

## **Sherry Towers, PhD MS**

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### **Research Interests**

My unique skill set in applied statistics, data science, modelling and visual analytics enables me to examine a wide range of interdisciplinary research questions in the social sciences and public health that are often of broad interest and importance to academia, policy makers and the general public. My research interests include statistical and dynamical modelling of social behaviors, including those related to crime, panic, and hate, with a focus on understanding the dynamics that underlie these societal problems. I have over 360 publications, many of which involve the use and/or development of advanced statistical methods, including machine learning methods.

### **Education**

- 2010 Purdue University, West Lafayette, IN  
MS, Applied Statistics
- 1999 Carleton University, Ottawa, Canada  
PhD, Physics
- 1991 Simon Fraser University, Burnaby, Canada  
BSc, Physics (Honours)

### **Citizenship**

Dual American and Canadian

### **Awards**

- 1999 Carleton University Senate medal  
“for outstanding achievement at the doctoral level”
- 1993-1997 Graduate research fellowship,  
Canadian Natural Sciences and Engineering Research Council (NSERC).
- 1991 Simon Fraser Putnam Award, for scoring in the top 100 on the Putnam  
international mathematics examination
- 1989-1991 Three consecutive undergraduate summer research fellowships  
Canadian Natural Sciences and Engineering Research Council (NSERC).
- 1987-1991 M. Lawson Scholarship for women in mathematics.

## Employment

- 2019- **Senior Fellow, Institute for Advanced Sustainability Studies, Potsdam Germany**  
*Duties: Modelling of the dynamics of spread of sentiment in social systems, including the recent rise of the ultra-nationalism in many developed countries, and the risks this poses to global efforts towards sustainability and control of climate change. Assessment of the time scales of change in social systems in adjustment to new laws or regulations. Development and teaching of seminar courses for researchers and students at the institute on dynamical modelling (including agent based modelling), fitting of dynamical model parameters to data, data visualization, and statistical methods.*
- 2012-2019 **Faculty research associate, Simon A. Levin Mathematical, Computational and Modeling Sciences Center, Arizona State University**  
*Duties: Modelling the dynamics of social systems, including the spread of panic and quantifying the copycat effect in high-profile firearm violence. Development of predictive crime analytics, and statistical studies of determinants of temporal and geospatial patterns in crime, and attitudes towards gun control. Modelling of the spread of disease (including pandemic influenza, Ebola, Zika and Dengue). Development and teaching of courses in advanced statistical methods, data visualization, and dynamical modelling (including agent based modelling) to graduate students in the ASU Applied Mathematics for Students in the Life and Social Sciences program.*
- 2007- **Owner, Towers Consulting, LLC**  
*Duties: Providing statistical consulting services to academia, and the public and private sectors*
- 2010-2012 **Postdoctoral research associate, Purdue university**  
*Duties: Modelling the spread of pandemic influenza*
- 2010 **Visiting scholar, Mathematics department, Purdue University**  
*Duties: Modelling the spread of pandemic influenza*
- 2000-2005 **Research scientist, State University of New York at Stony Brook, based at the Fermi National Accelerator Laboratory**  
*Duties: Discovery analysis of the Bc meson. Development of advanced machine learning methods.*

## Publications

I have over 360 publications on a wide variety of quantitative interdisciplinary topics, over 20,000 citations (over 4,000 since 2014), and an h-index of 75 (see [https://scholar.google.com/citations?hl=en&user=US-tPmcAAAAJ&view\\_op=list\\_works&sortby=pubdate](https://scholar.google.com/citations?hl=en&user=US-tPmcAAAAJ&view_op=list_works&sortby=pubdate)).

Below I list several of my recent publications produced during the past five years with relevance to quantitative methods in the social sciences. I was the lead investigator on publications where I appear as first author.

### **Representative list of recent publications:**

Towers S and Castillo-Chavez C. *Pre- and Post-Newtown: increasing divergence in socioeconomic demographics and political leanings of pro- and anti-gun control advocates* (in preparation).

Chabay I, Okada N, Towers S. *Growing “device-iveness” in society: the need to explore and understand systemic risk factors posed by the rise of the digital age* (in preparation).

Towers S, Wallace D, Hemenway D. *Temporal trends in public mass shootings: high-capacity magazines significantly increase fatality counts, and are becoming more prevalent* (in preparation).

Towers S, Amdouni B, Cordova R, Funderburk K, Montalvo C, Thakur M, Velazquez-Molina J, Castillo-Chavez C. *The Rising Prevalence of Weapons in Unsafe Arming Configurations Discovered in American Airports: the Increasing Practice of Storage and Carry of Firearms with a Round Chambered*. bioRxiv. 2019 Jan 1:613687 (under review, Journal of Transportation Security)

Towers S, Chen S, Malik A, Ebert D. *Factors influencing temporal patterns in crime in a large American city: A predictive analytics perspective*. PLoS one. 2018 Oct 24;13(10):e0205151.

Towers S, Mubayi A, Castillo-Chavez C. *Detecting the contagion effect in mass killings; a constructive example of the statistical advantages of unbinned likelihood methods*. PLoS ONE. 2018 May 9;13(5):e0196863.

Towers S, White MD. *The “Ferguson effect”, or too many guns?*. Significance. 2017 Apr 1;14(2):26-9.

Espinola M, Shultz JM, Espinel Z, Althouse BM, Cooper JL, Baingana F, Marcelin LH, Cela T, Towers S, Mazurik L, Greene MC. *Fear-related behaviors in situations of mass threat*. Disaster health. 2016 Oct 1;3(4):102-11.

Shultz JM, Cooper JL, Baingana F, Oquendo MA, Espinel Z, Althouse BM, Marcelin LH, Towers S, Espinola M, McCoy CB, Mazurik L. *The role of fear-related behaviors in the*

2013–2016 West Africa Ebola virus disease outbreak. *Current psychiatry reports*. 2016 Nov 1;18(11):104.

Zhao J, Wang G, Chae J, Xu H, Chen S, Hatton W, Towers S, Gorantla MB, Ahlbrand B, Zhang J, Malik A. ParkAnalyzer: *Characterizing the movement patterns of visitors VAST 2015 Mini-Challenge 1*. In *Visual Analytics Science and Technology (VAST)*, 2015 IEEE Conference on 2015 Oct 25 (pp. 179-180). IEEE.

Towers S, Gomez-Lievano A, Khan M, Mubayi A, Castillo-Chavez C. *Contagion in mass killings and school shootings*. *PLoS one*. 2015 Jul 2;10(7):e0117259.

Towers S, Afzal S, Bernal G, Bliss N, Brown S, Espinoza B, Jackson J, Judson-Garcia J, Khan M, Lin M, Mamada R. *Mass media and the contagion of fear: the case of Ebola in America*. *PLoS one*. 2015 Jun 11;10(6):e0129179.

Malik A, Maciejewski R, Towers S, McCullough S, Ebert DS. *Proactive spatiotemporal resource allocation and predictive visual analytics for community policing and law enforcement*. *IEEE transactions on visualization and computer graphics*. 2014 Dec 31;20(12):1863-72.

Towers S. *Potential fitting biases resulting from grouping data into variable width bins*. *Physics Letters B*. 2014 Jul 30;735:146-8.

In addition to the above publications and the list of many other recent publications available on Google Scholar, I was a collaborator the D0 experiment between 2001 and 2006, resulting in over 60 publications. A full list is available upon request, or can be obtained from the SPIRES database <http://www-spires.fnal.gov/spires/hep/search/> using author Towers, and collaboration D0.

I was also a collaborator on the OPAL experiment between 1993 and 2001, resulting in 245 publications. A full list is available on request, or can be obtained from the SPIRES database, using author Towers and collaboration OPAL.

## **Patents**

Ebert, David Scott, Abish Malik, Sherry Towers, and Ross Maciejewski. "Proactive spatiotemporal resource allocation and predictive visual analytics system." U.S. Patent Application 14/941,485, filed November 13, 2015.

The patent involves software tools with spatial and temporal scale templates that facilitate proactive decision making for law enforcement. My contribution to the technology was the development of the novel Dynamic Covariance Kernel Density Estimation (DCKDE) statistical method, which can be used for scale-free kernel density estimation in hotspot analyses.

## Grants

### Awarded

2013 Arizona State University, College of Liberal Arts and Sciences seed grant  
*Investigating the underlying dynamics of terrorist activity*  
Co-PIs G Chowell, D Schaefer, S Towers, and M Xie  
\$40,167

2010-2012 NSF Award #1022758  
*Model Development and Model Validation for Pandemic Influenza*  
Co-PIs Z Feng and S Towers  
\$260,230

### Declined

2019 National Collaborative on Gun Violence Research,  
*Developing evidence-based solutions for reducing high-profile public mass shootings*  
Co-PIs D Hemenway, S Towers, and D Wallace  
\$783,800

2019 National Institute of Justice NIJ-2019-15388  
*Developing evidence-based solutions for reducing high-profile public mass shootings*  
Co-PIs D Hemenway, S Towers, and D Wallace  
\$690,100

2018 National Institute of Justice NIJ-2018-13960  
*Developing evidence-based solutions for reducing high-profile public mass shootings*  
Co-PIs D Hemenway, S Towers, and D Wallace  
\$667,600

2018 GLOBAC Norwegian Research Council  
*Diagnosing the unknown: Addressing the causes of undiagnosed encephalitis and fevers in rural and urban areas of Laos and Nepal*  
Co-PIs A Andreassen, X de Lamballerie, E Holmes, P Newton, J Pettersson, S Shrestha, and S Towers  
NOK 22,042,000 (approximately \$2.4 million USD)

2016 McCarthur 100&Change  
*Evidence-based methods for understanding violence*  
Co-PIs B Adame, W Barnard, V Becker, S Corman, S Decker, T Dishion, N Gonzales, J He, D Hemenway, J Hodge, C Katz, H Liu, D Mackinnon, S Neuberg, R Roscoe, S Ruston, H Tong, S Towers, and J Young

\$100 million

- 2016 Arizona State University, Institute for Social Science Research seed grant  
*Characterization of Social Contexts and Networks of Health Risk Behaviors among ASU College Students*  
Co-PIs C Castillo-Chavez, A Mubayi, S Towers, and E Wentz  
\$7,500
- 2016 Norwegian Research Council  
*Lessons to be learned from emergence in the New World of Zika and related viruses, particularly focusing on Colombia*  
Co-PIs X de Lamballerie, A Failloux, A Falconar, B Freiesleben, M Gaunt, E Gould, A Lundkvist, J Pettersson, C Romero-Vivas, and S Towers  
NOK 13,588,000 (approximately \$1.5 million USD)
- 2015 National Institute of Health R01 PA13-302  
*Sustainable Surveillance and Control of Arboviral Outbreaks*  
Co-PIs C Castillo-Chavez, A Falconar, R Maciejewski, C Romero-Vivas, S Towers  
\$1,922,500
- 2013 National Science Foundation Interdisciplinary Behavioral and Social Science Research  
*Modeling the Societal and Group Dynamics Behind Insurgencies: An Interdisciplinary Approach Towards Improved Understanding of the Struggle for Stability in Afghanistan*  
Co-PIs: C Castillo Chavez, G Chowell, A Cintron-Arias, A Mubayi, D Schaefer, S Towers, M Xie  
\$1,080,000

### **Conferences and workshops**

NimBIOS Firearm Violence Modelling Workshop, Knoxville TN, May 1-3, 2019.

Invited presentation: Contagion in mass shootings and other firearms-related modelling studies

Canadian Mathematical Society winter meeting, Dec 6-10, 2018.

Presentation: Assessing the average length of infection chains in an outbreak of infectious disease

Conference for Undergraduate Women in Physics, Provo UT, Jan 18-20 2019.

Invited presentation: Adventures in modelling and big data

SIAM Dynamical Systems conference, Snowbird UT, May 21-25 2017.

Presentation: Contagion in mass killings

3rd International & Interdisciplinary Workshop on Mathematical Modeling, Ecology, Evolution, Health, Challenges and Opportunities in Latin America, Quito, Ecuador, Jul 18-22, 2016. Plenary presentation: Quantifying the role of sexual transmission in a Zika virus outbreak in Barranquilla, CO.

Second International & Interdisciplinary Workshop on Mathematical Modeling, Ecology, Evolution and Dynamics of Dengue and Related Diseases (IIWEE), Villa de Leyva, Colombia from Aug 31 to Sep 4, 2015. Plenary presentation: Estimation of the basic reproduction number of a Chikungunya virus outbreak in Barranquilla, CO

Mathematical Association of America Mathfest conference, Aug 5-8, 2015. Presentation: Engaging students in applied mathematics via experiential learning through research

American Institute of Mathematics workshop on Neglected Infectious Disease Aug 11-15, 2014. Plenary presentation: statistical methods for optimization of model parameters

First International & Interdisciplinary Workshop on Mathematical Modeling, Ecology, Evolution and Dynamics of Dengue and Related Diseases (IIWEE), Tempe, AZ Aug 4-5, 2014. Plenary Presentation: statistical methods for optimization of model parameters

The 4th International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems conference, Texas Tech University, Oct 4-6 2013. Poster presentation: The impact of climate change on influenza

MBI workshop: "Evolution and Spread of Disease", March 19-23, 2012, Ohio State University. Poster presentation: Impact of weekday social contact patterns on the modeling of influenza transmission, and determination of the influenza incubation period

CBMS Mathematical Epidemiology with Applications summer workshop, Jul 25-29, 2011, East Tennessee University.

MCMSC Summer Workshop III/MTBI summer institute, Jun 24-Jul 1, 2011. Arizona State University.

Mathematical, Computational and Modeling Science Center (MCMSC) Summer Workshop I, May 8-14, 2011, Arizona State University. Presentation: 2009 H1N1 data: a new window into the seasonality of influenza.

International Workshop in Mathematics in Emerging Infectious Disease Management, Centro Internacional de Ciencias, Cuernavaca, Mexico, Jan 10-15, 2011. Presentation: 2009 H1N1 data: a new window into the seasonality of influenza.

10th Red Raider mini-symposium, Mathematical Modeling in Population Biology and Epidemiology. Oct 28-30, 2010, Department of Mathematics and Statistics, Texas Tech University. Poster presentation: Deterministic SIR model with seasonality, mutations, and cross-immunity.

Fields Institute Program on the Mathematics of Drug Resistance in Infectious Diseases, Aug 3-13 2010, Toronto, ON Canada.

The Second International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems University of Alabama Huntsville, Oct 9-11, 2009. Poster presentation: 2009 H1N1: predicting the course of a pandemic

## Teaching

Since 2012 I have taught graduate courses in advanced quantitative methods (including time series analysis, inverse problems, visual analytics, and dynamical modelling) to graduate students in the Arizona State University Applied Mathematics in the Life and Social Sciences (AMLSS) program.

I maintain an instructional website, <http://www.sherrytowers.com>, containing material related to all courses and workshop lectures I have given over the past several years. In many of my graduate courses, I incorporate material on how to write quantitative papers, and as such “class publication projects” have been an integral part of several of my courses (indicated in red below), where the class and I write a paper together, related to one of the analyses done as part of the class homework. These projects give the students an excellent introduction to paper writing and the publication process, and some of the publications have been very high impact.

Courses taught at ASU AMLSS graduate program:

Spring 2019 ASU AML 612 course: Advanced statistical methods, inverse problems, visual analytics, and high-performance computing, with applications in R. *Class publication project: Towers S, Cole S, Iboi E, Montalvo C, Navas MG, Pringle JAM, Saha D, Thakur M, Velazquez-Molina J, Murillo A, Castillo-Chavez C, Norcross JC. How long do people stick to a diet resolution? A digital epidemiological estimation of weight loss diet persistence (under review, Public Health Nutrition)*

Spring 2018 ASU AML 612 course: Advanced statistical methods for students in the life and social sciences, with applications in R.



Class publication project: Towers S, Amdouni B, Cordova R, Funderburk K, Montalvo C, Thakur M, Velazquez-Molina J, Castillo-Chavez C. *The Rising Prevalence of Weapons in Unsafe Arming Configurations Discovered in American Airports: the Increasing Practice of Storage and Carry of Firearms with a Round Chambered*. bioRxiv. 2019 Jan 1:613687 (under review, Journal of Transportation Security)

Spring 2017 ASU AML 612 course: Advanced statistical methods, inverse problems, and high-performance computing, with applications in R.

Class publication project: Towers S, Chen J, Cruz C, Melendez J, Rodriguez J, Salinas A, Yu F, Kang Y. *Quantifying the relative effects of environmental and direct transmission of norovirus*. Royal Society Open Science. 2018 Mar 1;5(3):170602.

Spring 2016 ASU AML 612 course: Probability, statistics, and applied stochastic modeling methods in the life and social sciences, with applications in R.

Fall 2015 ASU AML 612 course: Probability, statistics, and applied stochastic modeling methods in the life and social sciences, with applications in R.

Fall 2014 ASU AML 610 course: Advanced statistical methods, inverse problems, and high-performance computing, with applications in R and C++

Class publication project: Towers S, Afzal S, Bernal G, Bliss N, Brown S, Espinoza B, Jackson J, Judson-Garcia J, Khan M, Lin M, Mamada R. *Mass media and the contagion of fear: the case of Ebola in America*. PLoS one. 2015 Jun 11;10(6):e0129179.

Fall 2013 ASU AML 610 course: Statistical analysis methods and time series analysis with applications in R

Spring 2013 ASU AML 610: Probability and methods in applied statistics, computational methods and high-performance computing, with applications in R and C++

Additional teaching:

2012-15 Faculty lecturer to undergraduates at the Mathematical and Theoretical Biology Institute, ASU, with lectures on applied statistics.

2012-14 Faculty lecturer at the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> undergraduate Workshops on Mathematical and Statistical Modeling at Northeastern Illinois University.

Collaborative work begun in 2012 with the undergraduate participants in the workshop resulted in the publication S Towers, et al *Climate change and influenza: the likelihood of early and severe influenza seasons following warmer than average winters*, PLoS Currents Influenza (2013)

## **Research skills**

**Programming languages:** R, Python, Perl, Ruby, C, C++, Java, Fortran

**Other:** SAS, Stata, SPSS, Mathematica, Unix, Linux, OSX, DOS, SQL

**Areas of specialization:**

Applied statistics

Quantitative and predictive analytics

Visual analytics

Statistical computing

Machine learning methods

Risk analysis

Cost/benefit analysis

Inverse problems

Time series analysis

High performance computing

Mathematical and computational modeling of dynamical systems

Markov Chain Monte Carlo

Stochastic differential equations

Agent-based modeling

## **Professional Society Affiliations**

American Statistical Association (ASA)

## **Other Activities**

2007-      Owner, Towers Consulting, LLC, providing statistical and quantitative analytics consulting services to the academic, private and public sectors