Maria Cuellar

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PRIMARY APPOINTMENT

2018–   Assistant Professor of Criminology, University of Pennsylvania, School of Arts and Sciences

OTHER FACULTY APPOINTMENTS

2023–   Appointment Without Voting Rights, Division of Biostatistics in the Department of Biostatistics, Epidemiology, & Informatics, Perelman School of Medicine

2021–   Appointment, Department of Statistics and Data Science, Wharton School

AFFILIATIONS / SHORT-TERM VISITS

2025   Senior Fellow for Forensic Science Policy, The Innocence Project

2024   Visiting Assistant Professor of Biostatistics, Johns Hopkins Bloomberg School of Public Health

2021–   Faculty Fellow, University of Pennsylvania Crime and Justice Policy Lab

2018–   Faculty Affiliate, University of Pennsylvania Quattrone Center

EDUCATION AND TRAINING

2017   Ph.D. in Statistics and Public Policy, Carnegie Mellon University
Dissertation: "Causal reasoning in the law: Estimation of the probability of causation"
(Norman Breslow Prize, Statistics in Epidemiology Section of the American Statistical Association)

2016   M.Phil. in Public Policy, Carnegie Mellon University
Thesis: "Shaken Baby Syndrome on trial: A statistical analysis of arguments made in court"
(Best paper award, Heinz College of Public Policy)

2015   M.S. in Statistics, Carnegie Mellon University
Thesis: "Weeding out underreporting: A study of trends in reporting of marijuana consumption"

2009   B.A. in Physics, Reed College
Thesis: "Using weak gravitational lensing to find dark matter distributions in galaxy clusters"
(Commendation for Academic Excellence)

Postdoctoral Training

2018   Postdoctoral Fellow in the Department of Criminology, University of Pennsylvania

HONORS AND AWARDS

2023   Blackwell Seminar: Invited annual seminar at the University of Washington.

2021   Significance Magazine, Top 10 most read articles (Stern HS, Cuellar M., Kaye D, 2019)

2018   Norman Breslow Prize, Top paper prize Statistics in Epidemiology, American Stat. Association

2017   Stephen Fienberg Travel Award, Center for Statistics and Applications in Forensic Evidence

2016   Wray Jackson Smith Scholarship, Government Statistics Section, American Stat. Association

2016   George Duncan Award for Excellence in Doctoral Studies, Heinz College of Public Policy

2015   Mihaela Serban Memorial Award, For starting CMU Women in Statistics group

2009   Commendation for Academic Excellence, Reed College

PUBLICATIONS (* DENOTES PEER-REVIEWED)

Journal Articles

1. * Cuellar, M. (2025) The Problem With Eliminations: Why Forensic Comparisons Need False Negative Rates, ***Forensic Science International: Synergy***, 11, 100621.

2. * Rubinstein, M., Cuellar, M., Malinsky, D. (2025) Mediated Probabilities of Causation, ***Journal of Causal Inference***, 13(1), p.20240019.

3. * Cuellar, M., Vanderplas, S., Luby, A., Rosenblum, M. (2024). Methodological Problems in Every Black-Box Study of Forensic Firearm Comparisons, ***Law, Probability and Risk***, 23(1), mgae015.
   Note: This article has been filed in at least one case in CO, DC, IL, IA, MD, NY, OR, and in Federal Court.

4. * Cuellar, M., Gao, S., and Hofmann, H., (2024). An Algorithm for Forensic Toolmark Comparisons. ***Forensic Science International: Synergy***, 9, p.100543.

5. * Rosenblum, M., Chin, E.T., Ogburn, E.L., Nishimura, A., Westreich, D., Datta, A., Vanderplas, S., Cuellar, M. and Thompson, W.C., (2024). Misuse of Statistical Methods Results in Highly Biased Interpretation of Forensic Evidence in Guyll et al. ***Law, Probability and Risk***, 23(1).

6. * Cuellar, M., Mauro, J., Luby, A. (2022). A Probabilistic Formulation of Contextual Bias in Forensic Analysis, ***Journal of the Royal Statistical Society: Series A***, 185(2), S620?S643.

7. * Cuellar, M., Gonzalez, C., Dror, I. (2022). Human and Machine Similarity Judgments in Forensic Firearm Comparisons. ***Forensic Science International: Synergy***, (5) 100283.

8. * Chalfin, A., Kaplan, J., Cuellar, M. (2021). Measuring Marginal Crime Concentration: A New Solution to an Old Problem. ***Journal of Research in Crime and Delinquency***,58(4),467–504.

9. * Lowenstein, M., Feuerstein-Simon, R., Dupuis, R., Herens, A., Hom, J., Sharma, M., Sheni, R., Encarnacion, L., Flaherty, C., Cuellar, M., Cannuscio, C. (2021). Overdose Awareness and Reversal Trainings at Philadelphia Public Libraries. ***American Journal of Health Promotion***, 35 (2), 250-254.

10. * Cuellar, M., Kennedy, E. H. (2020). A Non-Parametric Projection-Based Estimator for the Probability of Causation, With Application to Water Sanitation in Kenya. ***Journal of the Royal Statistical Society: Series A***, 183(4), 1793-1818.

11. * Mejia, R., Cuellar, M., Salyards, J. (2020). Implementing Blind Proficiency Testing in Forensic Laboratories: Motivation, Obstacles, and Recommendations. ***Forensic Science International: Synergy***, (2), 293-298.

12. * Ling, S., Kaplan, J., Cuellar, M. (2020). Public Beliefs About the Accuracy and Importance of Forensic Evidence in the United States. ***Science & Justice***, 60(3), 263-272.

13. * Moral, J., Hundl, C., Lee, D., Neuman, M., Grimaldi, A., Cuellar, M., Stout, P. (2019). Implementation of a Blind Quality Control Program in Blood Alcohol Analysis. ***Journal of Analytical Toxicology***, 43(8), 1-7.

14. * Cuellar, M. (2018). Trends in Self-Reporting of Marijuana Consumption in the United States. ***Statistics and Public Policy***, 5(1), 1-10.

15. * Cuellar, M. (2017). Causal Reasoning and Data Analysis: Problems With the Abusive Head Trauma Diagnosis, ***Law, Probability and Risk***, 16(4): 223-239.

Chapters

16. * Cuellar, M. (2022). Causes of Effects and Effects of Causes. In ***Statistics in the Public Interest, Data Sciences Book Series***, (pp. 211-233). Springer, Cham.

17. * Cuellar, M., Mentch, L., Spiegelman, C. (2019). Association Does Not Imply Discrimination: Flawed Analyses That Lead to Wrongful Convictions. In ***Handbook of Forensic Statistics***, (pp. 131–142). Chapman & Hall

Letters, Editorials, and Other Publications

18. * Rosenblum, M., Chin, E.T., Ogburn, E.L., Nishimura, A., Westreich, D., Datta, A., Vanderplas, S., Cuellar, M. and Thompson, W.C., (2024). Incorrect Statistical Reasoning in Guyll et al. Leads to Biased Claims About Strength of Forensic Evidence. ***Proceedings of the National Academies of Science***, 121(45) e2315431121.

19. * Stern, H.S., Cuellar, M., Kaye, D. (2019). Reliability and Validity of Forensic Science Evidence. ***Significance Magazine***, 16(2), 21-24.

20. * Mejia, R., Cuellar, M., Delger, D., Eddy, W. (2019). What Does a Match Mean? A Framework for Understanding Forensic Comparisons. ***Significance Magazine***, 16(2), 25-28.

21. * Cuellar, M. (2023). Proposer of the Vote of Thanks and Contribution to the Discussion of 'Experimental Evaluation of Algorithm-Assisted Human Decision-Making: Application to Pretrial Public Safety Assessment' by Imai et al. ***Journal of the Royal Statistical Society Series A: Statistics in Society***, 186(2), 190-191.

22. Cuellar, M. (2017). Short-Fall Arguments in Court: A Probabilistic Analysis, 50 ***U. Mich. J. L. Reform*** 763.

Works in Progress

1. Accuracy and fairness in police use of facial recognition – with James To and Arush Mehrotra (under review)
2. How Often are Fingerprints Repeated in the Population? – with Jackson Gold (under review)
3. The Statistical Foundations and Diagnostic Challenges of Shaken Baby Syndrome (under review)
4. Prosecutor's fallacy and the likelihood ratio (under review)
5. A hierarchical model to study forensic toolmark identification.
6. Review of fingerprint black-box studies.

Software

1. R package, nonparametric estimation of probability of causation: github.com/mariacuellar/pcausation

TEACHING

Classroom Instruction

2018–2024	"Forensic Analysis" (CRIM 2040-301)
2021–2024	"Statistics for the Social Sciences" (CRIM 1200-001)
2019–2023	"Criminal Justice" (CRIM 1100-401 / SOCI 2921-401)

RESEARCH GRANT PARTICIPATION

As Principal Investigator

2025   The Innocence Project, Senior Fellow for Forensic Science Policy
             Communicate academic research on forensic science to the policy and litigation divisions.

2024–2025   Forensic Justice Project Grant, Principal Investigator
             Review the methodological problems with black-box studies of fingerprint comparisons.

2024   University of Pennsylvania Data Driven Initiative Grant, Principal Investigator
             Estimate the accuracy and fairness of facial recognition technology, as used by the police.

2022–2023   Oracle for Research Grant, Principal Investigator
             Develop an algorithm for forensic toolmark comparisons using the Oracle Cloud Technology.

2020–2025   Center for Statistics and Applications in Forensic Evidence (CSAFE), Principal Investigator.
             Research the foundational validity of forensic toolmark comparisons. Cooperative Agreement
             70NANB20H019 between NIST and Iowa State University.

2018   University of Pennsylvania Law School, Quattrone Center Grant, Principal Investigator
             Develop a formalization of contextual bias in forensic science decisions, and study the human–
             machine interaction in firearms comparisons.

As Co-Investigator

2024   Johns Hopkins University Nexus Award
             Review the methodological problems with black-box studies of fingerprint comparisons.
2021–2024   National Institute of Justice Grant consultant, award number 15PNIJ-21-GG-04192-RESS.
             "Evaluation of the Occurrence and Associative Value of Non-Identifiable Fingermarks on
             Unfired Ammunition in Handguns for Evidence Supporting Proof of Criminal Possession, Use
             and Intent". Carry out the statistical analysis of an experiment to study the algorithmic
             comparison of fingerprints on bullets.

SERVICE TO THE DEPARTMENT

2024–   Dissertation director of a doctoral student in criminology: James To.
2025–   Advise a doctoral student in criminology: Maya Moritz.
2020–   Organize the criminology colloquium.
2019–   Write recommendation letters for students (~70 so far).
2019–   Advise five undergraduate students in criminology.

SERVICE TO THE UNIVERSITY

2025–   Pre-major advisor (PMA) to seven incoming first-year students.
2024–   Received a grant and gave lectures for the Data Driven Initiative.
2018–   Serve as affiliate and give lectures annually at the Quattrone Center.
2018–   Serve as a member of the Center for Latin American and Latinx Studies.
2018–   Serve as a member and give lectures at the Center for Causal Inference (CCI).
2020–   Mentor 11 students through the Center for Undergraduate Research and Fellowships (CURF).
2021–2023   Served on the Curriculum Committee.
2023   Advised a doctoral student's master's thesis in Biostatistics: Dane Isenberg.
2022   Hosted a student to do a REU grant from the National Science Foundation.
2022   Guest Lecturer for Dominic Sisti's course, "Social Media, Healthcare, and Medical Ethics"
2019   Guest Lecturer for John Hollway's course, "Conviction Integrity: Errors in Criminal Justice"
2019   Guest Lecturer for George Cronin's course, "Forensic Science"
2018–2021   Guest Lecturer for Greg Ridgeway's course, "Criminology in Practice"
2018   Guest Lecturer for Aaron Chalfin's course, "Seminar in Criminal Justice"

SERVICE TO THE PROFESSION

Society Membership and Leadership

2023–2026	Co-Chair, Committee on Law and Justice Statistics, American Statistical Association (ASA)
2024–2026	Program Chair, Social Statistics Section, American Statistical Association (ASA)
2021–2025	Affiliate (previously member), Friction Ridge Subcommittee, Forensic Science Standards Board's (FSSB) Statistics Task Group for the Organization of Scientific Area Committees for Forensic Science (OSAC) at the National Institute of Standards and Technology (NIST).
2022–2023	Member, Discussion Meetings Committee, Royal Statistical Society (RSS)
2021–2023	Chair (previously vice-chair and member), ASA Advisory Committee on Forensic Science (ASA)
2021–2023	Member, Royal Statistical Society Statistics and Law Section (RSS)
2019–2020	Publications Officer, American Statistical Association Biometrics Section (ASA)
2018	Co-organizer, Workshop about blinding in forensic proficiency testing and casework (CSAFE)

Journal Peer Review

2025	Journal of Quantitative Criminology (2018-2025)
2024	Chance Magazine
2024	Statistica Sinica
2023	Annals of Applied Statistics
2021	Journal of the Royal Statistical Society, Series A
2021	Forensic Science International
2020	Handbook of Forensic Statistics, Chapman & Hall/CRC Handbooks Modern Statistical Methods
2019	Journal of Causal Inference
2019	Science Advances
2019	Health Services and Outcomes Research Methodology
2019	Statistical Science
2018	Statistics in Medicine
2018	Trauma, Violence, and Abuse
2018	Law, Probability and Risk
2014	International Journal of Drug Policy

PRESENTATIONS

Invited

1. (Expected) Plenary talk at the American Causal Inference Conference (5/2026)
2. DNA Unit of the Legal Aid Society in NYC (3/2025)
3. American Academy of Forensic Sciences Annual Conference (2/2025)
4. Seoul National University College of Social Sciences (2/2025)
5. National Academies of Science, NAS (9/2024)
6. CSAFE All Hands Meeting (6/2024)
7. Association of Firearm and Tool Mark Examiners Conference (5/2024)
8. Johns Hopkins University, Biostatistics Department Seminar (5/2024)
9. Temple University, Biostatistics Department Seminar (4/2024)
10. Quattrone Center Spring Symposium, University of Pennsylvania Law School (4/2024)
11. ENAR Conference (3/2024)
12. Gun Violence Center, Johns Hopkins (3/2024)
13. Johns Hopkins University, T32 group on big data, causal inference, and behavioral health (2/2024)
14. CMStat Conference (12/2023)
15. American Association for the Advancement of Science, AAAS (9/2023)
16. Joint Statistical Meetings (8/2023)

17. The Blackwell Seminar, University of Washington, Statistics Department (10/27/2023)
18. Joint Statistical Meetings (8/10/2022)
19. JRSS Series A Discussion Paper Meeting, Discussant (2/8/2022)
20. ASA Florence Nightingale David Award Lecture, Discussant (8/12/2021)
21. Northwestern University, Statistics Seminar (5/19/2021)
22. Board for Judicial Administration, Conviction Integrity Units and Innocence Organizations (3/10/2021)
23. University of Massachusetts Amherst, Mathematics and Statistics Seminar (2/26/2021)
24. Vanderbilt University, Biostatistics Seminar (2/24/2021)
25. Royal Statistical Society International Conference (9/2020)
26. Joint Statistical Meetings (8/12/2020)
27. Joint Statistical Meetings (7/2020)
28. Drexel University, Epidemiology and Biostatistics Seminar (10/2019)
29. Oregon Health & Science University, Department of Internal Medicine Seminar (10/2019)
30. Yale University, Quantitative Research Methods Workshop (9/2019)
31. Capital Habeas Corpus of Pennsylvania Conference, Plenary talk (4/2019)
32. NYU School of Medicine, Biostatistics Seminar (1/2019)
33. Harvard University, Biostatistics Seminar (12/2018)
34. Rutgers School of Public Health, 21st Century Seminar Series (10/2018)
35. Harvard University, Data Science Initiative (10/2018)
36. University of Cambridge, Isaac Newton Institute for Mathematical Sciences (9/2016)
37. West Virginia Law Review, Symposium on Flawed Forensics and Innocence panel (3/2016)
38. University of Michigan Law School, Child Abuse Evidence Symposium (11/2015)

Contributed

1. Criminology Colloquium at the University of Pennsylvania (9/2024)
2. UPenn Center for Causal Inference (3/2024)
3. Johns Hopkins Center for Gun Violence Solutions (2/2024)
4. Joint Statistical Meetings (7/2016, 7/2017, 7/2018, 7/2019, expected 8/2025)
5. Atlantic Causal Inference Conference (5/2017, 6/2018, 5/2019)
6. CSAFE All Hands Meeting at Iowa State University (6/2017, 6/2018, 5/2019)
7. Blinding in Forensic Laboratories Workshop (11/2018)
8. Quattrone Center Advisory Board Meeting (4/2018)
9. 10th International Conference on Forensic Inference & Statistics (9/2017)
10. Shaken Baby Syndrome Webinar (7/2017)
11. American Academy of Forensic Sciences 69th Meeting (02/2017)
12. Statistical and Applied Mathematical Sciences Institute, Forensics Workshop (5/2016)
13. Statistical and Applied Mathematical Sciences Institute, Women in Mathematical Sciences (4/2016)