# Baltazar Espinoza

Ph.D.


December 16, 1989,
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## About me

I am a Research Assistant Professor in the Network Systems Science and Advanced Computing division at the University of Virginia.

I received my Ph.D. in Applied Mathematics for Life and Social Sciences from Arizona State University (ASU) in 2018. My Ph.D. dissertation focused on analyzing population mobility as a disease control mechanism in economically heterogeneous and locally connected communities.

Before joining the University of Virginia, I was a Postdoctoral Research Scholar at ASU and a Visiting Research Scholar at Brown University.

I served as co-director of the Mathematical and Theoretical Biology Institute (MTBI) at ASU, after having served as MTBI mentor for five years. He has mentored several undergraduate students from Latin America and the United States of America.

## Interests

Applied mathematics, mathematical ecology and epidemiology, multi-scale systems & computational methods.

## Education

2018 **PhD** Applied Mathematics for the Life and Social Sciences
USA
*Arizona State University*

2016 **MiP** Applied Mathematics for the Life and Social Sciences
USA
*Arizona State University*

2012 **BS** Mathematics
Mexico
University of Colima

## PROFESSIONAL POSITIONS

2022 **Research Assistant Professor, Network Systems Science and Advance Computing, Biocomplexity Insitute & Initative, University of Virginia.**

2020 **Postdoctoral Research Associate, Network Systems Science and Advance Computing, Biocomplexity Insitute & Initative, University of Virginia.**

- *Senior Key Researcher* - An integrated strategy for Biosurveillance and Forecasting Viral Evolution. Biocomplexity Institute, University of Virginia, Virginia Department of Education & Virginia Department of Health.
- Developed a research agenda on coupling epidemiological and human behavioral models to study epidemics as complex adaptive systems.

2020 **Co-director, Mathematical and Theoretical Biology Institute, Arizona State University.**

- Designed and implemented a virtual program to teach selected topics in mathematical biology to international undergraduate students.
- Lectured and mentored international undergraduate students through research.

2019 **Visiting Research Scholar, Division of Applied Mathematics & Data Science Initiative, Brown University.**

- Developed a research agenda on multi-scale analysis of infectious diseases from the perspective of complex adaptive systems.

2018 - 2020 **Postdoctoral Scholar, Simon A. Levin Mathematical, Computational and Modeling Sciences Center, Arizona State University.**

- Leading modeler at the International Workshop on Challenges in Mathematical and Computational Modeling of Epidemiology and Ecological Systems, Leticia, Colombia (2019).
- Assisted in teaching and designing lectures for graduate courses in epidemiology, stochastic dynamic programming and partial differential equations.
- Developed a research agenda to study epidemiology in multi-patch systems using Lagrangian modeling approaches and population structure.
- Designed and led a Wolfram Mathematica coding course to expand the computational and coding skills of SALMCSC graduate students.
- Lectured and mentored international undergraduate students in the Mathematical and Theoretical Biology Institute (MTBI) summer program at Arizona State University through self-generated projects (`https://mtbi.asu.edu/`)

2014 - 2018 **Research Assistant, Simon A. Levin Mathematical, Computational and Modeling Sciences Center, Arizona State University**

- Modeling Ebola, Tuberculosis and Zika disease dynamics as part of my research training. These collaborations resulted in six peer-reviewed publications.
- Lectured stochastic models at the Universidad de los Andes, Colombia.
- Lectured and mentored native American of high school students focused on improving their math skills via solving real-life problems: Salt River Excelling at Math (STREAM) Arizona State University, `https://oan.srpmic-nsn.gov/archives/2015/apr-02-2015/news/news-02.htm`.
- Designed and taught a three days course on data science at the Universidad Francisco Gavidia in El Salvador.
- Presented my research at international conferences in the USA, Canada, Mexico, El Salvador, Ecuador and Colombia.
- Lectured and mentored international undergrad students in the MTBI through self-generated projects.

## HONORS AND AWARDS

- *Invited young researcher, $9^{th}$ Heidelberg Laureate Forum, the Carl-Zeiss-Stiftun*
  Heidelberg, Germany, 2022.
- *UVA Provost's Office Award for Collaborative Excellence in Public Service.*
  NSSAC division, Biocomplexity Institute, University of Virginia, 2022.
- *Academic activities and scientific development*
  For young people less than 30 years old. Colima State Government, Mexico, 2018
- *Distinguished mentor.*
  The Mathematical and Theoretical Biology Institute. Arizona State University, USA, 2017.
- *Academic activities and scientific development*
  For young people less than 19 years old. Colima State Government, Mexico, 2007.

## Publications

### Books

- *Modelos para La Propagación De Enfermedades Infecciosas*
  Universidad Autónoma de Occidente
  Authors: Fred Brauer, Carlos Castillo-Chavez, Elmer De La Pava-Salgado, Kamal Barley, Carlos W. Castillo-Garsow, Diego Chowell, **Baltazar Espinoza**, Paula Gonzalez Parra, Carlos Hernandez Suarez and Victor M. Moreno. Universidad Autonoma de Occidente, ISBN 978-958-8713-65-6.

### Book chapters

- *Assessing the Efficiency of Movement Restriction as a Control Strategy of Ebola*
  Authors: **Baltazar Espinoza**, Victor Moreno, Derdei Bichara, Carlos Castillo-Chavez. Springer International Publishing, Chapter: "Mathematical and Statistical Modeling for Emerging and Reemerging Infectious Diseases", pp 123-145, ISBN 978-3-319-40413-4.

### Journal articles

1. *Coupled models of genomic surveillance and evolving pandemics with applications for timely public health responses*
   Authors: **Baltazar Espinoza**, Aniruddha Adiga, Srinivasan Venkatramanan, Andrew Scott Warren, Jiangzhuo Chen, Bryan L. Lewis, Anil Vullikanti, Samarth Swarup, Sifat Moon, Christopher L. Barrett, Siva Athreya, Rajesh Sundaresan, Vijay Chandru, Ramanan Laxminarayan, Benjamin Schaffer, H. Vincent Poor, Simon Levin, Madhav Marathe.
   Proceedings of the National Academy of Sciences: In review.

2. *Airborne disease transmission during indoor gatherings over multiple time scales: Models and policy implications*
   Authors: Avinash Dixit, **Baltazar Espinoza**, Zirou Qiu, Anil Vullikanti, Madhav Marathe.
   Proceedings of the National Academy of Sciences: `https://doi.org/10.1073/pnas.2216948120`.

3. *Consequences of Traceable Mobility in Populations Exhibiting Strong Allee Effect*
   Authors: **Baltazar Espinoza**, Yun kang, Oyita Udiani.
   Epi-SCIENCE: accepted.

4. *Understanding the co-evolution of mask-wearing and epidemics : a network perspective*
   Authors: Zirou Qiu, **Baltazar Espinoza**, Vitor V. Vasconcelos, Chen Chen, Sara M. Constantino, Stefani A. Crabtree, Luojun Yang, Anil Vullikanti, Jiangzhuo Chen, Jörgen Weibull, Kaushik Basu, Avinash Dixit, Simon Levin, Madhav Marathe.
   Proceedings of the National Academy of Sciences: `https://www.pnas.org/doi/10.1073/pnas.2123355119`.

5. *Heterogeneous Adaptive Behavioral Responses May Increase Epidemic Burden*
   Authors: **Baltazar Espinoza**, Samarth Swarup, Christopher L. Barrett, Madhav Marathe.
   Scientific Reports - Nature: `https://doi.org/10.1038/s41598-022-15444-8`.

6. *Asymptomatic individuals can increase the final epidemic size under adaptive human behavior*
   Authors: **Baltazar Espinoza**, Madhav Marathe, Samarth Swarup, Mugdha Thakur.
   Scientific Reports - Nature: `https://doi.org/10.1038/s41598-021-98999-2`.

7. *Transmission dynamics and forecasts of the COVID-19 pandemic in Mexico, March-December 2020*
   Authors: Amna Tariq, Juan M Banda, Pavel Skums, Sushma Dahal, Carlos Castillo-Garsow, **Baltazar Espinoza**, Noel G Brizuela, Roberto A Saenz, Alexander Kirpich, Ruiyan Luo, Anuj Srivastava, Humberto Gutierrez, Nestor Garcia Chan, Ana I Bento, Maria-Eugenia Jimenez-Corona, Gerardo Chowell.
   PLOS ONE: `https://doi.org/10.1371/journal.pone.0254826`.

8. *The Impact of Temperature-Dependent Sex Determination on the Population Dynamics of Green Sea Turtles (Chelonia mydas)*
   Authors: Candy Herrera[1], Evelyn Guerra[1], Victoria Penalver[1], Andrea Rosad[1], Yingying Wei[1], Jack Pringle, **Baltazar Espinoza**, Baojun Song. [1]Undergraduate students.
   Bionatura Latin American Journal of Biotechnology and Life Sciences: dx.doi.org/10.21931/RB/2020.05.01.4

9. *Epidemics on Networks: Reducing Disease Transmission Using Health Emergency Declarations and Peer Communication*
   Authors: Asma Azizi, Cesar Montalvo, **Baltazar Espinoza**, Yun Kang, Carlos Castillo-Chavez.
   Infectious Disease Modelling: www.sciencedirect.com/science/article/pii/S2468042719300405

10. *The role of mobility and health disparities on the transmission dynamics of Tuberculosis*
    Authors: Victor Moreno, **Baltazar Espinoza**, Kamal Barley, Marlio Paredes, Derdei Bichara, Anuj Mubayi, and Carlos Castillo-Chavez.
    Theoretical Biology and Medical Modeling: www.ncbi.nlm.nih.gov/pmc/articles/PMC5273827/

11. *Role of short-term dispersal on the dynamics of Zika virus in an extreme idealized environment*
    Authors: Victor M.Moreno, **Baltazar Espinoza**, Derdei Bichara, Susan A.Holechek, Carlos Castillo-Chavez.
    Infectious Disease Modeling: www.sciencedirect.com/science/article/pii/S2468042716300410

12. *Modeling Ebola at the Mathematical and Theoretical Biology Institute (MTBI)*
    Authors: Carlos Castillo-Chavez, Kamal Barley, Derdei Bichara, Diego Chowell, Edgar Diaz Herrera, **Baltazar Espinoza**, Victor Moreno, Sherry Towers, Kamuela Yong.
    Notices of the American Mathematical Society (AMS): doi.org/10.1090/noti1364

13. *Restrictions of harmonic functions and Dirichlet eigenfunctions of the Hata set to the interval*
    Authors: **Baltazar Espinoza** and Ricardo A. Sáenz.
    Analysis International mathematical journal of analysis and its applications: www.degruyter.com/view/journals/anly/36/3/article-p135.xml

14. *Mass Media and the Contagion of Fear: The Case of Ebola in America*
    Authors: Sherry Towers, Shehzad Afzal, Gilbert Bernal, Nadya Bliss, Shala Brown, **Baltazar Espinoza**, Jasmine Jackson, Julia Judson-Garcia, Maryam Khan, Michael Lin, Robert Mamada, Victor M. Moreno, Fereshteh Nazari, Kamaldeen Okuneye, Mary L. Ross, Claudia Rodriguez, Jan Medlock, David Ebert, Carlos Castillo-Chavez.
    PLOS ONE: journals.plos.org/plosone/article?id=10.1371/journal.pone.0129179

15. *Population Mobility and Adaptive Human Behaviour as Disease Control Mechanisms*
    Authors: **Baltazar Espinoza**.
    Psychology Journal Research Open: https://researchopenworld.com/population-mobility-and-adaptive-human-behaviour-as-disease-control-mechanisms/#.

## Research with undergraduate students

- *Topography and Behavior Based Movement Modeling for Missing Hikers in a Land-Wilderness Context*
  Full-text

- *Economics of Prison: Modeling the Dynamics of Recidivism*
  Full-text

- *Comparison of screening for methicillin-resistant Staphylococcus aureus (MRSA) at hospital admission and discharge*
  Full-text

- *A Cost-Effective Analysis of Treatment Strategies for the Control of HSV-2 Infection in the US*
  Full-text

- *Cheating the Cheaters: Spatial Dynamics in the Evolutionary Stability of Antibiotic Resistance*
  Full-text

- *The Impact of Preferred Mixing on the Sexual Transmission of ZIKV at the 2016 Summer Olympics*
  Full-text

- *Mathematical Model for Time to Neuronal Apoptosis Due to Accrual of DNA DSBs*
  Full-text

## Selected talks

- *Modeling social complexity in epidemiology: risk perception and human behavior*
  University of Maryland, Washington, USA, 2023.

- *An integrated strategy for Biosurveillance and Forecasting Viral Evolution.*
  Virginia Department of Health, Virginia, USA, 2022.

- *Modelos matemáticos en epidemiología*
  Instituto Heisenberg, Universidad de Colima, Colima, México, 2022.

- *Modeling social complexity in epidemiology: population mobility and adaptive human behavior.*
  Excite the Dream program, Old Dominion University, Virginia, USA, 2021.

- *Ebola Virus Disease dynamics on distinct risk environments.*
  Canadian Mathematical Society Winter Meeting, Vancouver, Canada, 2018.

- *Multi-patch assessment of short-term dispersal of Zika virus disease*
  International and Interdisciplinary Workshop on Mathematical Modeling of Environment and Evolution of Social and Life Processes, Universidad Nacional de Colombia, Manizales, Colombia, 2018.

- *Assessing the efficiency of cordon sanitaire as a strategy for Ebola control*
  Primer Congreso Internacional de Modelaje Matemático con Enfasis en Salud, Seguridad y Educación, Universidad Francisco Gavidia & Arizona State University, San Salvador, El Salvador, 2017.

## Journal Referee Service

- Scientific Reports - Nature
- Plos ONE
- Indian Institute of Science
- Journal of Theoretical Biology
- Journal of Biological Dynamics
- Mathematical Biosciences

## References available to contact

- **Dr. Madhav Marathe** - email: marathe@virginia.edu,
  Dr. Marathe, was my postdoctoral advisor. He is a Distinguished Professor in Biocomplexity, Director of the Network Systems Science and Advanced Computing (NSSAC) Division, Biocomplexity Institute and Initiative at the University of Virginia.

- **Dr. Carlos Castillo-Chavez** - email: ccchavez@asu.edu,
  Dr. Castillo-Chavez (retired professor), was one of my doctoral and postdoctoral advisers. Former director of the Mathematical and Theoretical Biology Institute (MTBI) and former director of the Simon A. Levin Mathematical and Computational Modeling Sciences Center.

- **Dr. Samarth Swarup** - email: ss7rs@virginia.edu,
  Dr. Swarup, is a research associate professor in the Network Systems Science and Advanced Computing division and a research collaborator.

- **Dr. Charles Perrings** - email: charles.perrings@asu.edu,
  Dr. Perrings is co-director of the School of Life Sciences Ecoservices Group and a research collaborator.

- **Dr. Chirstopher Kribs** - email: kribs@uta.edu,
  Dr. Kribs is a professor at the University of Texas at Arlington and a teaching collaborator.

- **Dr. Jose D. Flores** - email: Jose.Flores@usd.edu,
  Dr. Flores is chair of the Department of Computer Science at University of South Dakota and, a research and teaching collaborator.