Gian-Gabriel P. Garcia

Postdoctoral Research Fellow

@ MGH-ITA Harvard Medical School

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Address: 101 Merrimac St., Suite 1010

Boston, MA 02114

E-mail: ggarcia16@mgh.harvard.edu

Phone: (347) 542-7242

ORCID: http://orcid.org/0000-0001-9315-0195 Website: http://www.giangabrielgarcia.com

Employment

Georgia Institute of Technology, Atlanta, GA

Assistant Professor, H. Milton Stewart School of Industrial and Systems Engineering

Starting 8/2021

Harvard Medical School, Boston, MA

Postdoctoral Fellow, Massachusetts General Hospital Institute for Technology Assessment 7/2020-7/2021

Education

PhD, Industrial and Operations Engineering

8/2020

University of Michigan, Ann Arbor, MI

"Predictive and Prescriptive Analytics for Optimizing Concussion Management Decisions"

Thesis Advisor: Mariel S. Lavieri

M.S. Industrial and Operations Engineering

12/2016

B.S. Industrial Engineering, Summa Cum Laude University of Pittsburgh, Pittsburgh, PA

University of Michigan, Ann Arbor, MI

12/2014

Selected Awards and Honors

College of Engineering Towner Prize for Distinguished Academic Achievement

2020

Society of Medical Decision Making Lee B. Lusted Student Prize

Stephen Pauker Award for Quantitative Methods and Theoretical Developments

2018

2018

INFORMS Bonder Scholarship for Applied OR in Health Services

National Science Foundation Graduate Research Fellowship

2017-2020

IOE Graduate Student Instructor of the Semester

2017

Research Interests

My current research develops data-driven frameworks for *Predictive Analytics* and *Prescriptive Analytics* as motivated by and applied to high-impact problems in *Medical Decision-Making*. I am especially interested in modeling the role of behavioral and social dynamics in decision-making under uncertainty.

Methodology

Predictive modeling, data-driven optimization, dynamic programming, (Partially Observable) Markov decision processes, machine learning, stochastic optimization, robust optimization, Kalman filtering, stochastic control, applied statistics, game theory, social network analysis

Applications

Medical decision-making, concussion management, opioid use disorder, post-traumatic stress disorder, detecting glaucoma progression, cardiovascular disease, value-based insurance design, vaccine delivery under resource constraints

Publications

Journal Articles

- G.-G. P. Garcia, J. Yang, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2020). Optimizing Components of the Sport Concussion Assessment Tool for Acute Concussion Assessment. *Neurosurgery* (Accepted). ¹
- 2. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2020). Datadriven stochastic optimization approaches to determine decision thresholds for risk estimation models. *IISE Transactions* **52**(10), 1098–1121.
- 3. **G.-G. P. Garcia**, M. S. Lavieri, C. Andrews, X. Liu, M. P. Van Oyen, M. A. Kass, M. O. Gordon, and J. D. Stein (2019). Accuracy of Kalman Filtering in Forecasting Visual Field and Intraocular Pressure Trajectory in Patients With Ocular Hypertension. *JAMA Ophthalmology* **137**(12), 1416–1423. ²
- 4. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). A Data-Driven Approach to Unlikely, Possible, Probable, and Definite Acute Concussion Assessment. *Journal of Neurotrauma* **36**(10), 1571–1583. ³
- G.-G. P. Garcia, K. Nitta, M. S. Lavieri, C. Andrews, X. Liu, E. Lobaza, M. P. Van Oyen, K. Sugiyama, and J. D. Stein (2019). Using Kalman Filtering to Forecast Disease Trajectory for Patients With Normal Tension Glaucoma. *American Journal of Ophthalmology* 199, 111–119.
- 6. G. J. Schell, G.-G. P. Garcia, M. S. Lavieri, J. B. Sussman, and R. A. Hayward (2019). Optimal Coinsurance Rates for a Heterogeneous Population under Inequality and Resource Constraints. *IISE Transactions* 51(1), 74–91.
- G.-G. P. Garcia, S. P. Broglio, M. S. Lavieri, M. McCrea, and T. McAllister (2018). Quantifying the Value of Multidimensional Assessment Models for Acute Concussion: An Analysis of Data from the NCAA-DoD Care Consortium. Sports Medicine 48(7), 1739–1749.
- 8. M. H. Mofrad, G.-G. P. Garcia, L. M. Maillart, B. A. Norman, and J. Rajgopal (2016). Customizing Immunization Clinic Operations to Minimize Open Vial Waste. *Socio-Economic Planning Sciences* 54(March 2016), 1–17.

Submitted Papers

- 1. L. L. Czerniak, S. W. Liebel, G.-G. P. Garcia, M. S. Lavieri, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2020). Sensitivity and Specificity of Computer-Based Neurocognitive Assessments in Sport-Related Concussion: Findings from the NCAA-DoD CARE Consortium. *Sports Medicine* (Under revision)
- 2. S. W. Liebel, K. L. Van Pelt, G.-G. P. Garcia, L. L. Czerniak, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2020). The Relationship Between Sport-Related Concussion and Sensation-Seeking. *International Journal of Molecular Sciences* (Submitted)

Working Papers

- 1. **G.-G. P. Garcia**, C. M. Schumb, M. S. Lavieri, H. Koffijberg, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2020). Developing Insights for Possible and Probable Acute Concussions Using Cluster Analysis. *Journal of Neurotrauma* (Target Journal)
- 2. **G.-G. P. Garcia**, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2020). Estimating the Value of Incorporating Patient Behavior in Return-to-play from Concussion: A Behavior-Learning Multiagent POMDP Approach. *Operations Research* (Target Journal)

Presentations

Invited Talks and Seminars

- 1. "Predictive and Prescriptive Analytics for Concussion Management Decisions"
 - ➤ MGH Institute for Technology Assessment, Harvard Medical School, August 2020
 - ➤ Department of Industrial and Systems Engineering, University of Minnesota, January 2020

¹Impact Factor: 4.61

²Impact Factor: 6.17

³Impact Factor: 5.00

⁴Impact Factor: 4.80

⁵Impact Factor: 7.58

- ➤ Department of Industrial Engineering, Clemson University, January 2020
- ➤ School of Industrial Engineering and Regenstrief Center for Healthcare Engineering, Purdue University, December 2019
- ➤ H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, December 2019
- ➤ Department of Industrial and Systems Engineering, University of Florida, December 2019
- 2. "Data-driven Decision Thresholds for Risk Estimation Models with Application to Acute Concussion Assessment"
 - ➤ Edward P. Fitts Department of Industrial & Systems Engineering Department, North Carolina State University, April 2019
- 3. "Data-driven Optimization for Concussion Management Decisions"
 - Department of Industrial and Operations Engineering, University of Michigan, September 2018

Refereed Conference Abstracts and Presentations

- 1. **G.-G. P. Garcia**, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2020). The Value of Incorporating Symptom-Reporting Behavior in Optimal Treatment Decisions: An Application to Return-to-Play from Sports-Related Concussion. *Society of Medical Decision Making 42nd Annual Meeting*, Chicago, IL
- 2. **G.-G. P. Garcia**, M. S. Lavieri, C. Andrews, X. Liu, M. P. Van Oyen, M. A. Kass, M. O. Gordon, and J. D. Stein (2019). Using a Machine Learning Technique Called Kalman Filtering to Forecast Conversion from Ocular Hypertension to Primary Open Angle Glaucoma. *The Association for Research in Vision and Ophthalmology*, Vancouver, BC
- 3. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2018). A Novel Data-Driven Framework for Improving Risk-Based Medical Diagnosis with Application to Acute Concussion Assessment. *Society of Medical Decision Making 40th Annual Meeting*, Montreal, QC
- 4. M. S. Lavieri, X. Liu, G.-G. P. Garcia, Z. Zhou, E. Lobaza, J. Wang, K. Sugiyama, K. Nitta, C. Andrews, M. P. Van Oyen, and J. D. Stein (2017). Using Kalman Filtering to Personalize the Monitoring of Persons with Normal Tension Glaucoma. *The Association for Research in Vision and Ophthalmology*, Baltimore, MD
- 5. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2017). A Markov Decision Process to Model Symptom Self-Reporting Behavior in Concussion Management. *The 3rd Multidisciplinary Conference on Reinforcement Learning and Decision Making*, Ann Arbor, MI
- 6. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2016). Quantifying Risk Thresholds for On-field Concussion Diagnosis. *Industrial and Systems Engineering Research Conference*, Anaheim, CA

Conference Presentations

- 1. **G.-G. P. Garcia**, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2020). The Value of Incorporating Symptom-Reporting Behavior in Return-to-play from Concussion. *INFORMS Annual Meeting*, National Harbor, MD
- 2. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2019). Optimizing Treatment Decisions Under Strategically Reported Symptoms. *INFORMS Annual Meeting* (Bonder Scholars Session), Seattle, WA
- 3. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). Datadriven Stochastic Optimization Approaches to Determine Decision Thresholds for Risk Estimation Models. *INFORMS Annual Meeting* (Invited Session), Seattle, WA
- 4. **G.-G. P. Garcia**, J. Yang, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). Doing More with Less: Applying Modern Predictive Modeling Methods to Improve Acute Concussion Assessment. *IN-FORMS Healthcare* (Bonder Scholars Session), Boston, MA
- 5. **G.-G. P. Garcia**, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). Optimizing Treatment Decisions Under Objective Clinical Measures and Strategically Reported Symptoms. *INFORMS Healthcare* (Invited Session), Boston, MA
- 6. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2018). Optimization Approaches for Concussion Management Decisions. *INFORMS Annual Meeting* (Invited Session), Phoenix, AZ
- 7. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2018). Data-driven Optimization Models for Concussion Management Decisions. *INFORMS Annual Meeting* (Bonder Scholars Session), Phoenix, AZ

- 8. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. McCrea, T. W. McAllister, S. P. Broglio, and CARE Consortium Investigators (2017). A Novel Framework to Determine Decision Thresholds for Medical Diagnosis. *IN-FORMS Annual Meeting* (Invited Session), Houston, TX
- 9. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2016). An Optimization Approach to Concussion Management. *INFORMS Annual Meeting* (Invited Session), Nashville, TN

Poster Presentations

- 1. L. L. Czerniak, S. W. Liebel, G.-G. P. Garcia, M. S. Lavieri, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2020). Sensitivity and Specificity of Computer-Based Neurocognitive Assessments in Sport-Related Concussion. *Traumatic Brain Injury Conference*, Washington D.C.
- 2. L. L. Czerniak, S. W. Liebel, G.-G. P. Garcia, M. S. Lavieri, M. A. McCrea, T. W. McAllister, and S. P. Broglio (2020). Characterizing the Accuracy of Computer-Based Neurocognitive Tests in Sport-Related Concussion. *INFORMS Annual Meeting Minority Issues Forum Poster Competition*, National Harbor, MD
- 3. **G.-G. P. Garcia**, J. Yang, M. S. Lavieri, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). Optimization of the SAC, BESS, and SCAT Symptom Checklist for Acute Concussion Assessment. *Traumatic Brain Injury Conference*, Washington D.C.
- 4. **G.-G. P. Garcia**, M. S. Lavieri, C. M. Schumb, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2018). Developing Insights For Hard-to-Diagnose Concussions Using Machine Learning. *INFORMS Annual Meeting Minority Issues Forum Poster Competition*, Phoenix, AZ
- 5. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. McCrea, T. W. McAllister, S. P. Broglio, and CARE Consortium Investigators (2018). A Stochastic Programming Approach to Determine Decision Boundaries for Medical Diagnosis. *YinzOR Conference* **3rd Place**, Carnegie Mellon University, Pittsburgh, PA
- 6. M. S. Lavieri, X. Liu, G.-G. P. Garcia, Z. Zhou, E. Lobaza, J. Wang, K. Sugiyama, K. Nitta, C. Andrews, M. P. Van Oyen, and J. D. Stein (2017). Using Kalman Filtering to Personalize the Monitoring of Persons with Normal Tension Glaucoma. *The Association for Research in Vision and Ophthalmology*, Baltimore, MD
- 7. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. McCrea, T. W. McAllister, S. P. Broglio, and CARE Consortium Investigators (2017). A Stochastic Programming Approach to Determine Decision Boundaries for Medical Diagnosis. *Center for Healthcare Engineering and Patient Safety Symposium*, University of Michigan, Ann Arbor, MI
- 8. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. McCrea, T. W. McAllister, S. P. Broglio, and CARE Consortium Investigators (2017). A Stochastic Programming Approach to Determine Decision Boundaries for Medical Diagnosis. *Engineering Graduate Symposium* **2nd Place**(Session IOF-2), University of Michigan, Ann Arbor, MI
- 9. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, M. McCrea, T. W. McAllister, S. P. Broglio, and CARE Consortium Investigators (2017). A Stochastic Programming Approach to Determine Decision Boundaries for Medical Diagnosis. *INFORMS Annual Meeting Minority Issues Forum Poster Competition* **1st Place**, Houston, TX
- 10. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2016). Optimal Return-to-Play From Concussion. *Center for Healthcare Engineering and Patient Safety Symposium*, University of Michigan, Ann Arbor, MI
- 11. **G.-G. P. Garcia**, M. S. Lavieri, and S. P. Broglio (2016). Optimal Return-to-Play From Concussion. *Engineering Graduate Symposium*, University of Michigan, Ann Arbor, MI

Other Presentations

- 1. **G.-G. P. Garcia** and S. P. Broglio (2020). Optimizing Acute Concussion Assessment. *Concussion Assessment, Research and Education Consortium Investigators Meeting,* Chicago, IL
- 2. **G.-G. P. Garcia**, M. S. Lavieri, R. Jiang, T. W. McAllister, M. A. McCrea, and S. P. Broglio (2019). A Datadriven Approach to Unlikely, Possible, Probable, and Definite Acute Concussion. *Concussion Assessment, Research and Education Consortium Investigators Meeting*, Chicago, IL
- 3. **G.-G. P. Garcia**, S. P. Broglio, and M. S. Lavieri (2017). Quantifying The Added Value of a Multidimensional Model for Assessing Acute Concussion. *Concussion Assessment, Research and Education Consortium Investigators Meeting*, Chicago, IL
- 4. **G.-G. P. Garcia** and B. A. Norman (2011). Maximizing Vaccine Coverage Through Wastage Reduction. *Pitt EXCEL Summer Research Internship,* University of Pittsburgh, Pittsburgh, PA

Awards and Honors

Richard F. and Eleanor A. Towner Prize for Distinguished Academic Achievement Cornell ORIE Young Researchers Workshop - Departmental Nomination Society of Medical Decision Making Lee B. Lusted Prize Quantitative Methods and Theoretical Developments INFORMS Bonder Scholarship for Applied OR in Health Services INFORMS Doctoral Colloquium - Departmental Nomination INFORMS Minority Issues Forum Doctoral Colloquium Student Sponsorship INFORMS Minority Issues Forum Poster Competition - First Place INFORMS Bonder Scholarship for Applied OR in Health Services - Finalist IOE Graduate Student Instructor of the Semester National Science Foundation Graduate Research Fellowship Ford Foundation Fellowship Predoctoral Competition - Honorable Mention IOE Bonder Scholar Fellowship - Honorable Mention	2020 2019 2018 2018 2018 2017 2017 Winter 2017 2017-2020 2016, 2017 2016
Rackham Merit Fellowship	2015-2020
Grants and Funding	
Cornell ORIE Young Researchers Workshop Amount Awarded: \$500	2019
California Alliance Research Exchange Travel Grant Amount Awarded: \$1500	2019
Building Future Faculty, North Carolina State University, Raleigh, NC	2019
Amount Awarded: Cost of travel to workshop Future Faculty Development Program, University of Pittsburgh, Pittsburgh, PA	2018
Amount Awarded: Cost of travel to workshop NextProf Nexus Travel Grant, University of California, Berkeley	2018
Amount Awarded: Cost of travel to workshop	2010
INFORMS Bonder Scholarship and Travel Support Amount Awarded: \$6000	2018
INFORMS Minority Issues Forum Travel Grant Amount Awarded: \$500	2018
National Science Foundation Graduate Research Fellowship	2017-2020
Amount Awarded: \$102,000 INFORMS Minority Issues Forum Travel Grant	2017
Amount Awarded: \$500	2017
Rackham Travel Grant	Fall 2018
Amount Awarded: \$1050	2017
INFORMS Student Leadership Conference Amount Awarded: \$200	2017
Rackham Travel Grant	Fall 2017
Amount Awarded: \$800	
Rackham Travel Grant	Fall 2016
Amount Awarded: \$800 Rackham Travel Grant	Winter 2016
Amount Awarded: \$800	Willter 2010
Undergraduate Awards and Honors	
American Society of Engineering Education - National Intern Student of the Year University of Pittsburgh - Co-op Student of the Year University of Pittsburgh IIE Chapter - Outstanding Senior Award Eaton Multicultural Scholarship UPS Minority Scholarship Allias-Holzman Undergraduate Teaching Fellowship University of Pittsburgh Dean's List University of Pittsburgh's Honor's List Saw Creek Men's Club Scholarship	2014 2014 2014 2014 2013 Spring 2014, Fall 2014 Spring 2011-Fall 2014 Fall 2010 2010

Teaching Experience

University Teaching

I have teaching experience with the following courses at the University level:

- ➤ IOE316: Introduction to Markov Processes, University of Michigan
- ➤ IE1082: Probablistic Methods of Operations Research, University of Pittsburgh
- ➤ IE1055: Facility Layout and Material Handling, University of Pittsburgh
- ➤ IE1070: Probability, Random Variables, and Distributions, University of Pittsburgh
- ➤ IE1052: Manufacturing Processes and Analysis, University of Pittsburgh

Course	Position	Semester	Instructor Rating	College-wide Median	Response
IOE316	Instructor	Winter 2018	4.71	4.48	100/112
IOE316	GSI	Winter 2017	4.76	4.23**	88/93
IOE316	GSI	Fall 2016	4.49	4.50**	97/115
IE1082*	UTA	Summer 2015	NA	NA	NA
IE1055*	UTA	Spring 2015	NA	NA	NA
IE1070	Grader	Fall 2014	NA	NA	NA
IE1052	UTA	Spring 2014	NA	NA	NA

GSI: Graduate Student Instructor, UTA: Undergraduate Teaching Assistant

Other Teaching

In addition to teaching at the University level, I have had the opportunity to teach in other capacities.

Course	Position	Grade Level	Institution	Dates
Math	Course Instructor	7th Grade	FAME Academy, Pittsburgh, PA	Jan 2015 - May 2015
Math	Course Instructor	8th Grade	FAME Academy, Pittsburgh, PA	Jan 2015 - May 2015

Professional Development

Cornell ORIE Young Researchers Workshop, Cornell University, Ithaca, NY	2019
California Alliance Research Exchange	2019
Faculty Host: Anil Aswani, IEOR, University of California Berkeley	
Building Future Faculty, North Carolina State University, Raleigh, NC	2019
INFORMS Doctoral Colloquium, Phoenix, AZ	2018
Future Faculty Development Program, University of Pittsburgh, Pittsburgh, PA	2018
NextProf Nexus, University of California Berkeley, Berkeley, CA	2018
INFORMS Student Leadership Conference, Baltimore, MD	2017

Industry Experience

Eaton Corporation, Horseheads, NY Quality Engineer Intern

5/2014-8/2014

Universal Electronic Corporation, Canonsburg, PA

Manufacturing Engineer Co-op

5/2012-12/2013

Service Activities

Journal Refereeing

- ➤ Journal of Athletic Training
- ➤ BMJ Open Sport & Exercise Medicine
- ➤ BMC Medical Research Methodology
- ➤ The Clinical Neuropsychologist
- ➤ International Journal of Sports Medicine

Service to the Profession

Institute for Operations Research and the Management Sciences (INFORMS)	
Session Chair, HAS Bonder Scholars Session	2020
Session Chair, Personalized and Data-driven Medical Decision-Making, INFORMS Healthcare	2019
Session Chair, Personalized Medical Decision-Making, INFORMS Annual Meeting	2017

^{*}denotes a course taught with a flipped lecture style

^{**}University-wide median reported if college-wide median was unavailable

Inctitute	of Indus	trial and	I Syctome	Engineers	(IISE)
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Session Chair, Diagnosis Modeling, ISERC Annual Conference 2016

Service to the University

President*	2018
Vice President and Treasurer**	2017
Outreach Chair***	2016

Society of Hispanic Professional Engineers, University of Pittsburgh

External Vice President	2013-2014
Scholarship Chair	2012-2013

Pitt EXCEL, BROTHERHOOD, and INVESTING NOW, University of Pittsburgh

Alumni Council	2020-Present
BROTHERHOOD Leader, 1^{st} Foundation Member	2013
Peer Mentor	2011-2012
Freshman Engineering Leadership Team	2011-2013

^{*}Received INFORMS Student Chapter Award at Cum Laude level

Service to the Community

FAME Academy, Pittsburgh, PA

MathCounts Coach 2014-2015

Legacy Stem Project, Pittsburgh, PA

Activity Facilitator 2014-2015

Professional References

Mariel S. Lavieri, PhD

Associate Professor

Department of Industrial and Operations Engineering, University of Michigan

E-mail: lavieri@umich.edu Phone: (734) 647-0872

Brian T. Denton, PhD

Professor and Chair

Department of Industrial and Operations Engineering, University of Michigan

E-mail: btdenton@umich.edu Phone: (734) 763-2060

Ruiwei Jiang, PhD

Assistant Professor

Department of Industrial and Operations Engineering, University of Michigan

E-mail: ruiwei@umich.edu Phone: (734) 764-5723

Steven P. Broglio, PhD

Professor

Michigan Concussion Center and School of Kinesiology, University of Michigan

E-mail: broglio@umich.edu Phone: (734) 936-1925

Joshua D. Stein, MD

Associate Professor

Ophthalmology and Visual Sciences, University of Michigan

E-mail: jdstein@med.umich.edu Phone: (734) 763-9147

Programming Languages

LATEX, MATLAB, Python, R, VBA, C++

^{**}Received INFORMS Student Chapter Award at Magna Cum Laude level

^{***}Received INFORMS Student Chapter Award at Summa Cum Laude level