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EDUCATION

Ph.D. Biostatistics, University of California, Berkeley, 2013
M.S. Statistics, Universidad Nacional de Colombia, 2009
B.S. Statistics, Universidad Nacional de Colombia, 2007

ACADEMIC APPOINTMENTS

2016– Weill Cornell Medicine
Assistant Professor, Division of Biostatistics, Department of Population Health Sciences
2013–15 Johns Hopkins University
Postdoctoral Fellow, Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health

RESEARCH AREAS

Statistics: non-parametric statistical methods for causal inference from observational and randomized studies with complex datasets, using machine learning. This includes but is not limited to mediation analysis, methods for continuous exposures, longitudinal data including survival analysis, and efficiency guarantees with covariate adjustment in randomized trials.

Clinical research: neurology, pulmonary and critical care, precision medicine for cancer.

PUBLICATIONS

Statistics and Methodology Articles in Peer-Reviewed Journals

1. **Díaz, Iván.** Machine learning in the estimation of causal effects: targeted minimum loss-based estimation and double/debiased machine learning. *Biostatistics* **21**, 353–358 (2020).
2. **Díaz, Iván** & Hejazi, N. S. Causal mediation analysis for stochastic interventions. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* **n/a**. doi:10.1111/rssb.12362 (2020).
3. **Díaz, Iván**, Savenkov, O. & Kamel, H. Non-parametric targeted Bayesian estimation of class proportions in unlabeled data. *Biostatistics* (2020).

4. **Díaz, Iván.** Statistical inference for data-adaptive doubly robust estimators with survival outcomes. *Statistics in Medicine* **38**, 2735–2748 (2019).
5. **Díaz, Iván,** Colantuoni, E., Hanley, D. F. & Rosenblum, M. Improved precision in the analysis of randomized trials with survival outcomes, without assuming proportional hazards. *Lifetime Data Analysis*. ISSN: 1572-9249 (Feb. 2018).
6. **Díaz, Iván,** Savenkov, O. & Ballman, K. Targeted learning ensembles for optimal individualized treatment rules with time-to-event outcomes. *Biometrika* **105**, 723–738 (2018).
7. **Díaz, Iván** & van der Laan, M. J. Doubly robust inference for targeted minimum loss-based estimation in randomized trials with missing outcome data. *Statistics in Medicine*. ISSN: 1097-0258. doi:10.1002/sim.7389 (2018).
8. Scharfstein, D., McDermott, A., **Díaz, Iván,** Carone, M., Lunardon, N. & Turkoz, I. Global sensitivity analysis for repeated measures studies with informative drop-out: A semi-parametric approach. *Biometrics* **74**, 207–219 (2018).
9. **Díaz, Iván.** Efficient Estimation of Quantiles for Causal Inference and Missing Data. *Journal of Statistical Planning and Inference* (2017).
10. **Díaz, Iván,** Carone, M. & van der Laan, M. J. Second-Order Inference for the Mean of a Variable Missing at Random. *The International Journal of biostatistics* **12**, 333–349 (2016).
11. **Díaz, Iván,** Colantuoni, E. & Rosenblum, M. Enhanced precision in the analysis of randomized trials with ordinal outcomes. *Biometrics* **72**, 422 (2016).
12. **Díaz, Iván,** Hubbard, A., Decker, A. & Cohen, M. Variable Importance and Prediction Methods for Longitudinal Problems with Missing Variables. *PLoS ONE* **10** (2015).
13. **Díaz, Iván** & Rosenblum, M. Targeted Maximum Likelihood Estimation using Exponential Families. *International Journal of Biostatistics* **11**, 233–251 (2015).
14. Frangakis, C. E., Qian, T., Wu, Z. & **Díaz, Iván.** Deductive derivation and turing-computerization of semiparametric efficient estimation. *Biometrics* **71**, 867–874 (2015).
15. Rudolph, K. E., **Díaz, Iván,** Rosenblum, M. & Stuart, E. A. Estimating Population Treatment Effects From a Survey Subsample. *American Journal of Epidemiology* **180**, 737–748 (2014).
17. **Díaz, Iván** & van der Laan, M. J. Assessing the Causal Effect of Policies: An Example Using Stochastic Interventions. *The international journal of biostatistics* **9**, 161–174 (2013).
18. **Díaz, Iván** & van der Laan, M. J. Sensitivity analysis for causal inference under unmeasured confounding and measurement error problems. *The international journal of biostatistics* **9**, 149–160 (2013).
19. **Díaz, Iván** & van der Laan, M. J. Targeted Data Adaptive Estimation of the Causal Dose–Response Curve. *Journal of Causal Inference* **1**, 171–192 (2013).
20. Hubbard, A., **Díaz, Iván,** Decker, A., Holcomb, J. B., Schreiber, M. A., Bulger, E. M., Brasel, K. J., Fox, E. E., del Junco, D. J., Wade, C. E., *et al.* Time-dependent Prediction and Evaluation of Variable Importance Using Super-Learning in High-Dimensional Clinical Data. *Journal of Trauma-Injury, Infection, and Critical Care* **75**, S53–S60 (2013).
21. **Díaz, Iván** & van der Laan, M. Population Intervention Causal Effects Based on Stochastic Interventions. *Biometrics* **68**. <http://goo.gl/GK1l2Z>, 541–549 (2012).

22. **Díaz, Iván** & van der Laan, M. J. Super Learner Based Conditional Density Estimation With Application to Marginal Structural Models. *The International Journal of Biostatistics* 7, 1–20 (2011).
23. Cepeda-Cuervo, E., Aguilar, W., Cervantes, V., Corrales, M., **Díaz, Iván** & Rodríguez, D. Intervalos de confianza e intervalos de credibilidad para una proporción. *Revista Colombiana de Estadística* 31, 211–228 (2008).

Book Chapters

24. Carone, M., **Díaz, Iván** & van der Laan, M. J. in *Targeted Learning in Data Science* 483–510 (Springer, 2018).
25. **Díaz, Iván**, Luedtke, A. R. & van der Laan, M. J. in *Targeted Learning in Data Science* 511–522 (Springer, 2018).
26. **Díaz, Iván** & van der Laan, M. J. in *Targeted Learning in Data Science* 219–232 (Springer, 2018).
27. **Díaz, Iván**. in *Handbook on Big Data* (eds van der Laan, M. J., Buhlman, P., Kane, M. & Drineas, P.) (Chapman and Hall, 2016).
28. **Díaz, Iván**, Hubbard, A. & van der Laan, M. in *Targeted Learning* (eds van der Laan, M. J. & Rose, S.) (Springer, 2011).

Preprints and Articles Under Review

29. Benkeser, D., **Díaz, Iván**, Luedtke, A., Segal, J., Scharfstein, D. & Rosenblum, M. Improving Precision and Power in Randomized Trials for COVID-19 Treatments Using Covariate Adjustment, for Ordinal or Time to Event Outcomes. *medRxiv* (2020).
30. **Díaz, Iván**, Williams, N., Hoffman, K. L. & Schenck, E. J. *Non-parametric causal effects based on longitudinal modified treatment policies* 2020. arXiv: 2006.01366 [stat.ME].
31. Merkler, A. E., Parikh, N. S., Mir, S., Gupta, A., Kamel, H., Lin, E., Lantos, J., Schenck, E. J., Goyal, P., Bruce, S. S., Kahan, J., Lansdale, K. N., LeMoss, N. M., Murthy, S. B., Stieg, P. E., Fink, M. E., Iadecola, C., Segal, A. Z., Campion, T. R., **Díaz, Iván**, Zhang, C. & Navi, B. B. Risk of Ischemic Stroke in Patients with Covid-19 versus Patients with Influenza. *medRxiv* (2020).
32. **Díaz, Iván**, Hejazi, N. S., Rudolph, K. E. & van der Laan, M. J. *Non-parametric efficient causal mediation with intermediate confounders* 2019. arXiv: 1912.09936 [stat.ME].
33. Ogburn, E. L., Sofrygin, O., **Díaz, Iván** & van der Laan, M. J. Causal inference for social network data. *arXiv preprint arXiv:1705.08527* (2018).

Discussion Articles and Commentaries

16. Van der Laan, M. J., Luedtke, A. R. & **Díaz, Iván**. Discussion of Identification, Estimation and Approximation of Risk under Interventions that Depend on the Natural Value of Treatment Using Observational Data, by Jessica Young, Miguel Hernán, and James Robins. *Epidemiologic Methods* 3, 21–31 (2014).

Clinical and Health Services Research Articles in Peer-Reviewed Journals

34. Kamel, H., Navi, B. B., Merkler, A. E., Baradaran, H., **Díaz, Iván**, Parikh, N. S., Kasner, S. E., Gladstone, D. J., Iadecola, C. & Gupta, A. Reclassification of Ischemic Stroke Etiological Subtypes on the Basis of High-Risk Nonstenosing Carotid Plaque. *Stroke*, STROKEAHA–119.
35. Parikh, N. S., Chatterjee, A., **Díaz, Iván**, Merkler, A. E., Murthy, S. B., Iadecola, C., Navi, B. B. & Kamel, H. Trends in Active Cigarette Smoking Among Stroke Survivors in the United States, 1999 to 2018. *Stroke*, STROKEAHA–120.
36. Goyal, P., Unlu, O., Kneifati-Hayek, J., Levitan, E., Chen, L., **Díaz, Iván**, Hanlon, J., Lachs, M., Maurer, M. & Safford, M. *Polypharmacy in Older Adults Hospitalized for Heart Failure* in *Journal of the American Geriatrics Society* **68** (2020), S171–S171.
37. Goyal, P., Kneifati-Hayek, J., Archambault, A., Mehta, K., Levitan, E. B., Chen, L., **Díaz, Iván**, Hollenberg, J., Hanlon, J. T., Lachs, M. S., *et al.* Prescribing patterns of heart failure-exacerbating medications following a heart failure hospitalization. *JACC: Heart Failure* **8**, 25–34 (2020).
38. Lin, J., Piran, P., Lerario, M. P., Ong, H., Gupta, A., Murthy, S. B., **Díaz, Iván**, Stieg, P. E., Knopman, J., Falcone, G. J., *et al.* Differences in Admission Blood Pressure Among Causes of Intracerebral Hemorrhage. *Stroke* **51**, 644–647 (2020).
39. Murthy, S. B., **Díaz, Iván**, Wu, X., Merkler, A. E., Iadecola, C., Safford, M. M., Sheth, K. N., Navi, B. B. & Kamel, H. Risk of Arterial Ischemic Events After Intracerebral Hemorrhage. *Stroke* **51**, 137–142 (2020).
40. Murthy, S. B., Wu, X., **Díaz, Iván**, Parasram, M., Parikh, N. S., Iadecola, C., Merkler, A. E., Falcone, G. J., Brown, S., Biffi, A., *et al.* Non-Traumatic Subdural Hemorrhage and Risk of Arterial Ischemic Events. *Stroke* **51**, 1464–1469 (2020).
41. Telesford, K. M., Kaunzner, U. W., Perumal, J., Gauthier, S. A., Wu, X., **Díaz, Iván**, Kruse-Hoyer, M., Engel, C., Marcille, M. & Vartanian, T. Black African and Latino/a identity correlates with increased plasmablasts in MS. *Neurology-Neuroimmunology Neuroinflammation* **7** (2020).
42. Hung, P., Finn, C., Chen, M., Knight-Greenfield, A., Baradaran, H., Patel, P., **Díaz, Iván**, Kamel, H. & Gupta, A. Effect of Clinical History on Interpretation of Computed Tomography for Acute Stroke. *The Neurohospitalist* **9**, 140–143 (2019).
43. Kamel, H., Okin, P. M., Merkler, A. E., Navi, B. B., Champion, T. R., Devereux, R. B., **Díaz, Iván**, Weinsaft, J. W. & Kim, J. Relationship between left atrial volume and ischemic stroke subtype. *Annals of clinical and translational neurology* **6**, 1480–1486 (2019).
44. Kummer, B. R., Lerario, M. P., Hunter, M. D., Wu, X., Efraim, E. S., Omran, S. S., Chen, M. L., **Díaz, Iván**, Sacchetti, D., Lekic, T., Kulick, E. R., Pishanidar, S., Mir, S. A., Zhang, Y., Glenn Asaeda, B. B. N., Marshall, R. S. & Fink, M. E. Geographic Analysis of Mobile Stroke Unit Treatment in a Dense Urban Area: The New York City METRONOME Registry. *Journal of the American Heart Association* **8**, e013529 (2019).
45. Kummer, B. R., **Díaz, Iván**, Wu, X., Aaroe, A. E., Chen, M. L., Iadecola, C., Kamel, H. & Navi, B. B. Associations between cerebrovascular risk factors and parkinson disease. *Annals of neurology* **86**, 572–581 (2019).

46. Murthy, S., **Díaz, Iván**, Wu, X., Merkler, A., Iadecola, C., Navi, B. B. & Kamel, H. *Intracerebral Hemorrhage and Increased Risk of Arterial Ischemic Events in Annals of Neurology* **86** (2019), S259–S260.
47. Reynolds, A. S., Chen, M. L., Merkler, A. E., Chatterjee, A., **Díaz, Iván**, Navi, B. B. & Kamel, H. Effect of a randomized trial of unruptured brain arteriovenous malformation on interventional treatment rates for unruptured arteriovenous malformations. *Cerebrovascular Diseases* **47**, 299–302 (2019).
48. Yum, B., Archambault, A., Levitan, E. B., Dharamdasani, T., Kneifati-Hayek, J., Hanlon, J. T., **Díaz, Iván**, Maurer, M. S., Lachs, M. S., Safford, M. M., *et al.* Indications for β -Blocker Prescriptions in Heart Failure with Preserved Ejection Fraction. *Journal of the American Geriatrics Society* **67**, 1461–1466 (2019).
49. Merkler, A. E., **Díaz, Iván**, Wu, X., Murthy, S. B., Gialdini, G., Navi, B. B., Yaghi, S., Weinsaft, J. W., Okin, P. M., Safford, M. M., *et al.* Duration of heightened ischemic stroke risk after acute myocardial infarction. *Journal of the American Heart Association* **7**, e010782 (2018).
50. Mosconi, L., Rahman, A., **Díaz, Iván**, Wu, X., Scheyer, O., Hristov, H. W., Vallabhajosula, S., Isaacson, R. S., de Leon, M. J. & Brinton, R. D. Increased Alzheimer’s risk during the menopause transition: A 3-year longitudinal brain imaging study. *PloS one* **13** (2018).
51. Omran, S. S., Boddu, S. R., Gusdon, A. M., Kummer, B., Baradaran, H., Patel, P., **Díaz, Iván**, Navi, B. B., Gupta, A., Kamel, H., *et al.* Angiographic blush after mechanical thrombectomy is associated with hemorrhagic transformation of ischemic stroke. *Journal of Stroke and Cerebrovascular Diseases* **27**, 3124–3130 (2018).
52. Parikh, N. S., Chatterjee, A., **Díaz, Iván**, Pandya, A., Merkler, A. E., Gialdini, G., Kummer, B. R., Mir, S. A., Lerario, M. P., Fink, M. E., *et al.* Modeling the Impact of Interhospital Transfer Network Design on Stroke Outcomes in a Large City. *Stroke* **49**, 370–376 (2018).
53. Groh, M. A., **Díaz, Iván**, Johnson, A. M., Ely, S. W., Binns, O. A. & Champsaur, G. L. Is Surgical Intervention the Optimal Therapy for the Treatment of Aortic Valve Stenosis for Patients With Intermediate Society of Thoracic Surgeons Risk Score? *The Annals of thoracic surgery* **103**, 1193–1198 (2017).
54. Kreif, N., Grieve, R., **Díaz, Iván** & Harrison, D. Evaluation of the Effect of a Continuous Treatment: A Machine Learning Approach with an Application to Treatment for Traumatic Brain Injury. *Health economics* **24**, 1213–1228 (2015).
55. Kutcher, M., **Díaz, Iván**, Redick, B., Vilaridi, R., Nelson, M., Hubbard, A. & Cohen, M. *Critical Mediators of Coagulopathy After Trauma in Transfusion* **52** (2012), 33A–33A.

INVITED TALKS

“Causal mediation analysis for stochastic interventions”

2019 Atlantic Causal Inference Conference, Montreal, Canada.

2019 Cornell Tech Causal Inference Seminar.

“Targeted Learning Ensembles for Optimal Individualized Treatment Rules with Time-to-Event Outcomes”

- 2019 ICERM Workshop on Models and Machine Learning for Causal Inference and Decision Making in Health Research.
- 2018 University of Washington Department of Biostatistics Seminar.
- 2018 New York University, Population Health Sciences, Division of Biostatistics Seminar.
- 2018 John Hopkins Bloomberg School of Public Health, Department of Biostatistics, Causal Inference Seminar.
- “Collaborative double robustness using the e -score”
- 2018 Joint Statistical Meetings, Vancouver, Canada.
- “Doubly robust inference for targeted minimum loss-based estimation in randomized trials with missing outcome data.”
- 2017 Cornell Day of Statistics. Cornell University.
- “Targeted Learning Ensembles for Optimal Individualized Treatment Rules with Time-to-Event Outcomes.”
- 2017 Division of Biostatistics, UC Berkeley.
- “Improved Precision in the Analysis of Randomized Trials with Survival Outcomes, without Assuming Proportional Hazards.”
- 2017 Lifetime Data Analysis Conference, LIDA. University of Connecticut.
- 2016 Division of Biostatistics, UC Berkeley.
- 2016 Division of Biostatistics, Weill Cornell Medicine.
- 2016 Department of Biostatistics and Epidemiology, Perelman School of Medicine, UPenn.
- “Enhanced Precision in the Analysis of Randomized Trials with Ordinal Outcomes.”
- 2014 Food and Drug Administration, White Oak, MD, USA.
- 2014 Johns Hopkins School of Public Health Grand Rounds, Baltimore, MD, USA.
- “Efficient Estimation of the Causal Effect of a Binary Treatment on an Ordinal Outcome.”
- 2014 Joint Applied Statistics Symposium of International Chinese Statistical Association & Korean International Statistical Society, Portland, OR, USA.
- “Sensitivity Analysis for Causal Inference and Measurement Error”
- 2014 ENAR IMS Annual Meeting, Baltimore, MD, USA.
- “Time-varying prediction of death with associated variable importance using SuperLearning in high dimensional clinical data.”
- 2012 PROMMTT symposium, Kauai, HI, USA.
- “Targeted Data Adaptive Estimation of the Causal Dose Response Curve.”
- 2012 Joint Statistical Meetings, San Diego, CA, USA.

CONTRIBUTED TALKS

- “Targeted Data Adaptive Estimation of the Causal Dose Response Curve.”
- 2013 WNAR IMS Annual Meeting, Los Angeles, California.
- “Variable Importance and Prediction Methods for Longitudinal Problems with Missing Variables.”
- 2013 Joint Statistical Meetings, Montreal, QC, Canada.

“Causal Effects Based on Stochastic Interventions”

2012 Atlantic Causal Inference Conference, Baltimore, MD, USA.

“Population Intervention Causal Effects Based on Stochastic Interventions.”

2011 Joint Statistical Meetings, Miami, FL, USA.

“Bayesian Targeted Learning.”

2010 WNAR IMS Annual Meeting, Seattle, WA, USA.

GRANTS AND AWARDS

Awards and Honors

- 2013 Erich L. Lehmann citation for an outstanding Ph.D. dissertation in theoretical statistics. University of California at Berkeley.
- 2013 Graduate Division Scholarship in Recognition of Scholastic Achievements. UC Berkeley.
- 2011 Graduate Division Scholarship in Recognition of Scholastic Achievements. UC Berkeley.
- 2008 Scholarship for outstanding graduate students. National University of Colombia.

Grants and Fellowships

- 2020–22 Co-I. R21 NIH-NMSS “Defining ancestry associated B-cell inflammation in treatment naïve Multiple Sclerosis” Multiple sclerosis is a debilitating disease of the central nervous system (CNS) that manifests with particular severity amongst those identifying as African American and Latin American. Socioeconomic-based access to care does not appear to completely account for this clinical disparity, pointing to a biological root. MS possesses a strong B-cell-centralized immunopathogenesis, however; comparative, direct, immunologic analysis reconciling Black African ancestry and MS has not been published to the best of our knowledge. Retrospective clinical data demonstrates heightened CNS IgG class antibody levels in African Americans with MS compared to Caucasian Americans with MS. In light of these reports, as well as the direct relationship between B-cells and MS disease activity, this study aims to find out whether MS patients of African ancestry possess greater T-dependent inflammatory B cell function relative to those of Caucasian ancestry.
- 2018–21 Co-I. R01 NIH-AHRQ “Primary Care Physician-Staff Dyads (Teamlets): A Simple, Efficient Means to Improve Healthcare Quality and Decrease Cost?” The proposed research on teamlets is relevant to the AHRQ Special Emphasis Notice in 2016 which stated “revitalizing the Nation’s primary care system is critical” and requested innovative research that addresses “how different configurations of primary care teams affect the effectiveness and efficiency of care and health outcomes” This research will provide the first large-scale evidence on whether physicians practicing in a primary care teamlet meet these goals better than physicians not practicing in a teamlet, and will identify the characteristics of high-performing teamlets.
- 2017–21 Co-I. P50 NIH-NIMH “Alacrity for late- and mid-life mood disorders.” We propose to study a novel model for developing behavioral interventions to improve the care of older and middle-aged adults with mood disorders treated in the community. Our interventions are simplified based on input by consumers and community clinicians, guided by

neurobiological models, and supported by mobile technology. As a result, we expect that our novel interventions can become part of the practice of a variety of community settings and help many who are inadequately treated and suffering.

- 2018–20 Co-I. PCORI “Identifying and Predicting Patients with Preventable High Utilization: Phase II.” This project will translate the computable phenotypes into those that can be used in the real world settings, interview key stakeholders about their population health needs and priorities, adapt the phenotypes for use in learning health systems, and perform a comparative effectiveness study of the positive predictive value of phenotypes health system vs. CDRN data sources.
- 2017–19 Co-I. R03 NIH-NIA “Impact of Polypharmacy on Rehospitalization in Older Adults with Heart Failure.” The proposed research is relevant to public health because post-hospitalization outcomes remain particularly poor among older adults with heart failure. We propose to examine the role of an overlooked potentially modifiable factor, polypharmacy, on hospital readmissions among older adults with heart failure in order to develop a foundation upon which to design, implement, and evaluate an intervention aimed at preventing readmission and improving post-hospitalization quality of life.

TEACHING EXPERIENCE

Modern Methods in Causal Inference, Weill Cornell Medicine, Summer 2019, 2020.

Regression Analysis, Weill Cornell Medicine, Spring 2018.

Longitudinal Data Analysis, University of California at Berkeley, Spring 2010.

Probability and Statistics for Engineering, Universidad Nacional de Colombia, Fall 2008.

Nonparametric Statistics, Universidad Nacional de Colombia, Spring 2008.

SERVICE

Journal Peer Review

Biometrika

Biometrics

Annals of Statistics

Journal of the American Statistical Association

Statistics in Medicine

Statistical Methods in Medical Research

International Journal of Biostatistics

Journal of Causal Inference

Epidemiology

Stroke

PROFESSIONAL AFFILIATIONS

American Statistical Association

International Biometric Society, Eastern North American Region

International Chinese Statistical Association

CONSULTING ENGAGEMENTS

2012– MetronomX

2013–17 Mission Health.

2013–15 Instituto Colombiano para le Evaluación de la Educación Superior (“Colombian Institute for the Evaluation of Higher Education”)

2012–16 UCSF Clinical & Translational Science Institute (CTSI).

OTHER PROFESSIONAL EXPERIENCE

2007–09 Statistician. Instituto Colombiano para le Evaluación de la Educación Superior (“Colombian Institute for the Evaluation of Higher Education”)