

BIOGRAPHICAL SKETCH

NAME: Davis, Sharon Elizabeth

eRA COMMONS USER NAME (credential, e.g., agency login): sdavis25

POSITION TITLE: Research Assistant Professor, Department of Biomedical Informatics; Faculty Scientist, Center for Improving the Public's Health through Informatics

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Duke University, Durham, NC	AB	05/2004	Environmental Sciences and Policy
North Carolina State University, Raleigh, NC	MS	12/2008	Statistics
Johns Hopkins University, Baltimore, MD	Certificate	08/2017	Public Health Informatics
Vanderbilt University, Nashville, TN	MS	05/2017	Biomedical Informatics
Vanderbilt University, Nashville, TN	PhD	10/2019	Biomedical Informatics

A. Personal Statement

Dr. Davis is a biomedical informatician with formal statistical training, who focuses on the development and maintenance of predictive models. She is an expert in the use of machine learning and has developed a suite of generalizable and customizable methods supporting data-driven model updating for both regression and machine learning. This research involved the design and evaluation of a new statistical test for selecting model updating approaches, a method of continuous real-time calibration assessment, and a calibration drift detector to alert users to changes in model accuracy. These methods lay the groundwork for the design of automated model surveillance systems which will promote long-term performance and utility of prediction models underlying a variety of informatics applications for decision support and population management. She has also worked on the development of methods for using and assessing electronic health record technology and patient portals. Previously, Dr. Davis served as a statistician and environmental scientist for over a decade in maternal and child health, and she maintains a strong commitment to these populations. Research during this time emphasized the use of spatial analysis to address questions of maternal and child public health. Key projects explored associations between air pollution, the built environment, psychosocial health, and pregnancy outcomes – all of which required an explicit focus on the development and use of novel approaches to measurement. This research led to practical solutions for community partners, including tools to support targeted community lead screening and data-driven community advocacy. Today, Dr. Davis is focused on working within the Center for Improving the Public's Health through Informatics to bring advanced and evolving prediction methods to bear on topics and areas that have not experienced significant use of these approaches to solve problems that affect unique and vulnerable populations.

B. Positions and Honors**Positions and Employment**

2004 – 2011 Associate in Research, Children's Environmental Health Initiative, Duke University
 2011 – 2016 Senior Statistician, Children's Environmental Health Initiative, University of Michigan
 2013 – 2018 Predoctoral Fellow, Department of Biomedical Informatics, Vanderbilt University Medical Center
 2019 – Research Assistant Professor, Department of Biomedical Informatics, Vanderbilt University Medical Center
 2019 – Faculty Scientist, Center for Improving the Public's Health through Informatics

Other Experience and Professional Memberships

2014-2015 Student Editorial Board, Journal of the American Medical Informatics Association
2018 Co-chair, 2018 National Library of Medicine Informatics Training Conference

Honors

2019 Student Innovation Award, American Medical Informatics Association's Knowledge Discovery and Data Mining Workgroup
2019 Martin Epstein Award for 1st place in American Medical Informatics Association Student Paper Competition
2020 2nd place (honorable mention) American Medical Informatics Association Doctoral Dissertation Award

C. Contribution to Science

1. **Predictive Modeling and Machine Learning** – Dr. Davis has been recently recognized for her work developing and advancing methods that have the potential to substantially alter the way predictive models are developed and maintained. In particular, the recognition and development of methodologies that account for the reality that model behavior and performance have the potential to change over time and affect their utility and ultimate impact was a key success that was recognized when Dr. Davis received the prestigious award for best student paper at the American Medical Informatics Association. In addition to its impact on prediction theory, Dr. Davis' research is immediately implementable in the clinical space.
 - a. **Davis SE**, Lasko TA, Chen G, Matheny ME. 2017. "Calibration drift among regression and machine learning models for hospital mortality." *Proceedings of the American Medical Informatics Association 2017 Annual Symposium*. 2017:625-634. PMID: PMC5977580
 - b. **Davis SE**, Lasko TA, Chen G, Siew ED, Matheny ME. 2017. "Calibration drift in regression and machine learning models for acute kidney injury." *Journal of the American Medical Informatics Association*. 24(6): 1052-1061. PMID: PMC6080675
 - c. **Davis SE**, Greevy RA, Fonnesbeck C, Lasko TA, Walsh CG, Matheny ME. 2019. "A Nonparametric Updating Method to Correct Clinical Prediction Model Drift." *Journal of the American Medical Informatics Association*. ocz127, <https://doi.org/10.1093/jamia/ocz127>.
 - d. **Davis SE**, Greevy RA, Lasko TA, Walsh CG, Matheny ME. 2019. "Comparison of Prediction Model Performance Updating Protocols: Using a Data-Driven Testing Procedure to Guide Updating." *Proceedings of the American Medical Informatics Association 2019 Annual Symposium*. Accepted.
2. **Use of Electronic Health Systems** – Another area of Dr. Davis' work has been the study of how patients interact with electronic health systems, including portals, with a focus on how this might affect availability and utility of information for research and clinical care.
 - a. **Davis SE**, Osborn CY, Kripalani S, Goggins KM, and Jackson GP. 2015. "Health literacy, education levels, and patient portal usage during hospitalizations." *Proceedings of the AMIA Annual Symposium, 2015*. 1871-1880. PMID: PMC4765631
 - b. Cronin RM, **Davis SE**, Shenson JA, Chen Q, Rosenbloom ST, and Jackson GP. 2015. "Growth of secure messaging through a patient portal as a form of outpatient interaction across clinical specialties." *Applied Clinical Informatics*. 6(2): 288-304. PMID: PMC4493331
 - c. Masterman M, Cronin RM, **Davis SE**, Shenson JA, Jackson GP. 2016. "Adoption of secure messaging in a patient portal across pediatric specialties." *Proceedings of the American Medical Informatics Association 2016 Annual Symposium*. 1930-1939. PMID: PMC5333207
 - d. Steitz BD, Cronin RM, **Davis SE**, Yan E, Jackson GP. 2017. "Long-term patterns of patient portal use for pediatric patients at an academic medical center." *Applied Clinical Informatics*. 8(3): 779-793. PMID: PMC6220688
3. **Maternal and Child Health Epidemiology** – Dr. Davis' earlier work as a statistician focused on the epidemiology of maternal and child health, with a focus on challenging measurement issues and integration

of complex, disparate data. She has demonstrated expertise in integrating complex, disparate data sources, including data across clinical, geospatial, socio-behavioral, and environmental domains. Select papers in this area include:

- a. Miranda ML, **Edwards SE**, Chang HH, and Auten RL. 2013. "Proximity to roadways and pregnancy outcomes." *Journal of Exposure Science and Environmental Epidemiology*. 23(1): 32-38. PMID: 22805991
 - b. Gray SC, **Edwards SE**, and Miranda ML. 2013. "Race, socioeconomic status, and air pollution exposure in North Carolina." *Environmental Research*. 126: 152-158. PMCID: PMC3922656
 - c. Anthopolos R, **Edwards SE**, and Miranda ML. 2013. "Effects of maternal prenatal smoking and birth outcomes extending into the normal range on academic performance in 4th grade in North Carolina, USA." *Paediatric and Perinatal Epidemiology*. 27(6): 564-574. PMID: 24134528
 - d. **Edwards SE**, Strauss B, and Miranda ML. 2014. "Geocoding large population-level administrative datasets at highly resolved spatial scales." *Transactions in GIS*. 18(4): 586-603. PMCID: PMC4222194
4. Environmental Health and Justice – Dr. Davis' work in environmental health included addressing the challenge of measuring and evaluating the varied components of risks borne by disadvantaged communities. This work provided insight into interactions between social and environmental risks, while also developing methods to promote communication and dissemination of research findings with stakeholder communities. Her work has been used in community settings to take steps to reduce or mitigate the impacts of environmental exposures in children, pregnant women, and other vulnerable populations.
- a. Miranda ML, **Edwards SE**, Keating MH, and Paul CJ. 2011. "Making the environmental justice grade: the relative burden of air pollution exposure in the United States." *International Journal of Environmental Research and Public Health*. 8(6): 1755-1771. PMCID: PMC3137995
 - b. Miranda ML, Keating MH, and **Edwards SE**. 2008. "Environmental justice implications of reduced reporting requirements of the Toxics Release Inventory Burden Reduction Rule." *Environmental Science and Technology*. 42: 5407-5414. PMCID: PMC2847774
 - c. Miranda ML, Maxson PJ, and **Edwards SE**. 2009. "Environmental contributions to disparities in pregnancy outcomes." *Epidemiologic Reviews*. 31: 67-83. PMID: 19846592
 - d. Vinikoor-Imler L, Gray SC, **Edwards SE**, and Miranda ML. 2012. "The effects of exposure to particulate matter and neighborhood deprivation on gestational hypertension." *Paediatric and Perinatal Epidemiology*. 26(2): 91-100. PMID: 22324494

Complete Lists of Published Work:

Google scholar page: <https://scholar.google.com/citations?user=E0PiP4sAAAAJ&hl=en>

NIH bibliography: <https://www.ncbi.nlm.nih.gov/myncbi/sharon.davis.2/bibliography/public/>

D. Research Support

IMPROVE AKI: A Cluster-Randomized Trial of Team-Based Coaching Interventions to IMPROVE Acute Kidney Injury

Agency: NIH NIDDK Grant Number: R01-DK-113201-01A1 Period: 09/2018 – 08/2023

PI (Multiple): Jeremiah Brown, Michael Matheny, Richard Solomon, Co-I: Sharon Davis

This study asks whether supporting the use of the AKI Prevention Toolkit by: 1) Virtual Learning Collaborative (VLC) approach for coaching, augmented by an Automated Surveillance Reporting system (ASR), will lead to better patient outcomes compared to technical assistance (TA), TA + ASR, and VLC alone; and 2) VLC will be superior to TA with or without ASR. We will address these questions in a 2x2 factorial cluster--randomized trial that randomizes 16 hospitals to receive one of the following interventions for 18 months: A) Technical Assistance (TA); B) Technical Assistance with Automated Surveillance Reporting (TA+ASR); C) Virtual Learning Collaborative (VLC) with team--based coaching; and D) Virtual Learning Collaborative with Automated Surveillance Reporting (VLC+ASR).

Determining and Targeting Reasons for Low Statin Use to Improve Guideline-concordant Statin Therapy in High-Risk Patients

Agency: VA HSR&D Grant Number: IIR-16-072

Period: 07/2017-06/2021

PI: Salim Virani, Co-I: Sharon Davis

This study seeks to identify high-risk CVD patients on suboptimal statin therapy and the reasons behind this using NLP methods, and then deliver this information to the providers at the point-of-care along with cognitive support to discuss the risk-benefit ratio of statin therapy in these patients and algorithms to reinstate or titrate statins. We will involve stakeholders to further adapt the algorithm for treatment of patients with statin associated side effects. Summative evaluation of the providers and information technology (IT) personnel following the conclusion of the pilot will inform future large-scale dissemination of our study findings.

Synthetic Mid-Urethral Slings for Stress Urinary Incontinence in Women

Agency: National Evaluation System for Health Technology Grant Number: NEST-R2-B5

Period: 01/01/2020 – 12/31/2020

PI: Michael Matheny, Co-I: Sharon Davis

The objectives of this project are to assess the capacity of routinely collected electronic health record data to be used to evaluate long-term (>2 years) adverse events following synthetic surgical mesh implantation (mid-urethral slings) for female stress urinary incontinence (SUI).

Eunice Kennedy Shriver Intellectual and Developmental Disabilities Research Center at Vanderbilt

Agency: NIH/ NICHD Grant Number: 1 P50 HD103537-01 Period: 07/01/2020 – 06/30/2025

PI: Jeffrey Neul, Co-I: Sharon Davis

The overarching goal of the next phase of the Intellectual and Developmental Disorders Research Centers (IDDRC) is to develop precision care for intellectual and developmental disabilities (IDD) by providing infrastructure and scientific leadership to enable rapid translation of basic discoveries into high impact IDD interventions and treatments.

Completed Research Support

Vanderbilt Biomedical Informatics Training Program

Agency: National Library of Medicine, NIH Grant Number: T15 LM007450 Period: 8/2013-7/2018

PI: Cynthia Gadd

Provides tuition and stipend support for nine predoctoral (PhD), six postdoctoral (MS or nondegree), and four short-term training fellowships in biomedical informatics.

Role: Trainee