Guido Camargo España

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Interests

Modeling and analysis of dynamic systems, agent-based modeling, control theory, and optimization applied to epidemiology.

Education

Ph.D. in Electrical Engineering	National University of Colombia	2015
Advisor: Hernando Díaz	*Thesis: Large-scale vector-borne disease agent-based model, with application to Chikungunya in Colombia*	
M.Sc. in Engineering, Industrial Automation	National University of Colombia	2012
	Thesis: Modelamiento de la dinámica del dengue en Colombia	
Bachelor of Electronics Engineering	National University of Colombia	2010

Professional experience

Research Assistant Professor	Department of Biological Sciences, University of Notre Dame	2021-
Postdoctoral Fellow	Perkins Lab, University of Notre Dame	2016-2020
Pre-Doctoral Fellow	Public Health Dynamics Laboratory, University of Pittsburgh	2013-2015
Researcher	Research Group: Modeling and Control of Biological Systems, National University of Colombia	2011-2015
Modeling Engineer	School of Public Health, National University of Colombia	2011-2012

Teaching experience

Teaching Assistant, Automatic Control Theory	National University of Colombia	2013
Instructor, Sensors and Actuators	National University of Colombia	2012

Computer skills

Programming languages: C++, Python, Perl, R, Swift, JavaScript, SQL

Simulation Platforms: Matlab, NetLogo, LabView, FRED

Service

Co-coordinator MIDAS - Latin America (2022-present)

Reviewed **12** manuscripts for the following scientific journals: Plos Computational Biology, Plos Neglected Tropical Diseases, Plos One, BMC, American Journal of Tropical Medicine and Hygiene, Journal of Theoretical Biology, and Epidemics.

Awards and fellowships

Scenario Modeling Consortium Fellowship	Role: Principal Investigator	$150,000	2022
MIDAS High Performance Computing Services	Role: Principal Investigator	$5,000	2022
RAPID grant. Real-time updating of an agent-based model to inform COVID-19 mitigation strategies. Award number: 2027718.	Role: Co-Investigator	$199,883	2020-2021
NIH/NCATS - Indiana CTSI TL1 Postdoctoral Fellowship Award. Project: Simulation modeling to estimate dengue vaccine profile from trial results	Role: PI	$175,158	2018-2020
3rd place TL1 Peer Choice Poster Competition at the ACTS annual meeting. Abstract title: Model-based assessment of public health impact and cost-effectiveness of routine vaccination with Dengvaxia following screening for prior dengue virus exposure		$100	2019
Travel Award: Annual Meeting of the American Society of Tropical Medicine and Hygiene. Abstract title: Simulating chikungunya outbreaks in Colombia using an agent-based model		$540	2016
Laureate distinction awarded to Master's thesis. Title: Modeling dengue dynamics in Colombia		-	2012

Publications

Journal Articles

1. Borchering R., Mullany L., Howerton E., Chinazzi M., ... **España G.**, ... Lessler J. *Impact of SARS-CoV-2 vaccination of children ages 5–11 years on COVID-19 disease burden and resilience to new variants in the United States, November 2021–March 2022: A multi-model study.* The Lancet Regional Health - Americas 100398 (17), 2023.

2. **España G.**, Perkins T.A., Pollet S., Smith M., Moore S.,..., and Scott P. *Prioritizing interventions for preventing COVID-19 outbreaks in military basic training.* PLOS Computational Biology 1-23(18), 2022. 10.1371/journal.pcbi.1010489

3. **España G.**, Cucunubá Z.M., Diaz H., Cavany S.,Castañeda N., Rodríguez L. *Designing school reopening in the COVID-19 pre-vaccination period in Bogotá, Colombia: A modeling study.* PLOS Global Public Health 1-18(2), 2022. doi:10.1371/journal.pgph.0000467

4. Cramer E.Y., Ray E.L, Lopez V.K., ..., **España G.**,...,Reich N.G.*Evaluation of individual and ensemble probabilistic forecasts of COVID-19 mortality in the United States.* Proceedings of the National Academy of Sciences 119(15), 2022. `doi:10.1073/pnas.2113561119`

5. Huber J.H., Koepfli C., **España G.**, Nekkab N., White M.T., Perkins T.A.*How radical is radical cure? Site-specific biases in phase-III clinical trials underestimate the effect of radical cure against Plamodium vivax hypnozoites.* Malaria Journal 20(479), 2021. doi:10.1186/s12936-021-04017-1

6. **España G.**, Cavany S., Oidtman R., Barbera C., Costello A., ..., and Perkins T.A. *Impacts of K-12 school reopening on the COVID-19 epidemic in Indiana, USA.* Epidemics, 100487, 2021. doi:10.1016/j.epidem.2021.100487

7. Perkins T.A. and **España G.**. *Optimal control of the COVID-19 pandemic with non-pharmaceutical interventions.* Bulletin of Mathematical Biology 82(9) 118, 2020. doi:10.1007/s11538-020-00795-y

8. **España G.**, Leidner A.J., Waterman S.H., and Perkins T.A.. *Cost-effectiveness of dengue vaccination in Puerto Rico.* PLOS Neglected Tropical Diseases 15(7) e0009606, 2021. doi:10.1371/journal.pntd.0009606

9. Cavany S.M., **España G.**, Vazquez-Prokopec G.M., Scott T.W., and Perkins T.A.. *Pandemic-associated mobility restrictions could cause increases in dengue virus transmission.* PLOS Neglected Tropical Diseases 15(8) e0009603, 2021. doi:10.1371/journal.pntd.0009603

10. Diaz H., **España G.**, Castañeda N., Rodriguez L., De la Hoz-Restrepo F.. *Dynamical characteristics of COVID-19 epidemic: Estimation from Colombia's case* . International Journal of infectiouss Diseases, 2021. doi:10.1016/j.ijid.2021.01.053

11. Oidtman R., **España G.**, and Perkins T.A. *Co-circulation and misdiagnosis led to underestimation of the 2015-2017 Zika epidemic in the Americas.* PLOS Neglected Tropical Diseases, 15(3):e0009208, 2021. 10.1371/journal.pntd.0009208

12. Cavany, S.M., **España G.**, Lloyd A.L., Waller L.A., Kitron U., Astete H., Elson W.H., Vazquez-Prokopec G.M., Scott T.W., Morrison A.C., Reiner R.C., and Perkins T.A.. *Optimizing the deployment of ultra-low volume and indoor residual spraying for dengue outbreak response.* PLOS Computational Biology, 16(4):e1007743, 2020. doi:10.1371/journal.pcbi.1007743

13. Brito A.F., Machado L.C., Lima Siconelli M.J., Oidtman R.J.,...,**España G.**,...,Grubaugh N.D. *Lying in wait: the resurgence of dengue virus after the Zika epidemic in Brazil.* Nature Communications 12(1):2619, 2021. doi:10.1038/s41467-021-22921-7

14. Oidtman R.J., Omodei E., Kraemer M.U.G., Castañeda-Orjuela C., ...**España G.**,...,Perkins T.A.*Trade-offs between individual and ensemble forecasts of an emerging infectious disease.* Nature Communications (in press), 2021.

15. Siraj A.S., Sorichetta A., **España G.**, Tatem A.J., Perkins T.A.. *Modeling human migration across spatial scales in Colombia.* PLOS One 15(5):e0232702, 2020. doi:10.1371/journal.pone.0232702

16. **España G.**, Yao Y., Anderson K.B., Fitzpatrick M.C., Smith D.L., Morrison A.C., Wilder-Smith A., Scott T.W., and Perkins T.A.. *Model-Based Assessment of Public Health Impact and Cost-Effectiveness of Dengue Vaccination Following Screening for Prior Exposure.* PLOS Neglected Tropical Diseases, 13(1), 2019. doi:10.1371/journal.pntd.0007482

17. Wilder-Smith A., Smith P.G., Luo R., Kelly-Cirino C., Curry D., Larson H., Durbin A., Chu M., Tharmaphornpilas P., Ng L.C., Sartori A.M.C. Sartori, Luna E.J.A., Gubler D.J., **España G.**, Yoon I.k., and Flasche S. *Pre-vaccination screening strategies for the use of the CYD-TDV dengue vaccine: A meeting report.* Vaccine, 37 (5137-5146), 2019. doi:10.1016/j.vaccine.2019.07.016

18. **España G.**, Hogea C., Guignard A., ten Bosch Q.A., Morrison A.C., Smith D., Scott T., Schmidt A., and Perkins T.A. *Biased Efficacy Estimates in Phase-III Dengue Vaccine Trials Due to Heterogeneous Exposure and Differential Detectability of Primary Infections across Trial Arms.* PLOS One, 14(1), 2019. doi:10.1371/journal.pone.0210041

19. Perkins T.A.*, Reiner, R.C.*, **España G.***, ten Bosch Q.A., et al. *An Agent-Based Model of Dengue Virus Transmission Shows How Uncertainty about Breakthrough Infections Influences Vaccination Impact Projections.* PLOS Computational Biology, 15(1), 2019. doi:10.1371/journal.pcbi.1006710

20. **España G.**, Grefenstette J., Perkins A., Torres C., Campo Carey A., Diaz H., de la Hoz F., Burke D., and van Panhuis W. *Exploring Scenarios of Chikungunya Mitigation with a Data-Driven Agent-Based Model of the 2014–2016 Outbreak in Colombia.* Scientific Reports, 8(12201), 2018. doi:10.1038/s41598-018-30647-8

21. Perkins A., Rodriguez-Barraquer I., Manore C., Siraj A., **España G.**, Barker C., Johansson M., and Reiner R. *Heterogeneous local dynamics revealed by classification analysis of spatially disaggregated time series data.* Epidemics, (100357), 2019. doi:10.1016/j.epidem.2019.100357

22. Siraj A., Rodriguez-Barraquer I., Barker C.M., Tejedor-Garavito N., Harding D., Lorton C.,..., **España G.**, et al. *Spatiotemporal Incidence of Zika and Associated Environmental Drivers for the 2015-2016 Epidemic in Colombia.* Scientific Data, 5(180073), 2018. doi:10.1038/sdata.2018.73

23. Moore, S.M., ten Bosch Q.A., Siraj A., Soda K.J., **España, G.**, Campo, A., Gómez S., Salas D., Raybaud B., Wenger E., Welkhoff P., and Perkins T.A. *Local and Regional Dynamics of Chikungunya Virus Transmission in Colombia: The Role of Mismatched Spatial Heterogeneity.* BMC Medicine, 16(152), 2018. doi:10.1186/s12916-018-1127-2

24. Flasche S., Jit M., Rodríguez-Barraquer I., ..., **España G.**, et al. *The Long-Term Safety, Public Health Impact, and Cost-Effectiveness of Routine Vaccination with a Recombinant, Live-Attenuated Dengue Vaccine (Dengvaxia): A Model Comparison Study.* PLOS Medicine, 13(1), 2016. doi:10.1371/journal.pmed.1002181

25. Oidtman, R.J., Christofferson, R.C., ten Bosch Q.A., **España G.**, Kraemer, M., Tatem A., Barker C.M., and Perkins T.A. *Pokémon Go and Exposure to Mosquito-Borne Diseases: How Not to Catch 'Em All.* PLOS Currents, 2016. doi:10.1371/currents.outbreaks.2d885b05c7e06a9f72e4656d56b043cd

26. Castañeda-Orjuela, C., Díaz H., Alvis-Guzman N., Olarte A., Rodriguez H., **Camargo G.**, and De la Hoz-Restrepo F. *Burden of Disease and Economic Impact of Dengue and Severe Dengue in Colombia, 2011.* Value in Health Regional Issues, 1(123), 2012. doi:10.1016/j.vhri.2012.09.014

Preprints

1. **España G.**, Cucunubá Z.M., Cuervo-Rojas J., Diaz H., González-Mayorga M., Ramírez J.D. *The potential impact of delta variant of SARS-CoV-2 in the context of limited vaccination covereage and increasing social mixing in Bogotá, Colombia.* MedRxiv, 2021. doi:10.1101/2021.08.06.21261734

2. Ray E.L., Wattanachit N., Niemi J., Hannan Kanju A., House K.,..., **España G.**, ...,Reich N.G. *Ensemble forecasts of Coronavirus disease 2019 (COVID-19) in the U.S..* MedRxiv, 2020.doi:10.1101/2020.08.19.20177493

3. Paternina-Caicedo A.J., Choisy M., Garcia-Calavaro C., **España G.**, Rojas-Suarez J., Dueñas C.,... *Social interventions can lower COVID-19 deaths in middle-income countries.* MedRxiv, 2020.doi:10.1101/2020.04.16.20063727

4. Soda K.J., Moore S.M., **España G.**, Bloedow J., Raybaud B., Althouse B., Johansson M., Wenger E., Welkhoff P., Perkins T.A., and ten Bosch, Q.A. *DTK-Dengue: A New Agent-Based Model of Dengue Virus Transmission Dynamics.* BioRxiv, 2018. doi:10.1101/376533

Book Chapters

1. Perkins, T.A., **España G.**, Moore S.M., Oidtman R.J., Sharma S., ..., Michael E. *S*even Challenges for Spacial Analyses. Population Biology of Vector-Borne Diseases (Chapter 3, p29) 2020. doi:10.1093/oso/9780198853244.001.0001

Conferences and seminars

Invited talks

1. Agent-based modeling. Invited talk to the 10^{th} Annual Conference for Diversity in Mathematical Modeling and Public Health. Conference organized by MIDAS and the Center for Communicable Disease Dynamics at Harvard T.H. Chan School of Public Health. January, 2022.

2. ¿Es la variante delta de SARS-CoV-2 una nueva amenaza para Bogotá?. Invited talk to "Ateneo Javeriano Departamento de Epidemiología Clínica y Bioestadística". Universidad Javeriana, Bogotá, Colombia. September, 2021.

3. Modelo de agentes para estimar el impacto de COVID-19 en Bogotá, Colombia. Invited talk to seminar of MIDAS LATAM. September, 2021.

4. Modeling the impact of COVID-19 using agent-based models. Invited talk to IMAG/MSM Working Group. University of Florida. September, 2021.

5. Modelos individuales de SARS-CoV-2 en Colombia. Invited talk to the "Curso Internacional en Análisis de Brotes, Modelamiento y Respuesta en Salud Pública". Organized by the Pontificia Universidad Javeriana, Bogotá, Colombia. June, 2021.

6. Agent-based modeling. Invited talk to the 9^{th} Annual Conference for Diversity in Mathematical Modeling and Public Health. Conference organized by MIDAS and the Center for Communicable Disease Dynamics at Harvard T.H. Chan School of Public Health. February, 2021.

7. Estimating the impact of school reopening on the COVID-19 dynamics in Indiana, USA and Bogotá, Colombia. Invited talk to the PDG Seminar Series. University of Cambridge. February, 2021.

8. Estimating the impact of dengue vaccination using agent-based models. Invited talk to the IDI-EEPH seminar, Infectious Diseases Institute, The Ohio State University, Columbus, OH, 2020.

9. Impacts of K-12 school reopening on the COVID-19 epidemic in Indiana, USA. Invited talk to the MIDAS webinar series on the topic of "The impact of school reopening on COVID-19 transmission: modeling studies in Indiana, the San Francisco Bay Area, and King County, WA". September, 2020.

10. Impacts of K-12 school reopening on the COVID-19 epidemic in Indiana, USA. Invited talk to the COVID-19 Consortium Colloquium (CCC) series. University of Texas, Austin, Texas. August, 2020.

11. Agent-based models: a brief introduction. Invited talk to the 8^{th} annual conference for diversity in mathematical modeling and public health. Conference organized by MIDAS and the Center for Communicable Disease Dynamics at Harvard T.H. Chan School of Public Health. Boston, USA. December, 2019.

12. Cost-effectiveness of Dengvaxia® in Puerto Rico. Invited talk to the Advisory Committee on Immunization Practices, Centers for Disease Control and Prevention. September, 2019.

13. Public health impact and cost-effectiveness of routine pre-vaccination strategy with Dengvaxia®. Invited talk for the workshop: "Pre-vaccination screening for the use of dengue vaccines with differential performance dependent on serostatus: rapid diagnostic tests and implementation strategies." Organized by the Partnership for Dengue Control (PDC) workshop as part of the Global dengue and Aedes-transmitted diseases Consortium. Mérieux Foundation, Les Pensières, Annecy, France. January, 2019.

14. Agent-based model to assess public health impact of pre-vaccination screening strategy against dengue with the Dengvaxia vaccine: Annual Meeting of the Society for Mathematical Biology. Montreal, Canada. July, 2019.

15. The evaluation of imperfect vaccines. Invited talk for the postdoc seminar of the Mathematical Biosciences Institute, The Ohio State University, Columbus, OH, 2019.

16. Evaluación del impacto en salud pública de vacunas imperfectas: el caso de la vacuna contra el dengue. Invited talk for the seminar of the research group in epidemiology, National University of Colombia, Bogotá, Colombia, 2019.

17. Vaccine evaluation and mathematical modeling: dengue as a case study. Invited talk for graduate course "Global Health Challenges", University of Notre Dame, Notre Dame, IN, 2018.

18. A national agent-based model of dengue transmission in Colombia. Invited talk at workshop on modeling, Belém, Brazil, 2014.

Contributed Talks

1. Modelo de agentes para informar la respuesta en salud pública durante la pandemia COVID-19 en Bogotá: capacidad hospitalaria, seroprevalencia, y proyecciones futuras. X Jornada distrital de epidemiología y salud pública. Bogotá, Colombia, 2022.

2. Using an agent-based model for dengue virus transmission to estimate the impact of vaccination strategies in different settings: International Conference on Mathematical Multiscale Modeling in Biology, Guanacaste, Costa Rica, October 2019.

3. Model-based assessment of public health impact and cost-effectiveness of routine vaccination with Dengvaxia® following screening for prior dengue virus exposure: ASTMH Annual Meeting, New Orleans, USA, October, 2018.

4. Agent-Based Simulation of Chikungunya in Colombia. XVI Congreso Colombiano de Parasitología y Medicina Tropical, Santa Marta, Colombia, October 2015.

5. Análisis wavelet de la ocurrencia de dengue en dos departamentos de Colombia. 16th Latinamerican Control Conference, Cancún, México, October 2014.

6. Modelo del dengue estratificado por edad e incluyendo dos serotipos del virus para representar la dinámica en Colombia: Encuentro Nacional de Investigación y Desarrollo, ENID, Bogotá, Colombia, 2012.

7. Estimación de Parámetros de un Modelo Matemático del Dengue para Representar la Dinámica del Virus en Colombia: 15th Latinamerican Control Conference, Lima, Perú, October 2012.

Poster Presentations

- Designing school reopening in the COVID-19 pre-vaccination period in Bogotá, Colombia: a mathematical modelling study. EEID Conference. Atlanta, GA. June, 2022.
- The impact of K-12 school reopening on COVID-19 dynamics in Bogotá, Colombia. Annual MIDAS Conference. May, 2021.
- Creating synthetic populations to enable realistic simulations of dengue vaccine trials using an agent-based model. 7$^{\text{th}}$ International Conference on Infectious Disease Dynamics. Charleston, SC, USA, 2019.
- Model-based assessment of public health impact and cost-effectiveness of routine vaccination with Dengvaxia® following screening for prior dengue virus exposure.
  - Annual meeting of Association for Clinical and Translational Science, Washington DC, 2019.
  - Annual meeting of the Indiana Clinical and Translational Sciences Institute, West Lafayette, 2018.
- Phase-III dengue vaccine trial simulations quantify sensitivities of vaccine efficacy estimates to unmeasured heterogeneities.
  - 6th International Conference on Infectious Disease Dynamics, Sitges, Spain, 2017.
  - Annual Meeting of the American Society for Tropical Medicine and Hygiene (ASTMH), Baltimore, 2017.
- Simulating chikungunya outbreaks in Colombia using an agent-based model.
  - Annual Meeting of the American Society for Tropical Medicine and Hygiene (ASTMH), Atlanta, 2016.
  - 14$^{\text{th}}$ Annual Meeting on Ecology and Evolution of Infectious Disease, Ithaca, NY, 2016.
- Risk analysis of chikungunya in Colombia based on historical dengue epidemics. 5$^{\text{th}}$ International Conference on Infectious Disease Dynamics, Clearwater Beach, FL, 2015.
- A national agent-based model of dengue transmission in Colombia. 4$^{\text{th}}$ Pan-American Dengue Research Metting, Belém, Brazil, 2014.
- Mathematical model for the design of a dengue vaccination campaign in Colombia. 4$^{\text{th}}$ International Conference on Infectious Disease Dynamics, Amsterdam, The Netherlands, 2013.