Bingkai Wang

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Research Interests

- Causal inference
  - Clustered data
  - Causal machine learning
  - Robustness to model misspecification
  - Heterogeneous treatment effect
  - Test-negative designs for infectious diseases
  - Conformal inference
- Array data modeling and analysis
  - Functional brain imaging with application to Alzheimer's disease research

Professional Positions

- Assistant Professor, Department of Biostatistics, School of Public Health, University of Michigan, May 2024 – present.
- Postdoctoral Researcher, Statistics and Data Science Department of the Wharton School, University of Pennsylvania, April 2021 – April 2024.
  Mentors: Dylan Small and Nicholas Jewell.

Education

- Ph.D. in Biostatistics, Johns Hopkins University, Sep. 2016 – Mar. 2021
  Advisors: Michael Rosenblum and Brian Caffo.
  Thesis: Statistical Methods for Analyzing and Brain Imaging data
- B.S. in Mathematics, Fudan University, China, Sep. 2012 – May. 2016
  Advisor: Shuqin Zhang.

Honors and Awards

- IMS New Researcher Travel Award, 2024.
- Election to membership of the Phi Beta Kappa Society (honor for excellence in scholarship), 2021.
- Best student paper runner-up, ASA Biopharmaceutical Section, 2021.
- Margaret Merrell Award (awarded to one doctoral student per year for outstanding research), Johns Hopkins University Department of Biostatistics, 2021.

- Distinguished student paper award, ENAR International Biometric Society, 2021.
- Student paper award, the Statistical Meeting in Imaging, 2020.
- Center of Excellence in Regulatory Science and Innovation (CERSI) Scholarship, U.S. Food and Drug Administration and Johns Hopkins University, 2017-2021.
- Shanghai outstanding undergraduate student (for top 1% senior-year undergraduate students), 2016.
- Fudan University undergraduate research fellowship, 2015-2016.
- National Scholarship (for top 1% undergraduate students in China per year), 2014-2015.
- Shanghai Scholarship (for top 5% undergraduate students in Shanghai), 2013.

Publications

Statistical methodology

1. **Bingkai Wang**, Chan Park, Dylan Small, and Fan Li. (2023). "Model-robust and efficient inference for cluster-randomized experiments." *Journal of American Statistical Association: Theory and Methods*, in press.

2. **Bingkai Wang** and Yu Du. (2023). "Robustly leveraging post-randomization information to improve precision in randomized trials." *International Journal of Biostatistics*, Nov, 2023.

3. Yi Zhao, **Bingkai Wang**, Chin-Fu Liu, Andreia V. Faria, Michael I. Miller, Brian S. Caffo, and Xi Luo. (2022). "Identifying brain hierarchical structures associated with Alzheimer's disease using a regularized regression method with tree predictors." *Biometrics*, 79(3):2333-2345.

4. **Bingkai Wang**, Suzanne M. Dufault, Dylan S. Small, and Nicholas P. Jewell. (2022). "Randomization Inference for Cluster-Randomized Test-Negative Designs with Application to Dengue Studies: Unbiased estimation, Partial compliance, and Stepped-wedge design." *Annals of Applied Statistics*, 17(2): 1592-1614.

5. **Bingkai Wang**, Brian S. Caffo, Xi Luo, Chin-Fu Liu, Andreia V. Faria, Michael I. Miller, and Yi Zhao. (2022). "Regularized regression on compositional trees with application to MRI analysis." *Journal of the Royal Statistical Society: Series C (Applied statistics)*, 71(3): 541-561.

6. **Bingkai Wang**, Ryoko Susukida, Ramin Mojtabai, Masoumeh Amin-Esmaeili, and Michael Rosenblum. (2021). "Model-Robust Inference for Clinical Trials that Improve Precision by Stratified Randomization and Adjustment for Covariate Adjustment." *Journal of American Statistical Association: Theory and Methods*, 118(542): 1152-1163.
    - Cited by the FDA in their 2023 Guidance for Industry: "Adjusting for Covariates in Randomized Clinical Trials for Drugs and Biologics."

7. Yi Zhao, Brian Caffo, **Bingkai Wang**, R. Li Chiang-shan, and Xi Luo. (2021). "A Whole-Brain Regression Method to Identify Individual and Group Variations in Functional Connectivity." *Brain and Behavior*, 11(1): e01942.

8. **Bingkai Wang**, Xi Luo, Yi Zhao, and Brian Caffo. (2021). "Semiparametric Partial Common Principal Component Analysis for Covariance Matrices." *Biometrics*, 77(4): 1175-1186.

9. Yi Zhao, **Bingkai Wang**, Stewart Mostofsky, Brian Caffo, and Xi Luo. (2019). "Covariate Assisted principal regression for covariance matrix outcomes." *Biostatistics*, 22(3): 629–645.

10. **Bingkai Wang,** Elizabeth L. Ogburn, and Michael Rosenblum. (2019). "Analysis of covariance in randomized trials: More precision and valid confidence intervals, without model assumptions" with discussion. *Biometrics*, 75(4): 1391-1400.

Scientific collaboration

11. Mohamad Dbouk, Malorie Simons, **Bingkai Wang**, Michael Rosenblum, Olaya I. Brewer Gutierrez, Eun J. Shin, Saowanee Ngamruengphong, Lysandra Voltaggio, Elizabeth Montgomery, and Marcia Irene Canto. (2022). "Durability of Cryoballoon Ablation in Neoplastic Barrett's Esophagus." *Techniques and Innovations in Gastrointestinal Endoscopy*, 24(2): 136-144.

12. Canto, M.I., Trindade, A.J., Abrams, J., Rosenblum, M., Dumot, J., Corbett, F.S., Diehl, D., Chak, A., Khara, H., McKinley, M. Shin, E.J., Waxman, I., Infantolino, A., Tofani, C., Samarasena, J., Chang, K., **Wang, B**., Goldblum, J., Voltaggio, L., Montgomery, E., Lightdale, C.J., Shaheen, N.J. Multifocal Cryoballoon. (2020). "Ablation for Eradication of Barrett's Esophagus-Related Neoplasia: A Prospective Multicenter Clinical Trial." *American Journal of Gastroenterology*, 15(11): 1879-1890.

13. Paniz Charkhchi, **Bingkai Wang**, Brian Caffo, and David M. Yousem. (2019). "Bias in Neuroradiology Peer Review: Impact of a 'Ding' on 'Dinging' Others." *American Journal of Neuroradiology*, 40(1): 19-24.

Invited commentary

14. **Bingkai Wang**, Ryoko Susukida, Ramin Mojtabai, Masoumeh Amin-Esmaeili, and Michael Rosenblum. (2021). "Comment: Inference after covariate-adaptive randomization: aspects of methodology and theory." *Statistical Theory and Related Fields*, 5(3): 187-189.

15. Michael Rosenblum and **Bingkai Wang**. (2019). "The Critical Role of Statistical Analyses in Maximizing Power Gains from Covariate-Adaptive Trial Designs." *JAMA Network Open*, 2(4): e190789-e190789.

Submitted manuscripts

16. **Bingkai Wang** and Fan Li. "Asymptotic inference with flexible covariate adjustment under rerandomization and stratified rerandomization." arXiv: 2406.02834.

17. **Bingkai Wang**, Xueqi Wang, Rui Wang, and Fan Li. (2024) "How to achieve model-robust inference in stepped wedge trials with model-based methods?" arXiv: 2401.15680.

18. **Bingkai Wang**, Fan Li, and Rui Wang. (2024) "Handling incomplete outcomes and covariates in cluster-randomized trials: doubly-robust estimation, efficiency considerations, and sensitivity analysis." arXiv: 2401.11278.

19. **Bingkai Wang**, Fan Li, and Mengxin Yu. (2024) "Conformal causal inference for cluster randomized trials: model-robust inference without asymptotic approximations." arXiv: 2401.01977.

20. Mengxin Yu, Kendrick Qijun Li, Nicholas Jewell, Eric Tchetgen Tchetgen, Dylan Small, Xu Shi, and **Bingkai Wang***. (2023) "Test-negative designs with various reasons for testing: statistical bias and solution." arXiv: 2312.03967. Under revision of American Journal of Epidemiology.

21. Kan Chen, **Bingkai Wang**, and Dylan Small. (2023). "A Differential Effect Approach to Partial Identification of Treatment Effects." arXiv: 2303.06332. Under revision of Biometrika.

22. **Bingkai Wang**, Michael O. Harhay, Dylan S. Small, Tim P. Morris, and Fan Li. (2021). "On the robustness and precision of mixed-model analysis of covariance in cluster-randomized trials." arXiv:2112.00832. Under revision of Statistical Science.

Grant

- **NIH NIAID 1K99AI173395-01 (PI: Bingkai Wang)**
  05/01/2023-04/30/2026
  Title: Improving the design and statistical analysis of cluster-randomized trials on tropical infectious diseases.
  Role: Principal Investigator

Presentations

Invited talks

Model-robust and efficient inference for cluster-randomized experiments.

- *Society for Clinical Trials Annual Meeting,* May 2023

Randomization Inference for Cluster-Randomized Test-Negative Designs with Application to Dengue Studies

- *Scientific meeting of the World Mosquito Program,* February 2022

Model-Robust Inference for Clinical Trials that Improve Precision by Stratified Randomization and Covariate adjustment.

- JSM, August 2024
- *ICSA Applied Statistics Symposium,* June 2024
- *Society for Clinical Trials Annual Meeting,* May 2024
- *Harvard Biostatistics working group*, January 2024
- *ICSA Applied Statistics Symposium,* September 2021
- *Novartis Statistics Seminar,* September 2021
- *JSM,* August 2021
- *Johns Hopkins University Biostatistics Departmental Seminar,* September 2020
- *Data harmonization Initiative at Johns Hopkins School of Public Health,* August 2020

Semiparametric Partial Common Principal Component Analysis for Covariance Matrices.

- *Statistical Meeting in Imaging,* May 2020

Contributed presentations

Model-robust and efficient inference for cluster-randomized experiments.

- *American Causal Inference Conference,* May 2023 (Poster)

Randomization Inference for Cluster-Randomized Test-Negative Designs with Application to Dengue Studies

- *American Causal Inference Conference,* May 2022 (Poster)

On the mixed-model analysis of covariance in cluster-randomized trials

- *Society of Clinical Trials Annual Meeting,* May 2022

Robustly leveraging post-randomization information to improve precision in randomized trials

- *Center for causal inference at University of Pennsylvania*, December 2021

Model-Robust Inference for Clinical Trials that Improve Precision by Stratified Randomization and Covariate adjustment.

- *JSM,* August 2020
- *ENAR*, March 2020

Clarifying how adjustment for prognostic baseline variables leads to more precision and less bias in randomized trials.

- *JSM,* August 2019
- *ENAR*, March 2018
- *JSM,* August 2017

Session Organizer

Using machine learning to analyze randomized trials: valid estimates and confidence intervals without model assumptions

- *ENAR*, March 2020

Trial Design and Analysis Methods for COVID-19 Treatment/Prevention

- *JSM,* August 2021

- *ENAR*, March 2021

Reviewer

- *Journal of the American Statistical Association (2)*
- *Journal of the Royal Statistical Society: Series B (1)*
- *Biometrika (2)*
- *The International Journal of Biostatistics (2)*
- *Biostatistics (1)*
- *Statistics in Medicine (6)*
- *Biometrics (2)*
- *Annals of Applied Statistics (2)*
- *Journal of the Royal Statistical Society: Series C (1)*
- *Observational Studies (2)*
- *Applied Science (1)*
- *National Science Foundation (1)*
- *Biometrical Journal (1)*
- *Clinical Trials (1)*
- *BMC Medical Research Methodology (1)*

Student Advising

- Advisee: Yang Dong, undergraduate student at University of Pennsylvania, 2021-2024
  (co-advised with Professor Dylan Small)
  Projects: R package for randomization inference in cluster-randomized trials; Predicting survival rate of cerebral malaria with pulse wave data; covariate-adaptive randomization for cluster-randomized trials

- Advisee: Joanne Wei, PhD student at Harvard University, 2024-present
  (co-advised with Professor Rui Wang)
  Project: Estimating the average treatment effect in IRT of longitudinal outcomes with missing outcome and covariate data