John Ehrlinger, PhD

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Research Interests

Applied statistical machine learning research conducted in close collaboration with cardiovascular surgeons and clinicians. Methodological focus spans random forest and ensemble methods, clustering, deep learning, and time series analysis, with emphasis on time-to-event and longitudinal data in cardiovascular outcomes. A sustained focus is the translation of methodological advances into clinical practice through open-source software development and reproducible analytical workflows, with current work centered on open-source implementations of multi-phase hazard analysis methods.

Professional Experience

Cleveland Clinic — Heart, Vascular & Thoracic Institute

Assistant Staff, Lead Data Scientist — Cardiovascular Outcomes, Registries and Research (CORR) December 2024–Present

Lead a team of data engineers and data scientists supporting cardiovascular outcomes research within CORR. Drive statistical methods research as applied to observational clinical research, advancing rigorous analytic approaches for cardiovascular outcomes data. Champion software engineering best practices and implement process improvements to optimize the departmental research pipeline from data collection through publication.

Cleveland Clinic Lerner College of Medicine

Clinical Assistant Professor (Joint Appointment) June 2025–Present

Serving as faculty mentor and statistical advisor to medical students and trainees conducting clinical research within the Heart, Vascular & Thoracic Institute. Providing guidance in statistical methods, research design, and data analysis for trainee-led research projects.

Altamira Technologies

Senior Data Scientist — Technical Lead March 2023–October 2024

Technical lead of the data science team supporting USAF customers on secure networks. Built a reusable Plotly-based dashboard framework; developed predictive traffic flow models and a computer vision pipeline for vehicle volume estimation at base entry points.

Microsoft — Azure Global Commercial Industry (AGCI-AI)

Senior Data and Applied Scientist — Technical Lead July 2015–April 2023

Technical lead for customer-facing ML/AI engagements across oil & gas (Chevron), aerospace (Rolls Royce), and medical devices (Stryker). Developed Azure ML solution accelerators for predictive maintenance. Presented at Microsoft MLADS conference four times (2016–2020).

Cleveland Clinic — Quantitative Health Sciences

Assistant Staff / Assistant Professor of Medicine — August 2012–July 2015

Applied random survival forests to cardiovascular outcomes research. Initiated development of the ggRandomForests R package. Began migration of institutional SAS-based hazard analysis to open-source implementations.

Cleveland Clinic Lerner College of Medicine

Clinical Assistant Professor (Joint Appointment) — 2015

Mentored medical students and fellows in statistical methods and research design as part of joint fellowship programs within the Cardiovascular Outcomes, Registries and Research (CORR) group.

Cleveland Clinic — Thoracic and Cardiovascular Surgery

Lead Systems Analyst: Scientific Programmer — August 1999–August 2012

Supported research computing infrastructure, statistical software development, and HPC operations for the department. Completed doctoral research in Statistics at Case Western Reserve University during this period.

Education

Case Western Reserve University, Ph.D. Statistics — 2011

Dissertation: *Regularization: Stagewise Regression and Bagging*. Advisor: Hemant Ishwaran.

Case Western Reserve University, M.S. Mechanical / Aerospace Engineering — 1994

Case Western Reserve University, B.S. Mechanical Engineering — 1993

Honors & Awards

NASA Graduate Research Fellowship — 1992–1994

Cleveland Clinic Innovations Award — 2003

Publications

Blackstone, E. H., Chang, H. L., Rajeswaran, J., Parides, M. K., Ishwaran, H., Li, L., **Ehrlinger**, J., Gelijns, A. C., Moskowitz, A. J., Argenziano, M., DeRose, J. J., Couderc, J.-P., Balda, D., Dagenais, F., Mack, M. J., Ailawadi, G., Smith, P. K., Acker, M. A., O'Gara, P. T., … Schering, A. (2019). Biatrial maze procedure versus pulmonary vein isolation for atrial fibrillation during mitral valve surgery: New analytical approaches and end points. *The Journal of Thoracic and Cardiovascular Surgery*, *157*(1), 234–243.e9. https://doi.org/https://doi.org/10.1016/j.jtcvs.2018.06.093

Hurst, T. E., Xanthopoulos, A., **Ehrlinger**, J., Rajeswaran, J., Pande, A., Thuita, L., Smedira, N. G., Moazami, N., Blackstone, E. H., Starling, R. C. (2019). Dynamic prediction of left ventricular assist device pump thrombosis based on lactate dehydrogenase trends. *ESC Heart Failure*, *6*(5), 1005–1014. https://doi.org/https://doi.org/10.1002/ehf2.12473

Rajeswaran, J., Blackstone, E. H., **Ehrlinger**, J., Li, L., Ishwaran, H., Parides, M. K. (2018). Probability of atrial fibrillation after ablation: Using a parametric nonlinear temporal decomposition mixed effects model. *Statistical Methods in Medical Research*, *27*(1), 126–141.

Wojnarski, C. M., Roselli, E. E., Idrees, J. J., Zhu, Y., Carnes, T. A., Lowry, A. M., Collier, P. H., Griffin, B., **Ehrlinger**, J., Blackstone, E. H., Svensson, L. G., Lytle, B. W. (2018). Machine-learning phenotypic classification of bicuspid aortopathy. *The Journal of Thoracic and Cardiovascular Surgery*, *155*(2), 461–469. e4.

Li, L., Mao, H., Ishwaran, H., Rajeswaran, J., **Ehrlinger**, J., Blackstone, E. H. (2017). Estimating the prevalence of atrial fibrillation from a three class mixture model for repeated diagnoses. *Biometrical Journal*, *59*(2), 331–343.

Pande, A., Li, L., Rajeswaran, J., **Ehrlinger**, J., Kogalur, U. B., Blackstone, E. H., Ishwaran, H. (2017). Boosted multivariate trees for longitudinal data. *Machine Learning*, *106*(2), 277–305.

Alli, O., Rihal, C. S., Suri, R. M., Greason, K. L., Waksman, R., Minha, S., Torguson, R., Pichard, A. D., Mack, M., Svensson, L. G., Rajeswaran, J., Lowry, A. M., **Ehrlinger**, J., Tuzcu, E. M., Thourani, V. H., Makkar, R., Blackstone, E. H., Leon, M. B., Holmes, D. (2016). Learning curves for transfemoral transcatheter aortic valve replacement in the PARTNER-i trial: Technical performance. *Catheterization and Cardiovascular Interventions*, *87*(1), 154–162.

Kapadia, S., Agarwal, S., Miller, D. C., Webb, J. G., Mack, M., Ellis, S., Herrmann, H. C., Pichard, A. D., Tuzcu, E. M., Svensson, L. G., Smith, C. R., Rajeswaran, J., **Ehrlinger**, J., Kodali, S., Makkar, R., Thourani, V. H., Blackstone, E. H., Leon, M. B. (2016). Insights into timing, risk factors, and outcomes of stroke and transient ischemic attack after transcatheter aortic valve replacement in the PARTNER trial (placement of aortic transcatheter valves). *Circulation: Cardiovascular Interventions*, *9*(9), e002981.

Minha, S., Waksman, R., Satler, L. P., Torguson, R., Alli, O., Rihal, C. S., Mack, M., Svensson, L. G., Rajeswaran, J., Blackstone, E. H., Tuzcu, E. M., Thourani, V. H., Makkar, R., **Ehrlinger**, J., Lowry, A. M., Suri, R. M., Greason, K. L., Leon, M. B., Holmes, D. R., Pichard, A. D. (2016). Learning curves for transfemoral transcatheter aortic valve replacement in PARTNER-i trial: Success and safety. *Catheterization and Cardiovascular Interventions*, *87*(1), 165–175.

Raja, S., Rice, T. W., **Ehrlinger**, J., Goldblum, J. R., Rybicki, L. A., Murthy, S. C., Adelstein, D., Videtic, G., McNamara, M. P., Blackstone, E. H. (2016). Importance of residual cancer after induction therapy for esophageal adenocarcinoma. *The Journal of Thoracic and Cardiovascular Surgery*, *152*(3), 756–761.

Suri, R. M., Alli, O., Waksman, R., Rihal, C. S., Satler, L. P., Greason, K. L., Torguson, R., Pichard, A. D., Mack, M., Svensson, L. G., Rajeswaran, J., Lowry, A. M., **Ehrlinger**, J., Mick, S. L., Tuzcu, E. M., Thourani, V. H., Makkar, R., Holmes, D., Leon, M. B., Blackstone, E. H. (2016). Learning curves for transapical transcatheter aortic valve replacement in the PARTNER-i trial: Technical performance, success, and safety. *The Journal of Thoracic and Cardiovascular Surgery*, *152*(3), 773–780. e14.

Smedira, N. G., Blackstone, E. H., **Ehrlinger**, J., Thuita, L., Pierce, C. D., Moazami, N., Starling, R. C. (2015). Current risks of HeartMate II pump thrombosis: Non-parametric analysis of interagency registry for mechanically assisted circulatory support data. *The Journal of Heart and Lung Transplantation*, *34*(12), 1527–1534.

Szeto, W. Y., Svensson, L. G., Rajeswaran, J., **Ehrlinger**, J., Smith, C. R., Mack, M., Miller, D. C., McCarthy, P. M., Bavaria, J. E., Cohn, L. H., Corso, P. J., Guyton, R. A., Thourani, V. H., Lytle, B. W., Williams, M. R., Webb, J. G., Kapadia, S., Tuzcu, E. M., Leon, M. B., Blackstone, E. H. (2015). Appropriate patient selection or healthcare rationing? Lessons from surgical aortic valve replacement in the PARTNER-i trial. *The Journal of Thoracic and Cardiovascular Surgery*, *150*(3), 557–568.

Thourani, V. H., Jensen, H. A., Babaliaros, V., Kodali, S., Rajeswaran, J., **Ehrlinger**, J., Suri, R. M., Don, C. W., Aldea, G., Blackstone, E., Williams, M. R., Makkar, R., Svensson, L., Johnson, A., McCabe, J., Dean, L. S., Johnson, M., Kapadia, S., Cohen, D. J., ... Mackand, M. (2015). PARTNER: Outcomes in nonagenarians undergoing transcatheter aortic valve replacement (TAVR). *Annals of Thoracic Surgery*, *100*(3), 785–793.

Wojnarski, C. M., Roselli, E., Idrees, J., Zhu, Y., Collier, P., Griffin, B., Carnes, T., Lowry, A., **Ehrlinger**, J., Svensson, L., Blackstone, E., Lytle, B. (2015). Bicuspid valve and aneurysm phenotypes: Clinical and pathologic associations. *Journal of the American College of Cardiology*, *65*(10).

Wojnarski, C. M., Svensson, L. G., Roselli, E. E., Idrees, J., Lowry, A. M., **Ehrlinger**, J., Pettersson, G. B., Gillinov, A. M., Johnston, D. R., Soltesz, E. G., Navia, J. L., Hammer, D. F., Griffin, B., Thamilarasan, M., Kalahasti, V., Sabik, J. F., Blackstone, E. H. (2015). Aortic dissection in patients with bicuspid aortic valve– associated

aneursym. *Annals of Thoracic Surgery*, *100*(5), 1666–1674.

Starling, R. C., Moazami, N., Silvestry, S. C., Ewald, G., Rogers, J. G., Milano, C. A., Rame, J. E., Acker, M. A., Blackstone, E. H., **Ehrlinger**, J., Thuita, L., Mountis, M. M., Soltesz, E. G., Lytle, B. W., Smedira, N. G. (2014). Unexpected abrupt increase in left ventricular assist device thrombosis. *New England Journal of Medicine*, *370*(1), 33–40. http://www.nejm.org/doi/full/10.1056/NEJMoa1313385

Dalton, J. E., Glance, L. G., Mascha, E. J., **Ehrlinger**, J., Chamoun, N., Sessler, D. I. (2013). Impact of present-on-admission indicators on risk-adjusted hospital mortality measurement. *Anesthesiology*, *118*(6), 1298–1306.

Ehrlinger, J., Ishwaran, H. (2012). Characterizing L_2boosting. *The Annals of Statistics*, *40*(2), 1074–1101.

In Revision / Submitted

Robinson, J., Belitsis, G., **Ehrlinger**, J., Blackstone, E. H., Li, X., Mertens, L., Fackoury, C., Williams, W. G., Karamlou, T., Jacobs, M. L., Welke, K., Jacobs, J. P., DeCampli, W., Kirklin, J. K., Pourmoghadam, K., Polimenakos, A. C., Kumar, T. K. S., Jegatheeswaran, A., Herrmann, J. L., ... Overman, D. M. (2026). The search for borderline hearts within biventricular repairs of complete atrioventricular septal defects. *The Journal of Thoracic and Cardiovascular Surgery*.

In Preparation

Alshneikat, M., Alaraj, R., Awad, A. K., Ramsingh, R., **Ehrlinger**, J., Houghtaling, P. L., Unai, S. G., Koprivanac, M. J., Kapadia, S., Tong, M. Z., Soltesz, E. G., Smedira, N. G., Pettersson, G. B., Roselli, E. E., Gillinov, A. M., Svensson, L. G., Blackstone, E. H., Bakaeen, F. G. (2026). Coronary artery aneurysms: Evolving trends in surgical management. *Journal of the American College of Cardiology*.

Barron, J. O., Toth, A. J., **Ehrlinger**, J., Ramji, S., Jain, N., Conner, A., Lee, S., Sudarshan, M., Raymond, D. P., Blackstone, E. H., Murthy, S. C., Raja, S. (2026). *A morphology-based classification of esophageal achalasia: Development and assessment of longitudinal outcomes*.

Belitsis, G., Robinson, J., **Ehrlinger**, J., Blackstone, E. H., Li, X., Mertens, L., Fackoury, C., Williams, W. G., Karamlou, T., Jacobs, M. L., Welke, K., Jacobs, J. P., DeCampli, W., Kirklin, J. K., Pourmoghadam, K., Polimenakos, A., Kumar, T. K. S., Jegatheeswaran, A., Herrmann, J. L., ... Overman, D. (2026). *The search for borderline hearts within complete atrioventricular septal defects*.

Fang, M. Z., **Ehrlinger**, J., Lieber, E., Krzelj, K., Houghtaling, P., Stembal, F., Kelava, M., Grady, P., Indorf, J., Somogyi, D., Lou, X., Kimmaliardjuk, D., Vargo, P., Malas, T., Smedira, N., Tong, M. Z.-Y., Soltesz, E., Yun, J., Zaki, A., ... Koprivanac, M. (2026). *Is cardiopulmonary bypass providing adequate perfusion? Modeling perioperative lactate levels*.

Stembal, F., Fang, M. Z., Houghtaling, P., **Ehrlinger**, J., Lieber, E., Kelava, M., Grady, P., Krzelj, K., Indorf, J., Somogyi, D., Troy, A., Lou, X., Kimmaliardjuk, D., Vargo, P., Malas, T., Smedira, N., Tong, M. Z., Soltesz, E., Yun, J., ... Blackstone, E. H. (2026). Still room for improving cardiopulmonary bypass? Descriptive analysis of lactate and other clinical, hemodynamic, and biochemical characteristics. *The Journal of Thoracic and Cardiovascular Surgery*.

Technical Reports

Ehrlinger, J. (2016). *ggRandomForests: Exploring Random Forest Survival*. arXiv preprint. https://arxiv.org/abs/1612.08974

Ehrlinger, J. (2015). *ggRandomForests: Visually Exploring a Random Forest for Regression*. arXiv preprint. https://arxiv.org/abs/1501.07196

Conference Presentations

Ehrlinger, J. (2026). *Care and Feeding of Your Biostats Team: Scaling Best Practices in a Large Hybrid SAS/R Team*. Invited talk.

Zamanian, F., **Ehrlinger**, J., Zhan, C. (2020). *How to interpret model prediction using interpretability tools on Azure Machine Learning*. Conference session.

Ehrlinger, J., Solanki, P. S. (2019). *Distributed Strategies for Training Deep Learning Models at Scale*. Conference session.

Ehrlinger, J., Shah, P. (2018). *Automated Machine Learning: A Case Study in Efficiently Expanding Data Science Experimentation for Stryker Surgical IoT Devices*. Conference session.

Ehrlinger, J. (2016). *Are we counting correctly? Model evaluation for time series classification.* Conference session.

Ehrlinger, J. (2014). *Visually Exploring Random Forests with ggRandomForests*. Conference session.

Software

R Packages

ggRandomForests — Visual exploration of random forest models via graphical analysis of survival, regression, and classification forests. https://github.com/ehrlinger/ggRandomForests

boostmtree — Boosted multivariate trees for longitudinal data. https://github.com/ehrlinger/boostmtree

mixhazard — R port of the C computational core underlying the Cleveland Clinic Hazard SAS module. https://github.com/ehrlinger/mixhazard

hvtiPlotR — Publication-quality HVTI-standard graphics for reproducible clinical research figures. https://github.com/ehrlinger/hvtiPlotR

hvtiRutilities — Utility functions supporting reproducible HVTI research workflows. https://github.com/ehrlinger/hvtiRutilities

SAS/C Software

hazard — SAS and C implementation of multi-phase hazard analysis for time-to-event decomposition. Includes C source code, SAS macros and modules. (Maintainer) https://github.com/ehrlinger/hazard