introduction to AI for Health* Fall 2024

Assistant Instructor, *CSE 531A: AI for Health* Spring 2024

Teaching Assistant, *CSE 417: Introduction to Machine Learning* Spring 2023

Teaching Assistant, *CSE 240: Logic and Discrete Mathematics* Spring 2020

Service

Reviewer, ACM Transactions on Computing for Healthcare 2026

Reviewer, ACL Rolling Review (ARR) 2026

Reviewer, BMC Medical Informatics and Decision Making 2025, 2026

Reviewer, BMC Anesthesiology 2026

Reviewer, Scientific Reports 2024, 2025, 2026

Reviewer, Journal of Digital Health 2025