## BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Danny R. Hughes

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

POSITION TITLE: Professor, College of Health Solutions

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 |
|---|---|---|---|
| Georgia Institute of Technology | B.S. | 06/98 | Economics |
| University of Georgia | Ph.D. | 05/05 | Economics |

### A. Personal Statement

I have over 15 years of experience conducting and managing research projects in economics, health services research, and operations research. My research primarily focuses on the roles of incentives, innovation, and technology in the financing, delivery, and usage of health care services – with a specific focus on the economics of medical imaging. An econometrician by training, I have a passion for developing mathematical models with practical and relevant policy applications and am equally at home developing optimization and simulation models common to engineering as performing econometric and statistical analyses. I have published more than 100 papers in peer-reviewed journals to include leading health policy and medical journals such as *Health Affairs, JAMA Internal Medicine,* and *Medical Care.* My approach to research has always been collaborative as I receive as much joy developing junior researchers by providing opportunities to participate and lead studies as I do from the intellectual exploration itself. Serving as the research director for the Harvey L. Neiman Health Policy Institute and as a principal investigator on several external research grants, I have mentored numerous graduate students, early career researchers, and physicians in appropriate study design and analysis using large scale commercial and Medicare administrative claims data to examine contemporary health policy issues. Recent papers in this area include:

1. **D.R. Hughes**, C. Filar, D.T. Mitchell. 2022. “Nurse Practitioner Scope of Practice and the Prevention of Foot Complications in Rural Diabetes Patients,” *Journal of Rural Health, 38(4): 994-998*
2. N. Abashidze, C. Stecher, A. Rosenkrantz, R. Duszak, **D.R. Hughes**. 2021. "Racial/Ethnic Disparities in the Use of Prostate MRI Following an Elevated Prostate-Specific Antigen Test," *JAMA Network Open*, *4(11): e2132388*
3. H. Yeung, M.L. Baranowski, R.A. Swerlick, S.C. Chen, J. Hemingway, **D.R. Hughes**, R. Duszak. 2018. "Utilization and cost of actinic keratosis destruction in the Medicare Part B fee-for-service population in 2007-2015," *JAMA Dermatology, 154(11): 1281-1285*
4. M. Jiang, **D.R. Hughes**, W. Wang. 2018. "The Effect of Medicare's Annual Wellness Visit on Preventive Care for the Elderly," *Preventive Medicine, 116: 126-133*
5. **D.R. Hughes**, M. Jiang, R. Duszak. 2015. “A Comparison of Diagnostic Imaging Ordering Patterns between Advanced Practice Clinicians and Primary Care Physicians following Office-based Evaluation and Management Visits,” *JAMA Internal Medicine, 175(1): 101-107*

### B. Positions and Honors

**Positions and Employment**

1992-1995 Corporal – Nuclear, Biological, and Chemical Operations Specialist, 172nd Chemical Company, 4th Infantry Division, U.S. Army, Fort Carson, CO
1998-2000 Analyst, Tecolote Research, Bedford, MA
2000-2002 Graduate Instructor, Department of Economics, University of Georgia, Athens, GA
2001 Research Assistant, Carl Vinson Institute of Government, University of Georgia, Athens, GA
2002-2003 Research Associate, Center for Economic Development Research, University of South Florida, Tampa, FL
2003-2005 Research Fellow, Logistics Management Institute, McLean, VA
2004-2005 Instructor, Department of Economics, University of South Alabama, Mobile, AL
2005-2008 Assistant Professor, Department of Economics, University of South Alabama, Mobile, AL
2008-2010 Senior Researcher, American College of Radiology, Reston, VA
2010-2011 Assistant Director, Health Policy Research, American College of Radiology, Reston, VA
2011-2012 Assistant Professor, Department of Health Administration and Policy, University of Oklahoma Health Sciences Center, Oklahoma City, OK
2012-2018 Senior Director, Health Policy Research and Senior Research Fellow, Harvey L. Neiman Health Policy Institute, Reston, VA
2017-2018 Visiting Professor, School of Economics, Georgia Institute of Technology, Atlanta, GA
2018-2020 Executive Director and Senior Research Fellow, Harvey L. Neiman Health Policy Institute, Reston, VA
2018-2022 Professor, School of Economics, Georgia Institute of Technology, Atlanta, GA
2018-2022 Director, Health Economics and Analytics Lab, Georgia Institute of Technology, Atlanta, GA
2019-2020 Director, Master Programs, School of Economics, Georgia Institute of Technology, Atlanta, GA
2023-Present Professor, College of Health Solutions, Arizona State University, Phoenix, AZ

**Other Experience and Professional Memberships**

2009-present *ad hoc* member, Scientific Committee, APHA
2011-present *ad hoc* member, Scientific Committee, IHEA
2013 Member, CDC Expert Panel on Lung Cancer Surveillance
2013-2017 Affiliate Faculty, Department of Health Administration and Policy, George Mason University, Fairfax, VA
2015-present Editorial Board, *Journal of the American College of Radiology*
2016-present *ad hoc* member, Scientific Committee, ASHEcon
2016-2018 External Advisory Board, George Mason University Health Informatics PhD Program
2018-2022 Adjunct Professor, Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, GA
2018 Member, NIH/RSNA/ACR Expert Panel on Gadolinium Deposition: What We Know and Don't Know, A Research Roadmap
2019-2020 Member, National Lung Cancer Roundtable Implementation Strategies Workgroup
2019 Society for Interventional Radiology Foundation, Research Consensus Panel
2020 External Reviewer, Dutch Organisation for Health Research and Development (ZonMW)
2021 Panelist, National Science Foundation

**Selected Honors**

2015 Charles E. Gibbs Leadership Prize - Outstanding Paper in *Women's Health Issues* (co-author)
2016 JACR Paper of the Year, Health Services Research and Policy (co-author)
2018 Georgia Power Professor of Excellence
2019 JACR Paper of the Year, Training and Education (co-author)
2019 ACR 2019 Abstract Gold Merit Award (co-author)
2021 Ivan Allan College Million Dollar Club (2021, 2022)
2022 ACR 2022 Abstract Gold Merit Award (co-author)
2022 Ivan Allan College Faculty Excellence in Research

## C. Contribution to Science

1. Physician self-referral. Physician-induced demand for health care services through the self-referral of patients for diagnostic imaging and laboratory tests is routinely cited as an important driver of health care

costs. Although legislation (i.e. Stark Laws) was passed to curb physician self-referral, providers are incentivized to self-refer and many are able to exploit loopholes in the legislation to continue the practice. Previous research in this area had focused on the effects of self-referral on medical utilization. We were the first to examine the effect of physician self-referral for imaging on other outcomes such as the cost and duration of patient episodes of care.

a. **D.R. Hughes**, M. Bhargavan, J. Sunshine, 2010. "Imaging Self-Referral Associated With Higher Costs, Limited Impact On Illness Duration" *Health Affairs, 29(12): 2244-2251*. PMID 21134926.
b. **D.R. Hughes**, J. Sunshine, M. Bhargavan, H. Forman, 2011. "Physician Self-Referral for Imaging and the Cost of Chronic Care for Medicare Beneficiaries" *Medical Care, 49(9): 857-864.* PMID 21577161
c. M. Bhargavan, J. Sunshine, **D.R. Hughes**, 2011. "Clarifying the Relationship between Financial Self-interest and Imaging" *American Journal of Roentgenology, 197(5): W891-899.* PMID 22021538.

2. Emerging payment models for medical services. Evolving health care reforms are rapidly pushing medical providers away from the fee-for-service model of care that dominates health care payments towards alternative payment models that reward value rather than service volume. As part of this effort, CMS has piloted several new models to include Accountable Care Organizations, Patient Centered Medical Homes, and episodic bundled payments. These new models are largely oriented toward primary care organizations and providers with little thought towards how specialty physicians can best participate. We examine how specialty physicians fit into these evolving models which a specific focus on setting appropriate prices, distributing payments across different providers involved in episodes of care, and mitigating the risk of high utilization outliers.

a. H. Zhang, C. Wernz, **D.R. Hughes**. 2018. "Modeling and Designing Health Care Payment Innovations for Medical Imaging," *Health Care Management Science, 21(1): 37-51*
b. **D.R. Hughes,** M. Jiang, G. McGinty, S. Shetty, R. Duszak. 2017. "An Empirical Framework for Breast Screening Bundled Payments," *Journal of the American College of Radiology, 14(1): 17-23*
c. E. Silva III, G. McGinty, **D.R. Hughes**, R. Duszak. 2016. "Alternative Payment Models in Radiology: The Legislative and Regulatory Roadmap for Reform," *Journal of the American College of Radiology, 13(10): 1176-1181*

3. The effect of innovation and the diffusion of information technology in medical care delivery. The development and adoption of new technology is the driving force behind all economic growth and productivity – including in the medical arena. This line of research seeks to quantify the effects of new technologies on the delivery of medical care at different levels of the health care system. Our previous work has examined how specific technologies create value to physicians and improve practice productivity. We are currently expanding this research to explore the effects of these technologies on patient outcomes as well.

a. D. Deyo, A. Khaliq, D. Mitchell, **D.R. Hughes**. 2018. "Electronic Sharing of Diagnostic Information and Patient Outcomes," *American Journal of Managed Care,24(1): 294-299*
b. G. Sadigh, T. Hertweck, C. Kao, P. Wood, **D.R. Hughes**, T. Henry, R. Duszak. 2015. "Traditional Text-Only vs. Multimedia Enhanced Radiology Reporting: Referring Physician's Perception of Value," *Journal of the American College of Radiology, 12(5): 519-524*
c. A. Khaliq, A. Mwachofi, **D.R. Hughes**, R. Broyles, D. Wheeler, R. Roswell, 2013. "The Current State of Electronic Health Record (EHR) Use in Oklahoma," *Journal of the Oklahoma State Medical Association, 106(2): 53-56*
d. J. Sunshine, **D.R. Hughes**, C. Meghea, M. Bhargavan, 2010. "What Factors Affect the Productivity and Efficiency of Physician Practices?" *Medical Care*, *48(2): 110-117.* PMID 20057329.

4. Patient access to medical imaging. Ensuring adequate access to care is a vital component of the "access-cost-quality" triple aim sought by health care policy makers. Access to care is more than just access to physicians but often access to coverage for specific procedures by payers or through changes in clinical guidelines. My research in this area seeks to understand access on both of these fronts. We have

examined the physical availability imaging services in different settings, such as within critical access hospitals, and utilization changes resulting from policies that may alter coverage.

a. S.K. Kang, M. Jiang, R. Duszak, S. Heller, **D.R. Hughes**, L. Moy. 2018. "Use of Breast Cancer Screening and Its Association with Later Use of Preventive Services among Medicare Beneficiaries," *Radiology, 288(3): 660-668*
b. K. Cox, R. Duszak, J. Hemingway, **D.R. Hughes**, S. Nandwana. 2016. "Reassessing Medicare Trends in Diagnostic CT Colonography after Achieving CPT Code Category I Status," *Abdominal Radiology, 41(7): 1357-1362*
c. M. Jiang, **D.R. Hughes**, R. Duszak. 2015. "Screening Mammography Rates in the Medicare Population before and after the 2009 US Preventive Services Task Force Guideline Change: An Interrupted Time Series Analysis," *Women's Health Issues, 25(3): 239-245*
d. M. Wintermark, H. Kroll, **D.R. Hughes**, R. Duszak. 2016. "Same Day Sinus and Brain CT Imaging in the Medicare Population: Are Practice Patterns Changing in Association with Medicare Policy Initiatives?" *American Journal of Neuroradiology, 37(6): 1000-1004*

5. Radiology workforce. Understanding the geographic distribution of health care providers and their associated skills are vital to ensuring the national health care workforce can meet health care needs. This research has developed a method of identifying radiologist sub-specialties and uses these classifications to examine trends in the geographic variation of radiologists.
    a. A. Rosenkrantz, W. Wang, **D.R. Hughes**, R. Duszak. 2018. "Generalist vs. Subspecialist Characteristics of the United States Radiologist Workforce." *Radiology, 286(3): 929-937*
    b. A. Rosenkrantz, L. Ginocchio, D. Rosman, W. Wang, **D.R. Hughes,** R. Duszak. 2017. "Academic Radiologist Subspecialist Identification using a Novel Claims-Based Classification System." *American Journal of Roentgenology, 208(6):1249-1255*
    c. A. Rosenkrantz, **D.R. Hughes**, R. Duszak. 2016. "The United States Radiology Workforce: An Analysis of Temporal and Geographic Variation Using Large National Datasets," *Radiology, 279(1): 175-185*

6. Public management of innovation. Because of the uncertainties inherent in new technology development, it can be difficult for government organizations to acquire research & development (R&D) intensive goods and services. Moreover, governments do not face the same market signals, such as prices and expected profits, which private firms use to manage investments in R&D because the acquisition may satisfy a political goal or furnish a common good that may not be abandoned. This line of research develops methods for mitigating the risk of government R&D intensive acquisitions.
    a. J. Eckhause, S.A. Gabriel, **D.R. Hughes**, 2012. "An Integer Programming Approach for Evaluating R&D Funding Decisions with Optimal Budget Allocations," *IEEE Transactions on Engineering Management, 59(4): 679-691*
    b. J. Eckhause, **D. R. Hughes**, S.A. Gabriel, 2009. "Evaluating Real Options for Mitigating Technical Risk in Public Sector R&D Acquisitions," *International Journal of Project Management, 27(4):365-377*
    c. **D.R. Hughes**, Y.W. Whitaker, D. Lee, J. Eckhause, 2008. "Advantages, Disadvantages, and Uses of Generalized Activity Networks for Schedule Estimation," *Military Operations Research, 13(3):27-40*

**D. Research Support**

**Ongoing Research Support**

Cost Reimbursement Agreement #138861
American College of Radiology PI: Hughes, Danny 8/18-7/23
*Health Economics and Analytics Lab (HEAL)*
This project establishes the Health Economics and Analytics Lab (HEAL). The HEAL is focused on applying big data analytics and artificial intelligence to large-scale medical databases to better understand how evolving health care delivery and payment models affect patients and providers.
Amount Awarded: $3,310,178 Role: PI

**Selected Completed Research Support**

Georgia Tech Small Bets Grant PI: Hughes, Danny 6/20-7/21
*Optimizing Lung Cancer Screening (LCS) for Vulnerable, High Risk Populations*
This study will develop an optimization model to determine where to establish new LCS programs to maximize geographic access to LCS screening for recommended vulnerable populations.
Amount Awarded: $71,247 Role: PI

1P30AR072572-01
National Institute of Arthritis and Musculoskeletal and Skin Diseases PI: Jarvik, Jeffrey 9/17-9/22
*UW Core Center for Clinical Research (CCCR) of Musculoskeletal Conditions*
This project establishes the Clinical Learning, Effectiveness and Research (CLEAR) Center to promote musculoskeletal clinical research The CLEAR Center will catalyze high-quality, multi-institutional collaborations for conducting clinical musculoskeletal studies and by providing analysis-ready data for scientific investigators.
Amount Awarded: $3,700,000 Role: Co-Investigator

American College of Radiology PI: Hughes, Danny 1/18-8/18
*The Effect of Emerging Health Care Delivery and Payment Models on the Provision of Medical Imaging Services*
This project examines the effects of the Affordable Care Act and the Medicare Access and CHIP Reauthorization Act (MACRA) on the utilization and provision of imaging services.
Amount Awarded: $74,885 Role: PI

HHSM-500-2011-00015I/HHSM-500-T0004
Centers for Medicare and Medicaid Services PI: Moser, Jim 12/11-12/12
*Post-Reform Consumer Landscape Market Analytics and Implementation*
This project performed state specific market analyses of ACA state insurance exchanges. Dr. Hughes served as the team lead for estimating issuer and health care provider supply. Contract included three option years.
Amount Awarded: $15,600,000 Role: Co-Investigator

Oklahoma Health Information Exchange Trust PI: Hughes, Danny 10/11-4/12
*Gap Analysis*
The project was the first phase of a comprehensive performance assessment and evaluation of the Oklahoma Health Information Exchange.
Amount Awarded: $195,093 Role: PI

American College of Radiology PI: Hughes, Danny 01/11-09/11
*Economics of Diagnostic Imaging*
The project examined the relationship between the quantity and type of imaging received by Medicare patients and the likelihood that these patients are admitted (or readmitted) and episode duration.
Amount Awarded: $65,000 Role: PI

Logistics Management Institute PI: Hughes, Danny 08/06-07/07
*Analytical Methods for Public Sector Acquisition Decisions*
This project developed real options models for: 1) optimizing R&D project portfolios and 2) determining optimal funding strategies for multi-year, multi-vendor vendor source selections to mitigate technical risk in public sector R&D acquisitions.
Amount Awarded: $90,000 Role: PI

Los Alamos National Laboratory PI: Colie, Dennis 09/02-03/03
*Electric Power and Natural Gas Outage Study*
This project evaluated the potential economic effects of electric power and natural gas outages due to terrorist attacks in the Tampa Bay region as a pilot program for a national critical infrastructure analysis.
Amount Awarded: $50,000 Role: Co-Investigator