

# MUGE CAPAN

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## RESEARCH INTERESTS

My research interests include predictive analytics with applications to healthcare systems.

- **Methodology:** Stochastic Decision Models, Data Mining, Statistical Analysis.
- **Applications:** Decision Support Systems, Clinical Decision Making, Community-based Healthcare, Healthcare Resource Allocation.

## TEACHING INTERESTS

I am interested in teaching both undergraduate and graduate level courses including, but not limited to: stochastic models, decision analysis, data science, and statistics.

## EDUCATION

2010 – 2014	<b>Ph.D. in Industrial and Systems Engineering</b> , North Carolina State University, Raleigh, NC (Minor in Operations Research)
Final GPA	4.0/4.0
Dissertation title	Optimal Patient-centered Response to Acute Physiological Deterioration of Hospitalized Patients (Advisor: Dr. Julie S. Ivy)
2005 – 2008	<b>M.Sc., Industrial Engineering</b> , Technical University of Berlin, Germany (Minor in Quality Management and Technical Chemistry)
Thesis title	Quality Assurance in Non-Interventional Studies (Advisor: Dr. Joachim Herrmann)
Final GPA	1.3 (~ 3.7/4.0 scale)
2002 – 2005	<b>B.Sc., Industrial Engineering</b> , Technical University of Berlin, Germany
Final GPA	1.3 (~ 3.7/4.0 scale)
1994 – 2002	<b>High School Diploma</b> , German Academy of Istanbul (DSI), Istanbul, Turkey, Recipient of 2002 DSI Business Association Scholarship

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## ACADEMIC EXPERIENCE

09/2022 – Present     **Assistant Professor**

- Department of Mechanical and Industrial Engineering, University of Massachusetts-, Amherst, MA
- Courses: MIE 397DH Fundamentals of Data Visualization

02/2019 – Present     **Adjunct Faculty**

- Edward P. Fitts Industrial and Systems Engineering Department, North Carolina State University, Raleigh, NC
- Responsibilities: Mentoring students, Dissertation Defense Committee member for PhD students

03/2018 – 08/2022     **Associate Clinical Professor**

- Decision Sciences & MIS Department, LeBow College of Business, Philadelphia PA
- Courses: Introduction to Business Analytics, Business Analytics Senior Project, Statistical Inference, Business Statistics, Business Analytics Capstone Project

07/2015 – 09/2015     **Adjunct Faculty**

- Decision Sciences & MIS Department, LeBow College of Business, Philadelphia PA
- Course: OR 990 Applied Health Systems Engineering

08/2013 – 05/2014     **Preparing the Professoriate Fellow**

- Nationally recognized academic program offered by North Carolina State University, Raleigh NC
- Funded fellowship selected through competition (One of 19 fellows selected university-wide)
- Co-Lecturer, 08/2013 – 12/2013, Course: ISE362 Stochastic Models in Industrial Engineering
- Lecturer, 01/2014 – 05/2014, Course: ISE362 Stochastic Models in Industrial Engineering

08/2012 – 05/2014     **Certificate of Accomplishment in Teaching Participant**

- Nationally recognized academic program offered by North Carolina State University, Raleigh NC
- Courses: ISE361 Deterministic Models in Industrial Engineering, ISE362 Stochastic Models in Industrial Engineering

08/2011 – 01/2014     **Teaching Assistant, North Carolina State University, Raleigh NC**

- Courses: ISE362 Stochastic Models in Industrial Engineering, ISE361 Deterministic Models in Industrial Engineering, ISE453 Design of Production, Logistics, and Service Systems

07/2013 – 08/2013     **Graduate Intern, Mayo Clinic, Rochester, MN**

- Compared the performance of various Early Warning Score systems
- Developed personalized decision models to support the time-sensitive clinical decisions

06/2012 – 05/2013     **Research Assistant, North Carolina State University, Raleigh NC**

- Bedside Patient Rescue Optimization project in collaboration with Mayo Clinic, Rochester, MN
- Performed statistical analyses of large patient database and developed stochastic models to improve the recognition and individualized response to physiological deterioration

06/2012 – 08/2012     **Graduate Intern, Mayo Clinic, Rochester, MN**

- Analyzed key components of physiological deterioration of the hospitalized patients in a general care setting with continuous abnormality in physiological measures
- Developed mathematical models to optimize medical emergency team activation decisions

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**INDUSTRY EXPERIENCE**

10/2015 – 2/2018     **Associate Director of Health Systems Optimization**

- Value Institute, Christiana Care Health System, Newark DE
- Development and implementation of health systems engineering and patient outcomes research

09/2014 – 10/2015     **Research Investigator**

- Value Institute, Christiana Care Health System, Newark DE
- Management of research and quality improvement projects in health services research

09/2008 – 05/2010     **Technology Consultant**

- ALTRAN Technologies, Wolfsburg, Germany
- Identification and statistical analysis of error reduction rates and prognosis of errors for radio and onboard electronic systems at Volkswagen

10/2007 – 01/2008     **Graduate Intern**

- Department of Medical Affairs and Clinical Operations, Sanofi-Aventis, Bad Soden, Germany
- Analyzed quality assurance methods of pharmaceutical trials in the post-licensing phase

06/2005 – 09/2005     **Undergraduate Intern**

- Pfizer GmbH, Istanbul, Turkey
- Analysis of performance in pharmaceutical production processes and operating procedures

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**TECHNICAL SKILLS**

- Statistical Software: R, SAS
- Mathematical Programming: IBM ILOG CPLEX Optimization Studio
- Simulation Software: Arena
- Database: SQL
- Quality Management: Six Sigma Green Belt Certificate

**LANGUAGE SKILLS**

English (fluent), German (fluent), Spanish (proficient), Turkish (native speaker)

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**GRANTS AND AWARDS**

10/2015 – 10/2018     Principal Investigator of the grant *SEPSIS: Sepsis Early Prediction Support Implementation System* funded by the NSF Smart and Connected Health (SCH) INT Collaborative Research. Program Solicitation NSF 13-543. NSF Proposal ID: 1833538.

12/2015 – 05/2017     Principal Investigator of the grant *Visual Sepsis Risk Profiling Model* funded by ACCEL Clinical and Translational Research (CTR) Pilot Grant Program. NIH U54 GM104941.

09/2016 – 09/2020     Co-Investigator of the RO1 grant *Signaling Sepsis: Developing a Framework to Optimize Alert Design* funded by the National Library of Medicine of the National Institutes of Health, Grant Number: 1R01LM012300-01A1. Award Number: R01LM012300.

01/2017 – 12/2017     Co-Investigator of the grant *SEPTIC: Sepsis Evidence-based Presentation to Inform Clinical Decisions* funded by ACCEL Clinical Translational Research (CTR) Shovel Ready Pilot Grant. NIH U54 GM104941.

05/2014 – 04/2019     Collaborator on the grant NIGMS (Stanhope Overall PI/ Siegel at Christiana Care) Delaware INBRE III. Award Number: P20 GM103446.

10/2019                 Winner of the 2019 INFORMS Women in ORMS Family Care Award.

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## PUBLICATIONS

**Capan, M.**, Schubel, L., Pradhan, I., Catchpole, K., Shara, N., Arnold, R., Schwartz, J., Seagull, F., Miller, K. (2022). Display and Perception of Risk: Analysis of Decision Support System: Display and its Impact on Perceived Clinical Risk of Sepsis-induced Health Deterioration. *Health Informatics Journal*. 28(1):14604582211073075. doi: 10.1177/14604582211073075

Rosenstrom, E., Meshkinfam, S., Ivy, J. S., Goodarzi, S. H., **Capan, M.**, Huddleston, J., & Romero-Brufau, S. (2022). Optimizing the First Response to Sepsis: An Electronic Health Record-Based Markov Decision Process Model. *Decision Analysis*.

Jazayeri, A., Yang, C., & **Capan, M.** (2022) Frequent Temporal Patterns of Cellular and Physiological Responses' Dynamics and Their Evolution in Sepsis. *Artificial Intelligence In Medicine*. (Under review)

Jazayeri, A., **Capan, M.**, Ivy, J., Arnold, R., & Yang, C. C., (2021). Proximity of Cellular and Physiological Response Failures in Sepsis. *IEEE Journal of Biomedical and Health Informatics (J-BHI)*.

Smith, A. E. (2019). To Be Healthy, Wealthy, and Wise: Using Decision Modeling to Personalize Policy in Health, Hunger Relief, and Education. In *Women in Industrial and Systems Engineering*. (pp. 233-274). Retrieved from: <https://link.springer.com/book/10.1007/978-3-030-11866-2>.

Agor, J., Ozaltin, O.Y., Ivy, J.S., **Capan, M.**, Arnold, R., & Romero, S (2019). The value of missing information in severity of illness score development. *Journal of Biomedical Informatics*, 97, 103255. doi: 10.1016/j.jbi.2019.103255.

Prints, M., Fishbein, D., Arnold, R., Stander, E., Miller, K., Kim, T., & **Capan, M.** (2019). Understanding the perception of workload in the emergency department and its impact on medical decision making. *American Journal of Emergency Medicine*. doi: 10.1016/j.ajem.2019.07.021.

Jazayeri, A., **Capan, M.**, Yang, C., Khoshnevisan, F., Chi, M., & Arnold, R. (2019). Network-Based Modeling of Sepsis: Quantification and Evaluation of Simultaneity of Organ Dysfunctions. In the 10th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM BCB). doi: 10.1145/3307339.3342160.

Jazayeri, A., **Capan, M.**, Yang, C., Nambiar, S., Mayorga, M., Ivy, J., & Arnold, R. (2019, September). Simulating Uncertainty of Early Warning Scores in Sepsis Detection. In *Proceedings of the 10th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics* (pp. 543-543).

Schubel, L., Littlejohn, R., Romero Barrientos, R., Arnold, R., **Capan, M.**, & Miller, K. (2019). Everything but the Kitchen Sink: A Mixed Methods Approach to Health IT Usability Testing. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting 2019*. In Press.

Schubel, L., Weldon, D., Blumenthal, J., **Capan, M.**, Arnold, R., Kowalski, R., Seagull, F.J., Catchpole, K., Schwartz, J., Franklin, E., Littlejohn, R., & Miller K (2019). Informatics and Interaction: Applying Human Factors Principles to Optimize the Design of Clinical Decision Support for Sepsis. *Health Informatics Journal*, 1460458219839623. doi: 10.1177/1460458219839623.

- Capan, M.**, Hoover, S., Ivy, J., Miller, K., & Arnold, R. (2018). Not all organ dysfunctions are created equal – prevalence and mortality in sepsis. *Journal of Critical Care*, 48:257-262. doi: 10.1016/j.jcrc.2018.08.021.
- Capan, M.**, Hoover, S., Miller, K., Pal, C., Glasgow, J., Jackson, E.V., & Arnold, R. (2018). A data-driven approach to early warning score-based alert management. *BMJ Open Qual*, 7(3), e000088. doi: 10.1136/bmjoc-2017-000088.
- Li, B., Zhang, S., Hoover, S., Arnold, R., & **Capan, M.** (2018). Microsimulation Model Using Christiana Care Early Warning System (CEWS) to Evaluate Physiological Deterioration. *IEEE Journal of Biomedical and Health Informatics*, doi: 10.1109/JBHI.2018.2874185.
- Lin, C., Zhang, Y., Ivy, J., **Capan, M.**, Arnold, R., Huddleston, J.M., & Chi, M. (2018). Early Diagnosis and Prediction of Sepsis Shock by Combining Static and Dynamic Information Using Convolutional-LSTM. In 2018 IEEE International Conference on Healthcare Informatics (ICHI) (pp. 219-228).
- Miller, K., **Capan, M.**, Mosby, D., Noaiseh, Y., Kowalski, R., Kraft, R., Schwartz, S., Weintraub, W.S., & Arnold, R. (2018). The design of decisions: matching clinical decision support recommendations to Nielsen's design heuristics. *International Journal of Medical Informatics*, 117, 19-25. doi: 10.1016/j.ijmedinf.2018.05.008.
- Long, D., **Capan, M.**, Mascioli, S., Mosby, D., Arnold, R., & Miller, K. (2018). Evaluation of user interface alert displays for sepsis clinical decision support. *Critical Care Nursing*, 38(4) 46-52. doi: 10.4037/ccn2018352.
- Nataraj, N., Ivy, J.S., Huddleston, J., Arnold, R., & **Capan, M.** (2018), "What's in a Definition? A Simulation Framework for Modeling Sepsis Interventions Using Electronic Health Records," Proceedings of the Winter Simulation Conference 2018, In Press.
- Capan, M.**, Mosby, D., Miller, K., Tao, J., Wu, P., Weintraub, W.S., Kowalski, R., & Arnold, R. (2017). A Framework to Tackle Risk Identification and Presentation Challenges in Sepsis. *American Journal of Hospital Medicine*. doi: 10.24150/ajhm/2018.002.
- Capan, M.**, Pigeon, J., Marco, D., Powell, J., & Groner, K. (2017). We All Make Choices: A Decision Analysis Framework for Disposition Decision in the Emergency Department. *The American Journal of Emergency Medicine*, 36(3), 450-454. doi: 10.1111/j.1553-2712.1998.tb02777.x
- Capan, M.**, Khojandi, A., Denton, B.T., Williams, K.D., Ayer, T., Chhatwal, J., Kurt, M., Mason Lobo, J., Roberts, M.S., Zaric, G., Zhang, S., & Schwartz, J.S. (2017). From Data to Improved Decisions: Operations Research in Healthcare. *Medical Decision Making*, 37(8), 849-859. doi: 10.1177/0272989X17705636
- Capan, M.**, Hoover, S., Jackson, E.V., Paul, D., & Locke, R. (2017). Integrating Nurse Preferences and Organizational Priorities into Nurse Schedules – Application to the Neonatal Intensive Care Unit. In IIE Annual Conference Proceedings. Institute of Industrial Engineers-Publisher.

Kowalski, B., **Capan, M.**, Lodato, P., Thomas, T., Mosby, D., Arnold, R., & Miller K. (2017). Optimizing usability and signal capture: a proactive risk assessment for the implementation of a wireless vital sign monitoring system. *Journal of Medical Engineering and Technology*, 41(8):623-629. doi: 10.1080/03091902.2017.1382589.

Miller, K., Mosby, D., **Capan, M.**, Kowalski, R., Ratwani, R., Noaiseh, Y., Kraft, R., Schwartz, S., Weintraub, W.S., & Arnold, R. (2017). Interface, information, interaction: a narrative review of design and functional requirements for clinical decision support. *Journal of the American Medical Informatics Association*, 25(5):585-592. doi: 10.1093/jamia/ocx118.

Miller, K., Kowalski, R., **Capan, M.**, Wu, P., Mosby, D., & Arnold, R. (2017). Assessment of nursing response to a real-time alerting tool for sepsis: a provider survey. *American Journal of Hospital Medicine*, 1(3):2017.021.

Zhan, Y., Lin, C., Chi, M., Ivy, J.S., **Capan, M.**, & Huddleston, J.M. (2017). LSTM for Septic Shock Prediction Using Multi-Scale Imperfect Labels. IEEE International Conference on Big Data 2017. Accepted as regular paper.

**Capan, M.**, Hoover, S., Jackson, E.V., Paul, D., & Locke, R. (2016). Time Series Analysis for Forecasting Hospital Census: Application to the Neonatal Intensive Care Unit. *Applied Clinical Informatics*, 7(2):275-89. doi: 10.4338/ACI-2015-09-RA-0127.

Miller, K., Arnold, R., **Capan, M.**, Coffey Zern, S., Dressler, R., Duru, O., Ebbert, G., Jackson, E., Learish, J., Strauss, D., Wu, P., & Bennett, D. (2016) Improving Infusion Pump Safety through Usability Testing. *Journal of Nursing Care Quality*, 32(2):141-149. doi: 10.1097/NCQ.0000000000000208.

**Capan, M.**, Wu, P., Campbell, M., Mascioli, S., & Jackson, E.V. (2015). Using Electronic Health Records and Nursing Assessment to Redesign Clinical Early Recognition Systems. *Health Systems*, 6(2):112-121.

**Capan, M.**, Ivy, J.S., Wilson, J.R., & Huddleston, J.M. (2015). A stochastic model of acute-care decisions based on patient and provider heterogeneity. *Health Care Management Science*, 20(2), 187-206. doi: 10.1007/s10729-015-9347-x.

Miller, K.E., **Capan, M.**, Wu, P., Jackson, E.V., & Arnold, R. (2015). Operationalizing Sepsis Alert Design and Clinical Decision Support: Developing Enhanced Visual Display Models. Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care, 4(1):103-109. doi: 10.1177/2327857915041032.

Miller, K.E., **Capan, M.**, Wu, P., Jackson, E.V., & Arnold, R. (2015). Sepsis Alert Presentation: Developing a Framework to Optimize Alert Design for Clinical Decision Support. Proceedings of the 2015 International Annual Human Factors and Ergonomics Society Meeting. Forthcoming.

**Capan, M.**, Ivy, J.S., Rohleder, T., Hickman, J., & Huddleston, J.M. (2014). Individualizing and optimizing the use of early warning scores in acute medical care for deteriorating hospitalized patients. *Resuscitation*, 93:107-12. doi:10.1016/j.resuscitation.2014.12.032.

**Capan, M.**, Ivy, J.S. (2013). Optimizing Rapid Response Decisions to Improve Inpatient Care. In IIE Annual Conference Proceedings, 3560-3569. Institute of Industrial Engineers-Publisher.

**Capan, M.**, Ivy, J.S. (2012). Optimization of Treatment Initiation Decision for Patients with Alzheimer's Disease. In IIE Annual Conference. Proceedings, 1-10. Institute of Industrial Engineers-Publisher.

Theobald, K., **Capan, M.**, Herbold, M., Schinzel, S., & Hundt F (2009). Quality assurance in non-interventional studies. *Journal of German Medical Science*. doi: 10.3205/000088.

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#### **POSTER PRESENTATIONS**

Jazayeri, A., **Capan, M.**, Yang, C., Nambiar, S., Mayorga, M., Ivy, J., & Arnold, R. (2019, September). *Simulating Uncertainty of Early Warning Scores in Sepsis Detection*. In Proceedings of the 10th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics (pp. 543-543). ACM.

Profozich, A., Sytsma, T., Arnold, R., Miller, K., Kim, T., & **Capan, M.** (2019, March). *Forecasting the Unexpected Transfer to Upgraded Resources in Sepsis*. American Academy of Emergency Medicine's 25th Annual Scientific Assembly, Las Vegas, NV.

Prints, M., Profozich, A., **Capan, M.**, Fishbein, D., Stander, E., & Arnold, R. (2019, March). *The Burden of Emergency Medicine: Understanding the Perception of Workload in the Emergency Department and its Impact on Medical Decision Making*. International Symposium on Human Factors and Ergonomics in Health Care, Chicago IL.

Miller, K., Kowalski, R., **Capan, M.**, Mosby, D., & Arnold, R. (2018, May). *Sepsis Gamification as a Strategy for Healthcare Improvement*. National Patient Safety Congress, Boston, MA.

**Capan, M.**, Hoover, S., Miller, K., Pal, C., Glasgow, J., & Arnold, R. (2017, December). *A data-driven approach to early warning score-based alert management*. Academy Health 10th Annual D&I Conference, Arlington, VA.

**Capan, M.**, Ivy, J., Huddleston, J.M., Miller, K., & Arnold, R. (2017, September). *So You Think You Have Data – An Operational Framework for an EHR-based Sepsis Solution*. International Sepsis Forum, Paris, France.

**Capan, M.**, Hoover, S., Ivy, J., Huddleston, J.M., Miller, K., & Arnold, R. (2017, September). *Infections and organ failures: a single center study of prevalence and mortality*. International Sepsis Forum, Paris, France.

Schuchardt, B., **Capan, M.**, Linder, A., Åkesson, P., Kowalski, R., Miller, K., & Arnold, R. (2017, September). *The ability of Heparin-Binding Protein to identify delayed shock in Emergency Department sepsis patients is impacted by age and source of infection*. International Sepsis Forum, Paris, France.

Mosby, D., **Capan, M.**, Miller, K., Kowalski, R., Schuchardt, B., Kolm, P., Kraft, R., & Arnold, R. (2017, September). *Severity of illness scoring systems for prognosis and risk stratification of sepsis: a systematic review and comparative analysis*. International Sepsis Forum, Paris, France.

- Miller, K., Mosby, D., McKenzie, K., Branaghan, R., **Capan, M.**, Schuchardt, B., Kowalski, R., Blumental, J., Franklin, E., & Arnold, R. *Signaling Sepsis: Understanding Clinician Mental Models for Sepsis Diagnosis*. International Sepsis Forum, Paris, France.
- Miller, K., **Capan, M.**, Mosby, D., Kowalski, R., Kraft, R., Schuchardt, B., Schwartz, S., Seagull, J., Catchpole, K., & Arnold, R. (2017, May). *Sepsis Survivor Network*. Delaware Clinical Translational Research (CTR) ACCEL Community Research Exchange Conference, Newark, Delaware.
- Hoover, S., **Capan, M.**, Kraft, R., Miller, K., Kowalski, R., King, K., & Locke, R. (2017, May). *Predicting Pediatric Asthma-Related Admissions Using Public Air Quality Data*. Delaware Clinical Translational Research (CTR) ACCEL Community Research Exchange Conference, Newark, Delaware.
- Kowalski, R., Kraft, R., **Capan, M.**, Hoover, S., Miller, K., Noaiseh, Y., Surampudy, A., Ting, E., & Arnold, R. (2017, March). *Value Institute Design Lab*. Delaware Clinical Translational Research (CTR) ACCEL Annual Meeting, Newark, Delaware.
- Miller, K., **Capan, M.**, Mosby, D., Kowalski, R., Schwartz, S., Catchpole, K., & Arnold, R. (2017, March). *Sepsis Shadowboxing: Teaching through Insights*. Delaware Clinical Translational Research (CTR) ACCEL Annual Meeting, Newark, Delaware.
- Miller, K., **Capan, M.**, Mosby, D., Jackson, E., Seagull, J., Catchpole, K., Schwartz, S., & Arnold, R. (2017, March). *Bringing our Toys to your Sandbox: Developing Database Driven EMR Indifferent Sepsis Alerts*. Human Factors and Ergonomics in Health Care, New Orleans, Louisiana.
- Miller, K., **Capan, M.**, Hoover, S., Kowalski, R., Kraft, R., Noaiseh, Y., Surampudy, A., Ting, E., & Arnold, R. *If (Integrating Data, Design, and Technology): Print ("Value Institute Design Lab")*. Human Factors and Ergonomics in Health Care, New Orleans, Louisiana.
- Noaiseh, Y., Miller, K., **Capan, M.**, Mosby, D., & Arnold, R. (2017, March). *Applying User-Interface Design Heuristics on Computerized Clinical Decision Support Systems*. Human Factors and Ergonomics in Health Care, New Orleans, Louisiana.
- Glasgow, J.M., **Capan, M.**, Hoover, S., Mascioli, S., & Jackson, E.V. (2016, December). *Bringing Early Warning Systems into the Digital Age*. Institute for Healthcare Improvement Scientific Symposium, Orlando, Florida.
- Miller, K., **Capan, M.**, Mosby, D., Kowalski, R., Wu, P., & Arnold, R. (2016, December). *Visual Sepsis Risk Profiling Model Development and Evaluation*. Global Digital Health Forum, Washington, DC.
- Hoover, S., **Capan, M.**, Miller, K., Kowalski, R., Kraft, R., Noaiseh, Y., Surampudy, A., Ting, E., & Arnold, R. (2016, November). *If (Integrating Data, Design, and Technology): Print ("Value Institute Design Lab")*. Clinical Diagnostics and Research, Virtual Conference.
- Capan, M.**, Hoover, S., Glasgow, J., Mascioli, S., & Jackson, E.V. (2016, October). *Validation and Integration of a Predictive Warning System Combining Physiological Measures and Bedside Evaluations*. Society of Medical Decision Making (SMDM) Annual Meeting, Vancouver, Canada.

**Capan, M.**, Nataraj, N., Lin, L., Chi, M., Ivy, J., & Arnold, R. (2016, October). *Evaluation of the Impact of Comorbidities and Pre-existing Conditions on Sepsis Presentation*. Society of Medical Decision Making (SMDM) Annual Meeting, Vancouver, Canada.

Arnold, R., **Capan, M.**, Akesson, P., & Linder, A. (2016, March). *Impact of disease severity assessment on performance of Heparin-Binding Protein for the prediction of septic shock*. The International Symposium on Intensive Care and Emergency Medicine, Brussels, Belgium.

**Capan, M.**, Miller, K., Wu, P., Mosby, D., Tao, J., & Arnold, R. (2016, February). *Visual Sepsis Risk Profiling Model*. Delaware IDeAs Conference, Newark, Delaware.

**Capan, M.**, Wu, P., Campbell, M., Mascioli, S., & Jackson, E.V. (2015, October). *Using Technology and Provider Assessment to Redesign Clinical Recognition Systems*. Society of Medical Decision Making (SMDM) Annual Meeting, St. Louis, Missouri.

Miller, K., **Capan, M.**, Jackson, E.V., & Arnold, R. (2015, May). *A Human Factors Framework for Optimizing Sepsis Alert Design for Clinical Decision Support*. The United Kingdom Sepsis Trust 'Sepsis Unplugged' Conference, Nottingham, United Kingdom.

Miller, K., **Capan, M.**, Jackson, E.V., & Arnold, R. (2015, May). *Implementing a Sepsis Process of Care Assessment to Provide Patient-Specific Feedback to Clinicians*. The United Kingdom Sepsis Trust 'Sepsis Unplugged' Conference, Nottingham, United Kingdom.

**Capan, M.**, Ivy, S., & Huddleston, J. (2013, October). *Optimal Patient-centered Response to Acute Physiological Deterioration of Hospitalized Patients*. Society of Medical Decision Making Annual Meeting, Baltimore, Maryland.

**Capan, M.**, Ivy, S., & Huddleston, J. *Optimal Patient-centered Resuscitation for Hospitalized Patients Using Electronic Medical Records*. INFORMS Annual Meeting. Selected presenter at the Minority Issues Forum (MIF) Poster Competition, Minneapolis, Minnesota.

**Capan, M.**, Ivy, S., & Huddleston, J. (2013, May). *Optimal Patient-centered Response to Acute Physiological Deterioration of Hospitalized Patients*. IIE Annual Conference and Expo. Awarded Third Place Prize at the Doctoral Colloquium Poster Competition. San Juan, Puerto Rico.

**Capan, M.**, & Ivy, S. (2011, November). *A Dynamic Decision Making Model for Alzheimer's Disease*. INFORMS Annual Meeting, Charlotte, North Carolina.

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#### CONFERENCE PRESENTATIONS

**Capan, M.**, Jazayeri, A., Yang, C., Chi, M., Ivy, J.S., Huddleston, J.M., & Arnold, R. (2019, October). *Analysis of Temporal Patterns of Sepsis-related Cellular and Physiological Responses to Inform Personalized Prediction of Mortality*. INFORMS Annual Meeting, Seattle, WA.

Ramzy, M., **Capan, M.**, Sajadi-Ernazarova, K., Arnold, R., & Ramoska, E. (2019, May). *A Predictive Analytics Approach to Identify Indicators of Deterioration in Admitted Emergency Department Patients*. Society of Academic Emergency Medicine, Las Vegas, NV.

**Capan, M.**, Hoover, S., Ivy, J., Miller, K., & Arnold, R. (2018, October). *Not All Organ Dysfunctions Are Created Equal – Prevalence and Mortality in Sepsis*. Society of Medical Decision Making, Montreal, Canada.

**Capan, M.**, Jazayeri, A., Ivy, J., Miller, K., & Arnold, R. (2018, September). *Learning from Data Application of Healthcare Analytics to Predict & Prevent Sepsis*. MedStar Health Research Institute Research Symposium, Bethesda, MD.

**Capan, M.**, Ivy, J., Agor, J., Goodarzi, S.H., Miller, K., Huddleston, J.M., & Arnold, R. *Using Advanced Analytics In Healthcare To Predict Sepsis Risk & Patient Outcome*. INFORMS Business Analytics, Baltimore, MD.

**Capan, M.**, Ivy, J., Huddleston, J., Chi, M., Hoover, S., & Arnold, R. (2018, April). *Sepsis Early Prediction Support Implementation System*. Academy Health Datapalooza, Washington DC.

Blumenthal, J., Mosby, D., Branaghan, R., **Capan, M.**, Arnold, R., McKenzie, K., & Miller, K. (2018, April). *Crowd-Sourcing Mental Models: Collecting Data for the Application of Diagnostic Support Systems*. Academy Health Datapalooza, Washington, DC.

Kowalski, R., Miller, K., **Capan, M.**, Mosby, D., & Arnold, R. (2018, March). *FUTURES: Forecasting the Unexpected Transfer to Upgraded Resources in Sepsis*. International Symposium on Human Factors and Ergonomics in Health Care, Boston, MA.

Miller, K., Mosby, D., Blumenthal, J., McKenzie, K., **Capan, M.**, Arnold, R., Kowalski, R., Seagull, F.J., Catchpole, K., Franklin, E., & Branaghan, R. (2018, March). *Engineering the Future of Sepsis Care: An Application of Fuzzy Logic Cognitive Mapping for Sepsis Diagnosis*. International Symposium on Human Factors and Ergonomics in Health Care, Boston, MA.

Miller, K., McKenzie, K., Mosby, M., Blumenthal, J., **Capan, M.**, Arnold, R., & Branaghan, R. (2017, December). *Engineering the Future of Sepsis Care: An Application of Fuzzy Logic Cognitive Mapping for Sepsis Diagnosis*. Institute for Healthcare Improvement, Orlando, FL.

**Capan, M.**, Kowalski, R., Miller, K., Mosby, D., & Arnold, R. (2017, October). *FUTURE: Forecasting the Unexpected Transfer to Upgraded Resources in Sepsis*. INFORMS Annual Meeting, Houston, TX.

**Capan, M.**, Ivy, J.S., Huddleston, J.M., & Arnold, R. (2017, October). Session chair of “Smart and Connected Health”, Presentation on *Translating Prediction to Decision: A Framework to Tackle Risk Identification and Presentation Challenges in Sepsis*. INFORMS Annual Meeting, Houston, TX.

**Capan, M.**, Hoover, S., Ivy, J.S., Huddleston, J.M., & Arnold, R. (2017, October). *Sepsis and Organ Failures: A Single Center Study of Prevalence And Mortality*. INFORMS Annual Meeting, Houston, TX.

Hoover, S., **Capan, M.**, Miller, K., & Arnold, R. (2017, October). *Data-Driven Approach to Early Warning System Implementation*. INFORMS Annual Meeting, Houston, TX.

**Capan, M.**, Hoover, S., Jackson, E.V., Paul, D., & Locke, R. (2017, May). *Integrating Nurse Preferences and Organizational Priorities into Nurse Schedules – Application to the Neonatal Intensive Care Unit*. IIE Annual Conference and Expo, Pittsburgh, PA.

**Capan, M.**, Nataraj, N., Ivy, J., Wilson, J., Arnold, R., & Huddleston, J. (2017, May). *Personalizing Intervention Strategies for Multimorbid Patients with Sepsis*. IIE Annual Conference and Expo, Pittsburgh, PA.

Arnold, R., **Capan, M.**, Tao, J., Åkesson, P., & Linder, A. (2017, May). *Impact of disease severity assessment on performance of Heparin-Binding Protein and Procalcitonin for the prediction of septic shock*. Society for Academic Emergency Medicine, Orlando, FL.

McKittrick, J., Schuchardt, B., **Capan, M.**, Wu, P., & Arnold, R. (2017, May). *Quantifying the added value of Endotoxin Activity Assay to risk stratify Emergency Department sepsis patients*. Society for Academic Emergency Medicine, Orlando, FL,

Hoover, S., **Capan, M.**, Kraft, R., King, K., Jackson, E.V., & Locke, R. (2017, March). *Predicting Pediatric Asthma-Related Admissions Using Public Air Quality Data*. Eastern Society for Pediatric Research (ESPR) Annual Meeting, Philadelphia, PA.

**Capan, M.**, Miller, K., Mosby, D., Tao, J., Wu, P., & Arnold, R. (2017, March). *Visual Sepsis Risk Profiling Model*. Delaware Clinical Translational Research ACCEL Annual Meeting, Newark, DE.

Mosby, D., **Capan, M.**, & Miller, K. (2017, March). *Improving the Clinical Utility of Predictive Models in Obstetrics: An Innovative Application to Chorioamnionitis*. Human Factors and Ergonomics in Health Care, New Orleans, Louisiana.

Ivy, J., Nataraj, N., **Capan, M.**, Arnold, R., & Wilson, J. (2017, January). *Intervention Strategies for Complex Patients with Sepsis*. INFORMS Computing Society (ICS) Conference, Austin, TX.

**Capan, M.**, & Romero Brufau, S. (2016, September). *Getting to Patients Before They Die*. The 2nd National Consortium for Innovation at Mayo Clinic, Rochester, MN.

**Capan, M.**, Hoover, S., Glasgow, J.M., Mascioli, S., & Jackson, E.V. (November, 2016). *Validation And Implementation Of Early Warning System To Synthesize Acuity, Clinical Judgment, And Workload*. INFORMS Annual Meeting. Session chair of “Applications of Health Systems Analytics”, Nashville, TN.

Nataraj, N., Ivy, J., **Capan, M.**, Arnold, R., & Wilson, J. (2016, November). *Sepsis Early Prediction Support Implementation System*. INFORMS Annual Meeting, Nashville, TN.

**Capan, M.**, Hoover, S., & Locke, R. (2015, November). *Nurse Scheduling Optimization in the Neonatal Intensive Care Unit*. INFORMS Annual Meeting. Session chair of “Data-driven Healthcare Operations”, Philadelphia, PA.

Miller, K., **Capan, M.**, Wu, P., Jackson, E., & Arnold, R. (2015, October). *Sepsis Alert Presentation: Developing a Framework to Optimize Alert Design for Clinical Decision Support*. HFES International Annual Meeting of the Human Factors and Ergonomics Society, Las Angeles, CA.

Miller, K., **Capan, M.**, Wu, P., Jackson, E.V., & Arnold, R. (2015, April). *Operationalizing Alert Design for Clinical Decision Support*. HFES International Symposium on Human Factors and Ergonomics in Health Care: Improving the Outcomes, Baltimore MD.

**Capan, M.**, Ivy, J., & Huddleston, J.M. (2014, November). *Informing Resuscitation Decisions in Acute Care by Capturing Provider-specific Model Uncertainty*. INFORMS Annual Meeting, San Francisco, CA.

**Capan, M.**, Ivy, J., & Huddleston, J.M. (2013, October). *Individualizing and Optimizing the Use of Early Warning Score Systems in the Acute Medical Care Setting*. INFORMS Annual Meeting, Minneapolis, MN.

**Capan, M.**, Ivy, J., & Huddleston, J.M. (2013, June). *Optimal Patient-centered Response to Acute Physiological Deterioration of Hospitalized Patients*. INFORMS Healthcare, Chicago, IL.

**Capan, M.**, & Ivy, J. (2013, May). *Optimizing Rapid Response Decisions to Improve Inpatient Care*. IIE Annual Conference and Expo. Session Chair of “Stochastic Models and Applications in Medical Decision Making”, San Juan, Puerto Rico.

**Capan, M.**, & Ivy, J. (2012, October). *Modeling to Inform Proactive Management of Inpatient Care*. INFORMS Annual Meeting, Phoenix, AZ.

**Capan, M.**, & Ivy, J. (2012, May). *Optimization Decision for Patients with Alzheimer’s Disease*. IIE Annual Conference and Expo, Orlando, FL.

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## MENTORING

9/2021 – Present      Mentoring graduate student Yusi Wei (**Drexel University**)

- Analysis of the tradeoff between protection of data privacy and information loss using non-linear optimization and clustering methods applied to Electronic Health Records data

4/2022 – Present      Mentoring undergraduate student Anh Truong (**Drexel University**)

- Analysis of nurses’ and physicians’ clinical risk perception associated with hospitalized sepsis patients and the relationship between provider characteristics, information amount and display type using descriptive and statistical analysis

4/2021 – Present      Mentoring undergraduate students Ishika Pradhan and Utkarsh Panchal (**Drexel University**)

- Analysis of business attraction and retention opportunities in Greater Philadelphia region, ranking and classification of business outreach activities for Philadelphia Chamber of Commerce using large scale public domain data sources such as Gazelle.ai

- 6/2020 – 10/2020      Mentored undergraduate student Aasha Gupta and graduate student Benjamin Osei-Poku (**Drexel University**)
- Analysis of patient volume, primary diagnosis, and uncertainty in categorization of clinical signals during the COVID-19 pandemic using statistical methods
- 10/2018 – 09/2019      Mentored undergraduate students Temilolaoluwa Daramola and Suhrudh Daaram (**Drexel University**)
- Applied descriptive and predictive models to study the impact of timing and volume of fluids in sepsis population on clinical trajectories and outcomes for hospitalized patients
- 07/2018 – 09/2019      Mentored PhD candidate Ali Jazayeri and undergraduate student Alexa Profozich (**Drexel University**)
- Developing network models to personalize sepsis diagnosis and prediction of mortality
  - Quantitative analysis of uncertainty and information value associated with severity of illness scoring systems in diagnosis of sepsis and forecasting of clinical trajectories
- 07/2018 – 06/2019      Mentored undergraduate student Daniela Fishbein (**Thomas Jefferson University**)
- Narrative review of quantitative and objective measurement of provider workload in healthcare settings utilizing electronic health records
- 06/2017 – 08/2017      Mentored undergraduate students Kelly White, Jaliyah Scott, Kayla Cherry and Surag Baichwal (**North Carolina State University**)
- Supported by the National Science Foundation Smart and Connected Health Research Experiences for Undergraduates (REU) program
  - Analyzing the patient care processes in the Emergency Department to determine areas of improvement
- 06/2017 – 08/2017      Mentored undergraduate student Jessica Pigeon (**University of Delaware**)
- Observation and analysis of Emergency Department patient and work flow
  - Analyzing and visualizing the disposition decision process in the Emergency Department
- 06/2017 – 08/2017      Mentored PhD candidate Shadi Hassani Goodarzi (**North Carolina State University**)
- Developed Markovian models to capture patient trajectories in the infection and sepsis population
  - Determine and assess optimal policies with regards to diagnostic and therapeutic interventions
- 06/2017 – 08/2017      Mentored PhD candidate Siddhartha Nambiar (**North Carolina State University**)
- Developing system-level dynamic models to understand process flow of septic patients
  - Predicting demand for resources to study and optimize system-level resource allocations under dynamically changing system states
- 03/2017 – 05/2017      Mentored undergraduate Brett Schuchardt (**University of Delaware**)
- Predictive modeling using Heparin Binding Protein for Sepsis Patients
  - Quantifying the impact of Endotoxin Activity Assay on Risk Stratification of Sepsis Patients

- 02/2017 – 05/2017     Mentored PhD candidate Bin Li (**University of Arkansas**)
- Optimization of nurse resource allocation for the Christiana Care Early Warning System project
  - Microsimulation for policy evaluation of the Christiana Care Early Warning System project
- 09/2016 – 03/2017     Mentored undergraduate student Elliot Ting (**University of Delaware**)
- Cost modeling and analysis of the Christiana Care Early Warning System project
- 09/2016 – 12/2016     Mentored undergraduate student Nicole DiPasqual (**University of Delaware**)
- Personalizing Christiana Early Warning Score - Patient Clustering Using Network Theory
- 06/2016 – 08/2016     Mentored PhD candidate Nisha Nataraj (**North Carolina State University**)
- Developing analytical models to determine the impact of comorbidities and pre-existing conditions on sepsis presentation using discrete event simulation and system dynamics
- 06/2016 – 08/2016     Mentored PhD candidate Liana Lin (**North Carolina State University**)
- Combining observations and providers' documentation using Natural Language Processing
  - Analysis and development of sepsis risk stratification models using Hidden Markov models
- 04/2016 – 06/2016     Mentored MS student Whitney York (**Drexel University**)
- Risk Stratification and Statistical Modeling of Perinatal Care Process project
  - Data analysis and developing analytical models to measure and evaluate the relationship between delivery, medical history, patient demographics and process-related elements
- 01/2016 – 05/2016     Mentored MS student Jun Tao (**University of Delaware**)
- Visual Risk Profiling Model project
  - Data mining and statistical modeling in focusing on patients at risk of, or developing, sepsis and sepsis-induced deterioration - funded by ACCEL Clinical and Translational Research (CTR) Pilot Grant Program
- 07/2015 – 12/2015     Mentored MS student Stephen Hoover (**Drexel University**)
- Forecasting and staff scheduling optimization in the Neonatal Intensive Care Unit project
  - Predictive analytics and econometrics methods applied for Pediatric Asthma/ED admission prediction modeling
- 09/2015 – 12/2015     Mentored undergraduate student Nkoli Agbazue (**University of Delaware**)
- Data analysis on Early Warning System- threshold investigation and clinical decision support development using nursing interventions utilizing staff surveys
- 09/2015 – 03/2016     Mentored undergraduate student Alexandra Nightingale (**University of Delaware**)
- Literature review and manuscript development support for Identifying risk factors for Postpartum Obstetric Hemorrhage project

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#### **PROFESSIONAL MEMBERSHIPS**

- 09/2013 – Present     Society of Medical Decision Making (SMDM) member
- 09/2011 – Present     Institute for Operations Research and the Management Sciences (INFORMS) member. Member of: Women in ORMS, INFORMS Minority Issues Forum

02/2015 – 10/2018 Society of Medical Decision Making (SMDM) Operations Research Interest Group Leader  
05/2016 – 02/2018 Center for Applications of Mathematics in Medicine, University of Delaware  
12/2012 – 09/2014 Alpha Pi Mu member, North Carolina State University

**PROFESSIONAL SERVICE ACTIVITIES**

06/2019 – Present Reviewer for The Joint Commission Journal on Quality and Patient Safety  
10/2015 – Present Reviewer for Applied Clinical Informatics  
01/2014 – Present Reviewer for IIE Transactions on Health Systems Engineering  
03/2017 National Science Foundation (NSF) Grant Review Panelist for the Information & Intelligent Systems (IIS) Division Computer & Information Science & Engineering (CISE) Directorate  
09/2016 – 09/2017 Reviewer for ACCEL Clinical Translational Research (CTR) Pilot Grant Program  
01/2016 Track Program Committee member for the Healthcare Applications track of the 2016 Winter Simulation Conference  
05/2015 Reviewer for the Agent-Based Simulation track on Winter Simulation Conference