

BIOGRAPHICAL SKETCH

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NAME: Sewell, Daniel K.

eRA COMMONS USER NAME (credential, e.g., agency login): DKSEWELL

POSITION TITLE: Associate Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Harding University	B.A.	05/2006	Education
University of Arkansas	M.S.	05/2010	Statistics
University of Illinois Urbana-Champaign	Ph.D.	05/2015	Statistics

A. Personal Statement

I am an Associate Professor of Biostatistics at the University of Iowa, a faculty affiliate at the UI Public Policy Center, and a member of the CDC's Modeling Infectious Diseases in Healthcare Network, with research interests in network analysis, clustering, longitudinal analysis, Bayesian methodology, statistical computation, and data visualization. The primary focus of my research is in the development of statistical models and inference for network data, and in applying network methodology to answer important scientific questions. I have published papers on this and other topics in top statistical journals. I have collaborated with researchers from a myriad of scientific disciplines at the University of Iowa and at several other R1 institutions. I have also developed statistical software and web-based apps implementing novel methodology. I bring expertise in network methodology applied to infectious disease diffusion, effects of social networks on cognitive outcomes, and healthcare team communication networks, as well as expertise in software and web-app development for statistical methods.

- a) Sewell, D. K. and Chen, Y. (2015). Latent space models for dynamic networks. *Journal of the American Statistical Association* **110**(512), 1646-1657.
- b) Sewell, D. K., and Chen, Y. (2017). Latent space approaches to community detection in dynamic networks. *Bayesian Analysis* **12**(2), 351-377.
- c) Sewell, D. K. (2020). Model-based edge clustering. *Journal of Computational and Graphical Statistics*, In press (DOI: 10.1080/10618600.2020.1811104).
- d) Sewell, D. K. and Miller, Aaron (2020). Simulation-free estimation of an individual-based SEIR model for evaluating nonpharmaceutical interventions with an application to COVID-19 in the District of Columbia. *PLOS ONE*, In press.

B. Positions and Honors**Positions**

2008-2009	Teaching Assistant (Instructor), Department of Mathematical Sciences, University of Arkansas
2010	Research Assistant, Department of Mathematical Sciences, University of Arkansas
2010-2011	Teaching Assistant (Lon-Capa Programmer), Department of Statistics, University of Illinois Urbana-Champaign

2011-2012	Research Assistant to Professor Ping Ma, University of Illinois Urbana-Champaign
2012-2015	Research Assistant to Professor Yuguo Chen, University of Illinois Urbana-Champaign
2014	Teaching Assistant (Instructor), Department of Statistics, University of Illinois Urbana-Champaign
2015-2021	Assistant Professor, Department of Biostatistics, University of Iowa
2020-present	Faculty Affiliate at the UI Public Policy Center
2021-present	Associate Professor, Department of Biostatistics, University of Iowa

Honors

2007	Outstanding Calculus Award, Harding University
2014	Graduate College Travel Award, University of Illinois
2014	Finalist for the Norton Prize for Outstanding Doctoral Thesis in Statistics, University of Illinois
2014	Patrick J. Fett award for the best paper on the scientific study of Congress and the presidency
2015	New Faculty Research Award, College of Public Health, University of Iowa
2016	University of Illinois Nominee for GS/ProQuest Distinguished Dissertation Award (limit 1 per university)
2019	EEE/ACM ASONAM HI-BI-BI 2019 Best Paper Award

C. Contributions to Science

Network Analysis: Network analysis is a ubiquitous area of study used by scientists in many distinct fields and can most simply be thought of as the study of how objects interact or are connected. The statistical analysis of network data is an inherently difficult endeavor, however, and sophisticated tools are necessary to obtain correct inference. My research has focused on developing models and methods for analyzing a variety of types of network data. The first paper develops a framework for modeling temporally measured network data and provides tools for prediction, handling missing data, and detecting influence throughout the network. The second paper provides an analytical framework for analyzing partially observed networks (egocentric network data), appropriately modeling the heteroscedastic and correlated errors involved in network data as well as estimating the effect of social influence on the response. The third paper develops a non-linear regression model for determining how actors in the network vary with respect to their susceptibility to influence as it diffuses through the network; I also provide an efficient algorithm for sampling from the posterior distribution and performing inference. The fourth paper develops a novel statistical test for determining the association between two networks. Existing approaches are permutation tests which may not control the Type I error rate appropriately. My proposed method is based on a multilinear representation of the two networks, and accurately controls the Type I error rate while maintaining power comparable to that of permutation tests.

- a) Sewell, D. K. and Chen, Y. (2015). Latent space models for dynamic networks. *Journal of the American Statistical Association* **110**(512), 1646-1657.
- b) Sewell, D. K. (2017). Network autocorrelation models with egocentric data. *Social Networks*, **49**, 113-123.
- c) Sewell, D. K. (2017). Heterogeneous susceptibilities in social influence models. *Social Networks*, **52**, 135-144.
- d) Sewell, D. K. (2019). Multilinear tests of association between networks. *Proceedings of the Meeting of the Classification and Data Analysis Group '19*.

Clustering analysis: Numerous applications exist in which it is of interest to partition the data into homogeneous groups, or clusters. This is particularly difficult in longitudinal data, where researchers must think carefully about

how to define such clusters within their specific contexts. The first paper develops a novel approach for clustering the edges of a network, thereby finding the latent contexts in which edges form, and derives fast scalable algorithms for estimation; these methods are available in the R package 'LSEC'. The second paper derives a statistical model which takes into account temporal dependencies in the data, allows covariate information to help explain the grouping/clustering, and develops computationally efficient algorithms to make model estimation feasible. Clustering the nodes of a network, called community detection, is a particularly challenging task, and this is more so when the network data is collected over time. The third paper develops a statistical framework that allows one to perform community detection on temporally collected network data, and I again provide computationally efficient algorithms to make the model estimation feasible; these methods are available in the R package 'dnc'. The last paper provides novel methodology for analyzing longitudinal, or dynamic, network rank-order data. In this work I provide explicit mechanisms for the estimation of changes over time in the stability and emerging clustering structure of the network.

- a) Sewell, D. K. (2020). Model-based edge clustering. *Journal of Computational and Graphical Statistics*, In press.
- b) Sewell, D. K., Chen, Y., Bernhard, W. and Sulkin, T. (2016). Model-based longitudinal clustering. *Statistica Sinica* **26**(1), 205-233.
- c) Sewell, D. K., and Chen, Y. (2016). Latent space approaches to community detection in dynamic networks. *Bayesian Analysis* **12**(2), 351-377.
- d) Sewell, D. K. and Chen, Y. (2015). Analysis of the formation of the structure of social networks using latent space models for ranked dynamic networks. *Journal of the Royal Statistical Society, Series C* **64**, 611-633.

Longitudinal Data Analysis: Studies often require a temporal component in order to track changes over time or to better understand an ongoing process. Failure to correctly account for the additional dependencies in the data induced by this temporal component can lead to biased results, wrong standard errors, and hence wrong inference and conclusions gleaned from the data. Much of my methodological research has focused on temporal, or longitudinal, data analysis. The first paper takes a commonly used network analytic approach and extends it in a non-trivial way to networks observed over time, allowing for the underlying network structure to evolve over time and providing prediction tools for future unobserved time points. The second paper also provides novel methodology for analyzing longitudinal, or dynamic, network data. In this work I provide explicit mechanisms for the estimation of changes over time in the stability and emerging clustering structure of the network. The third paper develops a model-based clustering algorithm for multivariate longitudinal data. The fourth paper considers the temporal variation in surgical site infections (SSIs); in particular, we estimate the seasonality of SSIs and the proportion of that seasonality that can be explained by climate variables.

- a) Sewell, D. K. and Chen, Y. (2015). Latent space models for dynamic networks. *Journal of the American Statistical Association* **110**(512), 1646-1657.
- b) Sewell, D. K. and Chen, Y. (2015). Analysis of the formation of the structure of social networks using latent space models for ranked dynamic networks. *Journal of the Royal Statistical Society, Series C* **64**, 611-633.
- c) Sewell, D. K., Chen, Y., Bernhard, W. and Sulkin, T. (2016). Model-based longitudinal clustering. *Statistica Sinica* **26**(1), 205-233.
- d) Anthony, C.A., Peterson, R.A., Polgreen, L.A., Sewell, D.K., and Polgreen, P.M. (2017). The seasonal variability in surgical site infections and association with warmer weather: a population-based investigation. *Infection Control & Hospital Epidemiology*. 1-8. doi:10.1017/ice.2017.84.

Computational Statistics: Statistical tools can be implemented to accomplish otherwise intractable computational problems, such as numerical integration or optimization. Network analysis is notorious for having high computational cost. In the first paper, I derive a novel estimation algorithm that reduces the computational cost from exponential to linear in the number of time points, thereby making an otherwise infeasible estimation procedure have extremely short run times. In the second paper, I implement a variational Bayes approach to perform community detection, i.e., clustering, on dynamic networks, reducing the computational burden by around 95%. In the third and fourth papers, I extend a method of reducing computational cost from quadratic to linear in the number of actors in the network to longitudinal network data and to a wide range of distributions, namely any exponential family of distributions. Additionally, I have two as of yet unpublished papers contributing to statistical computing. The first derives a method with which to perform on-line learning of static parameters in

a general state space framework through a novel sequential Monte Carlo algorithm. The second provides a new way of deriving, and thus understanding, a well-known estimator for the marginal likelihood, which is often an intractable integral key to many model selection approaches.

- a) Sewell, D. K., Chen, Y., Bernhard, W. and Sulkin, T. (2016). Model-based longitudinal clustering. *Statistica Sinica* **26**(1), 205-233.
- b) Sewell, D. K., and Chen, Y. (2016). Latent space approaches to community detection in dynamic networks. *Bayesian Analysis* **12**(2), 351-377.
- c) Sewell, D. K. and Chen, Y. (2015). Latent space models for dynamic networks. *Journal of the American Statistical Association* **110**(512), 1646-1657.
- d) Sewell, D. K. and Chen, Y. (2016). Latent space models for dynamic networks with weighted edges. *Social Networks* **44**, 105-116.

Infectious Disease: Our society is dramatically impacted on multiple levels by our understanding, treatment, and prevention of infectious diseases. The study of infectious disease often requires complex analyses shaped by a substantive understanding of disease-specific mechanisms of spread. I have worked in this domain with researchers at the University of Iowa College of Medicine, College of Public Health, as well as with researchers at other R1 institutions and at the CDC. These analyses often require novel methodological developments in network analysis, longitudinal analysis, agent-based modeling, and statistical computation.

- a) Jang, H., Justice, S., Polgreen, P.M., Segre, A.M., Sewell, D.K., and Pemmaraju, S.V. (2019). Evaluating architectural changes to reduce the infection spread in a dialysis unit. *International Conference on Advances in Social Networks Analysis and Mining '19*.
- b) Sewell, D. K., Simmering, J.E., Justice, S., Pemmaraju, S.V., Segre, A.M., and Polgreen, P.M. (2019). Estimating the attributable disease burden and effects of inter-hospital patient sharing on *Clostridium difficile* infections in California. *Infection Control & Hospital Epidemiology*, **40**(6), 656-661.
- c) Medgyesi, D., Brogan, J.M., Sewell, D.K., Creve-Coeur, J. P., Kwong, L.H., and Baker, K.K. (2018). Where children play: Young child exposure to environmental hazards during play in public areas in a transitioning internally displaced persons community in Haiti. *International Journal of Environmental Research and Public Health*, **15**(8), 1646.
- d) Anthony, C.A., Peterson, R.A., Polgreen, L.A., Sewell, D.K., and Polgreen, P.M. (2017). The seasonal variability in surgical site infections and association with warmer weather: A population-based investigation. *Infection Control & Hospital Epidemiology*. **38**(7), 809-816.

Complete List of Published Work in My Bibliography:

A full listing of my published work can be found at <https://orcid.org/0000-0002-9238-4026/print>

D. Additional Information: Research Support and/or Scholastic Performance

ACTIVE RESEARCH

No contract number (Baker, Kelly, PI) IFPRI	7/01/18-12/31/19 \$382,000	1.5 calendar
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Market-to-Mouth Infant Food Contamination Study - A Collaboration Between the Safe Start Study and IFPRI

The overall goal for this study is to understand whether household-level boiling and safe storage of infant food can effectively reduce enteric pathogen contamination in locally vended cow's milk at the point-of-consumption by infants.

Role: Co-Investigator

1 U01 CK000531-01 (Segre, Alberto, PI) CDC	8/1/17-7/31/20 \$392,894	2.6 calendar
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Data-Driven Modeling and Simulation of Healthcare-Associated Infections

According to the CDC, healthcare-associated infections affect about two million patients in American hospitals each year. Of particular concern are strains of antimicrobial resistant pathogens that could be quickly amplified in hospitals, transmitted to other hospitals, nursing homes, and then, eventually, to the

community at large. This project will apply the analytic techniques and simulation tools of computational science to provide a much-needed framework to better understand and evaluate hospital patient safety measures, from common interventions specifically designed for infection control, such as hand-washing or patient-cohorting, targeted hand-washing compliance measures, and healthcare worker vaccination strategies, to more subtle questions about, e.g., patient/unit assignment, inter-facility transfer policies, antibiotic administration and staff/patient allocations.

Role: Co-Investigator

9/30/14-9/29/19 1.2 calendar

3 U48 DP005021-03S7 (Parker, Edith, Contact PI)

CDC

\$770,505

University of Iowa Prevention Research Center for Rural Health

The University of Iowa Prevention Research Center for Rural Health was first funded by the Centers for Disease Control and Prevention in 2002. The 26 Prevention Research Centers, designated by the CDC, constitute a network of academic, community, and public health partners that conducts applied public health research. The overall objective of this study is to determine the effectiveness, through a community-based participatory research pre-post design, of a community-based physical activity intervention that uses a lay health advisors approach to inform residents, provide social and behavioral support, and advocate for social and environmental changes in a micropolitan new destination community in the rural state of Iowa.

Role: Co-Investigator

5 R25 HL131467-02 (Zamba, Gideon, PI)

NIH

2/15/16-1/31/19 0.48 calendar

\$228,258

Iowa Summer Institute for Research Education in Biostatistics

This is a proposal to the National Institutes of Health (NIH), National Heart, Lung and Blood Institute (NHLBI), from the University of Iowa, in response to RFA-HL-16-017 for a Summer Institute for Research Education in Biostatistics. The ultimate vision of our proposed research education program is to increase the number of undergraduates who enter graduate programs in Biostatistics and to maintain a solid underrepresented minority pipeline into biostatistics graduate programs. The proposal is for the University of Iowa (UI) Department of Biostatistics to recruit a diverse group of 18 trainees each year, from 2016 to 2018, with focus on minority, underrepresented and disadvantaged students who wouldn't have otherwise been exposed to the field of biostatistics.

Role: Co-Investigator

Completed Research

Internal UI Account, (Polgreen P, Project Director)

11/26/14-12/31/18

IA715-B17 US. Dept. of Agriculture (Brophy P, PI)

e-Health Network/The University of Iowa Hospitals and Clinics eHealth Extension Network Project

The University of Iowa eHealth Extension Network Project will supply 65 sites in 45 counties (Figure 2) around Iowa with telehealth carts equipped with high quality cameras, HIPPA compliant video conferencing (Vidyo) and cloud-based image sharing software (IifEIMAGE). By utilizing this technology and building collaborations with our rural providers, we can build an eHealth Extension Network to address many of the unique challenges our Iowa patients and providers face. This grant outlines multiple approaches to address rural healthcare challenges. Through its implementation we will provide access to medical specialists not currently available to rural medical professionals or their patients. The UIHC has committed to a 107% match to our grant application budget of \$498,973.

Role: Co-Investigator