

# Alexander Gutfraind, Ph.D.

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Senior Data Scientist, Researcher and Speaker

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## **Publications**      **Refereed Journal Papers in Mathematics, OR and their applications**

- [1] D. Echevarria\*, A. Gutfraind\*, B. Boodram, J. Layden, J. Ozik, K. Page, S. J. Cotler, M. Major, and H. Dahari, “Modeling indicates efficient vaccine-based interventions for the elimination of hepatitis c virus among persons who inject drugs,” *Vaccine*, vol. 37, pp. 2608–2616, May 2019.
- [2] V. Bier and A. Gutfraind, “Risk analysis beyond vulnerability and resilience - characterizing the defensibility of critical systems,” *European Journal of Operational Research*, vol. to appear, 2019.
- [3] M. Major, A. Gutfraind\*, Q. Cui\*, L. Shekhtman, A. Kachko, S. J. Cotler, B. Hajarizadeh, R. Sacks-Davis, K. Page, B. Boodram, and H. Dahari, “Model-based analysis of patient immunity profiles indicates that vaccination could reduce hepatitis c transmission via syringe sharing,” *Science Translational Medicine*, vol. 10, Jul 2018.
- [4] A. Gutfraind, J. K. Peterson, E. B. Rose, C. Arevalo-Nieto, J. Sheen, G. F. Condori-Luna, N. Tankasala, R. Castillo-Neyra, C. Condori, P. Anand, C. Naquira-Velarde, and M. Z. Levy, “Integrating evidence, models and maps to enhance Chagas disease vector surveillance,” *PLOS Neglected Tropical Diseases*, 2018.
- [5] B. Boodram, A. L. Hotton, L. Shekhtman, A. Gutfraind, and H. Dahari, “High-risk geographic mobility patterns among young urban and suburban persons who inject drugs and their injection network members,” *Journal of Urban Health*, vol. to appear, 2017.
- [6] A. Gutfraind and M. Genkin, “A Graph Database Framework for Covert Network Analysis: An Application to the Islamic State Network in Europe,” *Social Networks*, vol. 51, pp. 178–188, October 2017.

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- [7] C. L. Staudt, M. Hamann, I. Safro, A. Gutfraind, and H. Meyerhenke, “Generating realistic scaled complex networks,” *Applied Network Science*, 2017. to appear.
- [8] R. Fu, A. Gutfraind, and M. L. Brandeau, “Modeling a dynamic bi-layer contact network of injection drug users and the spread of blood-borne infections,” *Mathematical Biosciences*, vol. 273, pp. 102–113, Mar 2016.
- [9] A. A. Ganin, E. Massaro, A. Gutfraind, N. Steen, J. M. Keisler, A. Kott, R. Mangoubi, and I. Linkov, “Operational resilience: concepts, design and analysis,” *Scientific Reports*, vol. 5, Dec 2015.
- [10] A. Gutfraind\*, B. Boodram\*, N. Prachand, A. Hailegiorgis, H. Dahari, and M. Major, “Agent-based model forecasts aging of the population of people who inject drugs in metropolitan Chicago and changing prevalence of Hepatitis C infections,” *PLoS ONE*, Sept 2015.
- [11] D. Echevarria, A. Gutfraind, B. Boodram, M. Major, S. D. Valle, S. J. Cotler, and H. Dahari, “Mathematical modeling of Hepatitis C prevalence reduction with antiviral treatment scale-up in persons who inject drugs in metropolitan Chicago,” *PLoS ONE*, Aug 2015.
- [12] A. Gutfraind, J. Kuhn, A. Lelkes, and L. Reyzin, “Network installation under convex costs,” *Journal of Complex Networks*, vol. 4, July 2015. doi:10.1093/comnet/cnv020.
- [13] A. Gutfraind and L. A. Meyers, “Evaluating large-scale blood transfusion therapy for the current Ebola epidemic in Liberia,” *Journal of Infectious Diseases*, vol. 211, pp. 1262–1267, February 2015.
- [14] A. Gutfraind, A. Galvani, and L. A. Meyers, “Efficacy and optimization of palivizumab injection regimens against RSV,” *JAMA Pediatrics*, vol. 169, pp. 341–348, April 2015.
- [15] B. Singh, H.-C. Huang, D. P. Morton, G. P. Johnson, A. Gutfraind, A. P. Galvani, B. Clements, and L. A. Meyers, “Optimizing Distributions of Pandemic Influenza Antivirals,” *Emerging Infectious Diseases*, vol. 21, Feb 2015.
- [16] A. Gutfraind, M. Bradonjic, and T. Novikoff, “Modeling the Neighbor Aid Phenomenon for Installing Costly Complex Networks,” *Journal of Complex Networks*, Aug 2014. 10.1093/comnet/cnu033.
- [17] M. P. Johnson, A. Gutfraind, and K. Ahmadizadeh, “Evader interdiction: Algorithms, complexity and collateral damage,” *Annals of Operations Research*, vol. 222, pp. 341–359, Nov 2014.

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- [18] A. Gutfraind, “New Models of Interdiction in Networked Systems,” *Phalanx - Journal of the Military Operations Research Society*, vol. 44, pp. 25–27, June 2011.
- [19] M. P. Atkinson, A. Gutfraind, and M. Kress, “When do armed revolts succeed: lessons from Lanchester theory,” *Journal of the Operational Research Society*, vol. 63, no. 10, pp. 1363–1373, 2012.
- [20] A. Gutfraind, “Optimizing topological cascade resilience based on the structure of terrorist networks,” *PLoS ONE*, vol. 5, p. e13448, 11 2010.
- [21] A. Gutfraind, “Understanding terrorist organizations with a dynamic model,” *Studies in Conflict and Terrorism*, vol. 32, pp. 45–59, Jan 2009.
- [22] A. Gutfraind and A. Kempf, “Error-reducing structure of the genetic code indicates code origin in non-thermophile organisms,” *Orig Life Evol Bios*, vol. 38, no. 1, pp. 75–85, 2008.

### Invited and Conference Papers

#### Submitted

- [1] “Symptom-Based Isolation Policies: Evidence from a Mathematical Model of Outbreaks of Influenza and COVID-19,” *medRxiv*, Mar 2020.

#### Technical Reports

beginthebibliography1Total: 10 (through 2014)  
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#### Talks and Posters

- [1] “What models can and cannot say about infectious diseases,” June 2020. Invited briefing to the Indiana National Guard Reserve.
- [2] “Cloud-based spatial data analytics with R/Shiny,” May 2017. Invited plenary at the Data Science Association conference, University of Chicago, Chicago, Illinois.
- [3] M. Major, A. Gutfraind, Q. Cui, L. Shekhtman, A. Kachko, S. J. Cotler, B. Hajarizadeh, R. Sacks-Davis, K. Page, B. Boodram, and H. Dahari, “Modeling reveals the role of hepatitis c titer in transmission risk through syringe sharing: implications for viral elimination via vaccination (oral talk),” April 2017. 20th Annual Conference on Vaccine Research, Bethesda, MD.
- [4] “NoSQL databases and covert social networks,” March 2017. Talk at the ASA Chicago Chapter conference on Recent Advances in Machine Learning.

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- [5] S. K. Nutman, A. Gutfraind, E. Billig, R. Castillo-Neyra, M. Z. Levy, and the Zoonotic Disease Research Group in Arequipa Peru, “A bandit algorithm to optimize epidemiological surveillance,” 2016. Poster at the Annual meetings of the American Society of Tropical Medicine and Hygiene.
- [6] “Nowhere to hide - Analytics in Graphical Databases with Application to Covert Network Forensics,” Aril 2017. Talk at the INFORMS Business Analytics conference, Orlando, FL.
- [7] “Forecasting surges in the hospital emergency department,” 2015. Poster - INFORMS Annual meeting, Philadelphia, PA.
- [8] “An OR Emergency: The 2014 Ebola outbreak and transfusion therapy,” May 2015. Colloquium at U of Wisconsin - Madison.
- [9] A. Gutfraind, M. M. Carvalho-Cunha, B. Boodram, H. Dahari, and M. Major, “Comprehensive mapping of injecting drug users and their networks in the Chicago metropolitan area,” 2014. Refereed poster at the Health Systems Optimization Workshop, Chicago, IL.
- [10] D. Echevarria, A. Gutfraind, B. Boodram, M. Major, S. J. Cotler, and H. Dahari, “Modeling treatment scale up effect on Hepatitis C prevalence among persons who inject drugs in metropolitan Chicago,” 2014. Refereed abstract at the 65th Annual meeting of the American Association for the Study of Liver Diseases. Boston MS, USA: Nov 7 11, 2014; *Hepatology* 2014; 60:4(Suppl): 671A-672A.
- [11] “Epidemics of Hepatitis C among drug injectors - the role of network dynamics,” Nov 2014. Invited talk at the INFORMS Annual Meeting, San Francisco, CA.
- [12] “Multigrid approach for modeling networks,” May 2014. Contributed talk to Graph Theory Workshop in honor for Derek Corneil, The Fields Institute, Toronto, ON.
- [13] “Multiscale network generation and modeling,” Nov 2013. Invited talk at Northwestern University, Evanston, IL.
- [14] “Optimizing control of infectious diseases,” Nov 2013. Invited talk at Clemson University, Clemson, SC.
- [15] H. Dahari, S. D. Valle, S. Feinstone, A. Gutfraind, M. Major, S. M. Mniszewski, R. Novak, L. J. Ouellet, A. S. Perelson, and N. Prachand, “Integrating rich survey datasets in computational simulations of hepatitis C virus infection among injecting drug users in Chicago area,” Oct 2013. Poster at the 10th International Conference on Health Policy Statistics (ICHPS), Chicago, IL.

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- [16] “Inferring the transmission tree during an outbreak investigation,” Oct 2013. Invited talk at the INFORMS Annual Meeting, Minneapolis, MN.
- [17] “Optimizing schedules for prophylaxis with antibodies,” Oct 2013. Invited talk at the INFORMS Annual Meeting, Minneapolis, MN.
- [18] “Generation of realistic networks by multi-scale perturbations,” Oct 2013. Talk at the INFORMS Annual Meeting, Minneapolis, MN.
- [19] “Winning Networks with MUSKETEER,” Jul 2013. Full-meeting talk at the SIAM Workshop on Network Science, San Diego, CA.
- [20] “Administering Antibodies for Seasonal Infections: a Dynamic Programming Approach,” June 2013. Contributed talk at the INFORMS Healthcare Conference, Chicago, IL.
- [21] A. Gutfraind, K. Patel, R. C. Christofferson, D. Wesson, A. Galvani, C. N. Mores, and L. A. Meyers, “Temporal correlations in mosquito vectors for West Nile Virus in St. Tammany Parish, LA,” May 2013. Poster at the NIH MIDAS research network meeting, Austin, TX.
- [22] “Mapping and Modeling Hidden Risk Networks,” Apr 2013. Colloquium to the Division of Epidemiology and Public Health, University of Illinois at Chicago.
- [23] “MUSKETEER: Multiscale Generator of Network Data,” May 2013. Poster at the 11th Annual Ecology and Evolution of Infectious Disease Conference, College Station, Pennsylvania.
- [24] “A proposal for simulating social networks,” Feb 2013. Seminar at the Department of Computational Social Science, George Mason University, Fairfax, VA.
- [25] “A multiscale method for graph generation,” Feb 2013. Invited colloquium at the Dept. of Applied Mathematics, Illinois Institute of Technology, Chicago, IL.
- [26] “Generating Realistic Infrastructure Networks With MUSKETEER,” Jan 2013. Presentation at the INFORMS Computer Society Biannual conference, Santa Fe, NM.
- [27] “Empirically-based Network Epidemiology with MUSKETEER,” Oct 2012. Invited presentation to the Department of Health Studies, University of Chicago, Chicago, Illinois.
- [28] “Mathematical optimization of antibody injections improves protection against seasonal RSV infections,” Sept 2012. Presentation to the Division of Viral Products, Food and Drug Administration, Bethesda, Maryland.

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- [29] “Mathematical optimization of antibody injections improves protection against seasonal RSV infections,” June 2012. Full-meeting talk at the NIH MIDAS research network meeting, Atlanta, Georgia.
- [30] “Matching antibodies with seasonal RSV infections,” May 2012. Poster at the 10th Annual Ecology and Evolution of Infectious Disease Conference, Ann Arbor, Michigan.
- [31] “Multiscale Network Generation,” Sept 2011. Invited talk at Argonne National Laboratory, Chicago, Illinois.
- [32] “Solving Global and Tactical Security Problems on Networks,” Sept 2011. Invited talk at Arizona State University, Tempe, Arizona.
- [33] “Crime and Terror: Mathematical Exploration and Modeling of Dark Networks,” November 2011. Invited colloquium at Applied Mathematics and the Waterloo Institute for Complexity and Innovation, Waterloo, Canada.
- [34] “Minimizing collateral damage in network interdiction,” Nov 2011. Invited talk at the INFORMS annual meeting, Charlotte, NC.
- [35] “The neighbor aided network installation problem: Optimizing network deployment and recovery,” Nov 2011. Invited talk at the INFORMS annual meeting, Charlotte, NC.
- [36] “Network Science in National Security,” Sept 2011. Invited talk at the Sandia National Laboratories, Livermore, California.
- [37] “Scheduling the reconstruction of massively-damaged networks,” August 2011. Contributed talk at Modeling and Optimization: Theory and Applications (MOPTA), Lehigh University.
- [38] “Can we predict the winners of wars?,” July 2011. Invited talk at the Santa Fe Institute, Santa Fe, NM.
- [39] “Assessing home-grown terrorism using ABM and SNA,” July 2011. Invited talk at Homeland Security Analysis Institute, Washington, DC.
- [40] “Network interdiction methods for cybersecurity,” July 2011. Seminar at the Institute for Systems Research (ISR), University of Maryland.
- [41] “Propagation of epidemics on dynamically-adapting networks,” May 2011. Contributed talk at SIAM Snowbird Conference on Applications of Dynamical Systems.

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- [42] “Transnational security cooperation,” Jan 2011. Invited talk, Workshop on Mathematics for Counter Terrorism, University of Reading, UK.
- [43] “Markovian Network Interdiction,” Nov 2010. Invited talk at the University of California, Berkeley.
- [44] “Global Network Interdiction and the Four Color Theorem,” Oct 2010. Invited talk at the University of Waterloo, Ontario, Canada.
- [45] “Who Is Next? Transnational Terrorism and Network Interdiction,” Nov 2010. Contributed talk at the INFORMS annual meeting, Austin, TX.
- [46] “The structure of cascade-resilient networks,” Nov 2010. Invited talk at the INFORMS annual meeting, Austin, TX.
- [47] “Tradeoffs in the structure of terrorist networks,” Nov 2010. Invited talk at the INFORMS annual meeting, Austin, TX.
- [48] “Dark networks and vital infrastructure,” Aug 2010. Introductory talk at the Opening Workshop of SAMSI Program on Complex networks, Research Triangle Park, NC.
- [49] “Markovian network interdiction and the four color theorem,” June 2010. Contributed talk at SIAM Conference on Discrete Mathematics, Austin, TX.
- [50] “Monotonicity of SIR Epidemics on Graphs,” June 2010. Contributed talk at SIAM Conference on Discrete Mathematics, Austin, TX.
- [51] “What can we learn from terrorists about network optimization?,” May 2010. Contributed talk at NetSci 2010 conference.
- [52] “What can we learn from terrorists about protecting complex networks?,” April 2010. Presented at the National Center for Risk and Economic Analysis of Terrorism Events (CREATE) and at the Naval Postgraduate School (NPS).
- [53] “Network interdiction: New models and algorithms,” December 2009. Invited talk at the University of Tilburg, Netherlands.
- [54] “Models of network interdiction,” December 2009. Invited talk at the Netherlands Defense Academy.
- [55] “Network Interdiction with a Markovian Adversary,” Oct. 2009. Contributed talk at INFORMS Annual Meeting, San Diego, CA.
- [56] “Mathematical terrorism,” September 2009. Invited talk at Lawrence Berkeley National Laboratory.

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- [57] “Constructing networks for cascade resilience,” July 2009. Poster - SIAM Annual meeting, Denver, CO.
- [58] “Constructing networks for cascade resilience,” June 2009. Talk at the International Workshop on Coping with Crises in Complex Socio-Economic Systems, Zurich.
- [59] “Understanding Terrorist Organizations with a Dynamic Model,” May 2009. Mini-symposium and introductory talk at SIAM Snowbird Conference on Applications of Dynamical Systems.
- [60] “Resilient complex networks,” April 2009. Talk at the Risk 2009 conference, Santa Fe, NM.
- [61] “Understanding Terrorist Organizations with a Dynamic Model,” Mar 2009. Invited talk at the 5th Conference on Mathematical Methods in Counterterrorism.
- [62] “Network interdiction of Markovian evaders,” 2008. Poster - DIMACS Workshop on Port Security, Piscataway, NJ.
- [63] “Interdicting nuclear smuggling with imperfect information,” Oct. 2008. Contributed talk at INFORMS Annual Meeting, Washington, DC.
- [64] “Optimal interdiction of constrained Markovian evaders,” 2008. Poster - SIAM Annual meeting, San Diego, CA.
- [65] M. Genkin and A. Gutfraind, “How Do Terrorist Cells Self-Assemble? Insights from an Agent-Based Model,” Dec. 2007. Invited talk at the Society for Risk Analysis Annual Conference.
- [66] “A mathematical model of terrorist organizations,” 2007. Invited Poster - DHS University Network Summit.
- [67] A. Gutfraind and A. Kempf, “Reverse-engineering the genetic code using information theory.” Poster and Workshop Presentation - Astrobiology and Origins of Life Conference, 2005.

Compiled June 21, 2020