



**Wisconsin Institute for
Healthcare Systems Engineering**
UNIVERSITY OF WISCONSIN-MADISON

Wisconsin Institute for Healthcare Systems Engineering

2018 Conference

May 2, 2018

Executive Summary

June 6, 2018

Vision: WIHSE strives to be the premier research institute that transforms health care through engineering.



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Wisconsin Institute for Healthcare Systems Engineering 2018 Conference Executive Summary

The second conference for the Wisconsin Institute for Healthcare Systems Engineering (WIHSE) was held May 2, 2018 at the Wisconsin Institutes for Discovery in Madison, WI. In attendance were 142 speakers, faculty, researchers and students from the University of Wisconsin-Madison, UW Health, stakeholder groups and industry (see Appendix A). Keynote speakers included David Bates, Senior Vice President and Chief Innovation Officer, Brigham and Women's Hospital, and Patricia Flatley Brennan, Director of the National Library of Medicine. Also joining as speakers were Janet Campbell, Vice President of Patient Engagement, Epic (Verona, WI); leaders from the Agency for Healthcare Research and Quality (AHRQ) – Chris Dymek, Director, Health IT Division and Shannon Dean, Chief Medical Information Officer, UW Health; as well as Pascale Carayon, Procter & Gamble Professor in Total Quality, Industrial and Systems Engineering and Director, WIHSE, and Jingshan Li, Professor, Industrial & Systems Engineering and Associate Director, WIHSE, UW-Madison.

Conference Overview

In concert with WIHSE's role in the Grainger Institute for Engineering thrust area of Smart and Connected Healthcare (graingerinstitute.engr.wisc.edu/), the objective of the conference was to identify challenges and opportunities to achieving smart and connected health care. This conference was preceded by the WIHSE Inaugural Conference held on March 16-17, 2017 (wihse.engr.wisc.edu/events/wihse-inaugural-conference/), and two previous roundtables. Since the previous events were instrumental in developing WIHSE's research agenda, participants at the 2018 Conference were asked to identify projects and proposals in response to specific RFAs on smart and connected health care that currently exist at AHRQ and NSF. These proposals are intended to benefit faculty in the College of Engineering, especially junior faculty, as they pursue research collaborations within and outside of the College in the area of smart and connected health care.

Speakers at the 2018 Conference were asked to challenge the audience to think about research in the area of smart and connected health care and identify opportunities to help solve critical healthcare needs of patient safety and quality. Also important was the need to identify the various stakeholders and determine implications of smart and connected health care for each of them. Full support of WIHSE's research agenda was echoed by introductory remarks made by the deans (or their representatives) from the College of Engineering – Ian Robertson, Schools of Medicine and Public Health – Robert Golden, Nursing – Barbara Bowers and Pharmacy – Steven Swanson.

Introductory keynote speaker David Bates began by pointing out the unsustainable cost of the U.S. health system and the quality and safety problems it faces. To address and solve these challenges, Dr. Bates emphasized the importance of having individuals with significantly different backgrounds work together. He discussed the need to understand the sociotechnical system in health care and the importance of user-centered design. He also discussed the need for advanced engineering applications such as predictive modeling, analytics and sensors in health care. Dr. Bates then provided concrete examples from his work that addressed dysfunctional systems and how research-driven change motivated innovations that successfully improved systems.

A joint presentation between Professors Pascale Carayon and Jingshan Li introduced "Healthcare 4.0" to the audience, and described the challenges facing smart and connected health care. Using the evolution of "Industry 1.0 to 4.0" as an analogy, Professor Li discussed the changes that occurred as health care advanced clinically and technologically. The key aspects suggested by Professor Li are that Healthcare 4.0 is: smart, interconnected, AI-integrated, patient centered and personalized/precision medicine-driven. Professor Carayon discussed the challenges to achieving smart and connected health care: 1) consideration for people, including patients, healthcare professionals; 2) role of systems and process; and 3) impact on important patient outcomes. She then described implications for key stakeholders including:

engineering researchers, health scientists and educators, healthcare technology developers and healthcare delivery. The audience was then tasked with identifying and refining implications of Healthcare 4.0 for each of the different groups of stakeholders. The results of their discussions were synthesized and served as topics for the small groups to discuss later in the day (see below).

The External Stakeholders Panel, facilitated by Dan Thoma, Director of the Grainger Institute for Engineering, included individuals representing healthcare delivery, healthcare technology (namely an electronic health record (EHR) vendor) and a federal agency. Each panelist suggested challenges and opportunities to smart and connected health care from each of their perspectives.

Shannon Dean, CMIO, UW Health, representing healthcare delivery, emphasized three qualities of smart and connected health care from the perspective of an implementer. It must be: 1) patient-centered, 2) proactive and 3) focused on wellbeing. While smart and connected health care is about the wellbeing of patients, one should also be mindful of the potential impact of its increased connectedness between patients and providers on *provider* wellbeing. Dr. Dean suggested that engineers can help overcome the challenges of technology implementation by evaluating outcomes and the impact of the implementation on users, their organization and patients.

Janet Campbell, Vice President of Patient Engagement, Epic (Verona, WI), stated that Epic's EHR is used "beyond the traditional walls" that includes retail clinics, home health and regional and statewide collaboratives. Epic is developing a platform to handle the influx of massive amounts of data to be used for advanced analytics and machine learning. The platform would be invisible to providers, but would make the EHR "smarter." The goal of the platform is to translate experience using machine learning and deliver information when it is needed by clinicians.

AHRQ's Health IT program funds research to create actionable findings around "what and how health IT can work best" in various care settings. Chris Dymek, Director, Health IT Division, AHRQ proposed that smart and connected health can help solve the challenge of rising total health expenditures in the United States. Dr. Dymek emphasized the government priority of moving from volume to value to address the cost issue. Other AHRQ initiatives include moving clinical decision support to be more standard-based and publicly available, collecting and using patient-reported outcomes and building learning health systems.

The afternoon began with attendees convening in self-selected small groups to develop potential research proposals that coincide with the WIHSE research agenda. The ideas addressed five topics resulting from the synthesis of participant input to Professors Carayon and Li's request earlier in the day to identify and refine implications of Healthcare 4.0 for different groups of stakeholders. The final five topics included:

- 1) Addressing the opioid crisis for young people
- 2) Communicating and coordinating diagnosis and treatment for patients with multiple or complex conditions
- 3) Support for monitoring and improving quality of care and patient safety
- 4) Safe care transitions for older adults
- 5) Transforming data in useful and usable clinical decision support (CDS).

Each of the 13 small groups was asked to propose a research project or proposal that included: a clearly stated problem, how the problem could be addressed, possible solutions, challenges anticipated when addressing the problem, and what RFA* the group would recommend be considered when submitting a proposal. The results of the 13 small groups are provided in Appendix C.

*NSF 18-541-Smart and Connected Health(SCH)—Connecting Data, People, and Systems, NSF 17-602—Leading Engineering for America's Prosperity, Health, and Infrastructure (LEAP HI), NSF 18-549—Planning Grant for Engineering Research Centers

A “gallery walk” (Sharing the Results, as listed on the agenda) immediately followed the small group discussions. During the gallery walk, table representatives provided five-minute presentations summarizing their group’s efforts. Others were encouraged to express interest in participating in the proposed research project.

The closing keynote speaker, former UW-Madison Professor of Nursing and Industrial and Systems Engineering Patricia Brennan, now Director of the National Library of Medicine, shared the role of the NLM in advancing high reliability healthcare. To enhance high reliability health systems, the NLM enhances information delivery, streamlines identity and access management, fosters common data elements and curates value sets. To transform information into discovery, the NLM has three pillars in its strategic plan: 1) accelerate discovery and advance health through data-driven research, 2) reach more people in more ways through enhanced dissemination and engagement and 3) build a workforce for data-driven research and health.

Poster Session

Graduate students and researchers were given the opportunity to present their research. At the end of the day, thirty-two posters were available for participants to review and then pose questions to the presenters. Posters represented collaborations between UW College of Engineering faculty and research staff (i.e., BME, ECE, ISyE, CQPI, CHSRA, QSI Lab) and the Schools of Medicine & Public Health, Nursing and Pharmacy, UW Health, American Family Children’s Hospital, UW Schools of Business and Education, the Department of Family Medicine and Community Health, Wisconsin Research and Education Network (WREN) and UW Center for Tobacco Research and Intervention; the UW School of Medicine and Public Health/University of Texas-Southwestern Medical School; University of Florida; Red Forest Consulting/University of Michigan; Abbott (Chicago, IL)/Westgard QC (Madison, WI). (See Appendix D)

Evaluation Results

Sixty-two attendees completed an online evaluation distributed two days after the conference, and weekly for the next two weeks. Results are positive for all of the speakers, panels and the small group sessions. Suggestions from UW-Madison attendees for continued effort included the need to 1) expand networking opportunities, 2) host workshops and sessions for collaborative research, 3) target activities towards Junior faculty and 4) engage students with potential employers. Attendees external to UW-Madison envisioned their organizations partnering with WIHSE through 1) collaborative research, 2) pilot projects and 3) testing and implementing new methods. Detailed results are listed in Appendix E.

Appendices

Appendix A – Summary of WIHSE 2018 Conference Attendees

Appendix B – WIHSE 2018 Conference Agenda

Appendix C – Small Group Research Proposals

Appendix D – WIHSE 2018 Conference Poster Presentations

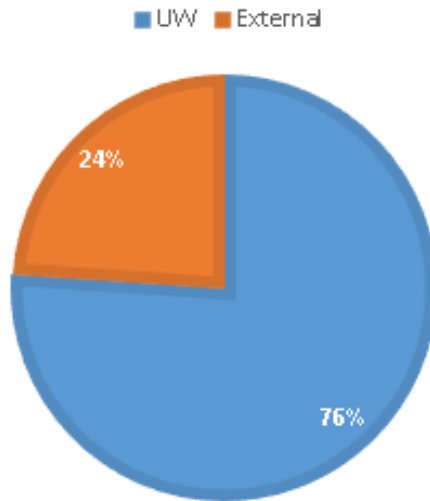
Appendix E – WIHSE 2018 Conference Evaluation Results

Appendix A

Summary of WIHSE 2018 Conference Attendees

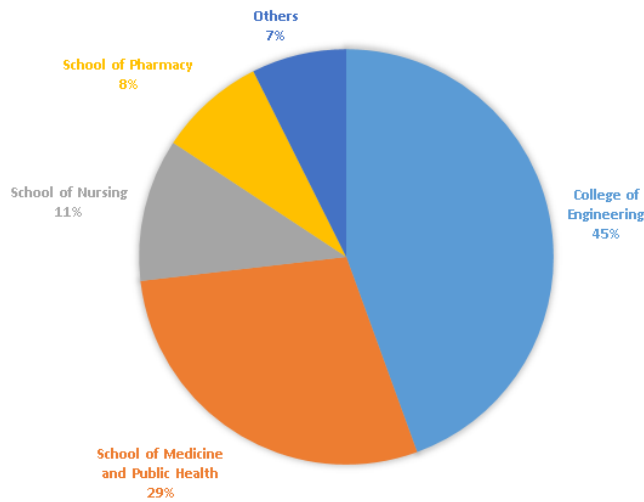
Total Number of Attendees: 142

UW AND EXTERNAL ATTENDEES



	UW	External
Number of Attendees	108	34

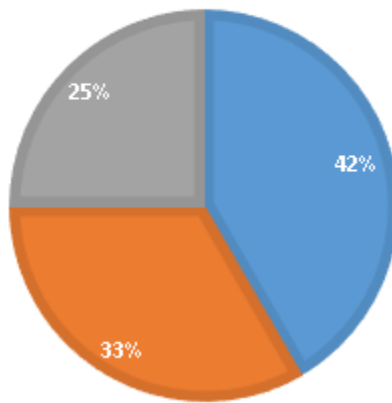
UW ATTENDEE DISTRIBUTION BY COLLEGE/SCHOOL



	College of Engineering	School of Medicine and Public Health	School of Nursing	School of Pharmacy	Others
Number of Attendees	48	31	12	9	8

UW ATTENDEE POSITIONS

■ Faculty ■ Staff ■ Students



	Faculty	Staff	Students
Number of Attendees	45	36	27

Appendix B

WIHSE Second Annual Conference Agenda May 2, 2018

Objective: To identify challenges and opportunities to achieving smart and connected healthcare.

7:00 – 8:00 AM: Registration and Breakfast

8:00 – 8:30 AM: Welcome and Conference Overview [[presentation video](#)]

- Pascale Carayon, PhD, Procter & Gamble Professor in Total Quality, Industrial and Systems Engineering; Director, WIHSE
- Ian Robertson, PhD, Dean, College of Engineering
- Barb Bowers, PhD, RN, FAAN, Professor, Associate Dean for Research, and Charlotte Jane and Ralph A. Rodefer Chair, School of Nursing
- Robert Golden, MD, Dean, School of Medicine and Public Health
- Steven Swanson, PhD, Dean, School of Pharmacy

8:30 – 9:30 AM: Keynote Address [[slides](#)] [[presentation video](#)]

- David Bates, MD, Senior Vice President and Chief Innovation Officer for Brigham and Women's Hospital

9:30 – 10:45 AM: Engineering Responds—Healthcare 4.0 [[slides](#)] [[presentation video](#)]

- Pascale Carayon, PhD, Procter & Gamble Professor in Total Quality, Industrial and Systems Engineering; Director, WIHSE
- Jingshan Li, PhD, Professor, Industrial and Systems Engineering; Associate Director, WIHSE

10:45-11:00 AM: Break

11:00 AM – 12:00 PM: External Stakeholder Panel -- Engineering at the Edge [[presentation video](#)]

- Dan Thoma, PhD, Director, Grainger Institute for Engineering, moderator
- Shannon Dean, MD, Vice President and Chief Medical information Officer, UW Health [[slides](#)]
- Janet Campbell, Vice President of Patient Engagement, Epic [[slides](#)]
- Chris Dymek, Ed.D, Director, Health IT Division, Agency for Healthcare Research and Quality (AHRQ) [[slides](#)]

12:00 – 1:00 PM: Lunch

1:00 – 2:30 PM: Pursuing the Agenda

- 1) Addressing the opioid crisis for young people
- 2) Communicating and coordinating diagnosis and treatment for patients with multiple or complex conditions
- 3) Support for monitoring and improving quality of care and patient safety
- 4) Safe care transitions for older adults
- 5) Transforming data in useful and usable clinical decision support (CDS).

2:30-2:45 PM: Break

2:45-3:45 PM: Sharing the Results

3:45-4:45 PM: Keynote Address [[slides](#)] [[presentation video](#)]

- Patricia Flatley Brennan, PhD, Director, National Library of Medicine

4:45-5:00 PM: Conference Wrap Up [[presentation video](#)]

- Oguzhan Alagoz, PhD, Professor, Industrial and Systems Engineering; Associate Director, WIHSE
- Pascale Carayon, PhD, Procter & Gamble Professor in Total Quality, Industrial and Systems Engineering; Director, WIHSE

5:00-6:30PM: Evening Reception and Poster Session

Small Group Research Proposals

Theme: Addressing the opioid crisis in young people

- Specific problem addressed in project/proposal:
 - Reducing opioid misuse among young people
- How to address problem?
 - Multi-stakeholder approach – Target those involved in the epidemic to try to reduce misuse and make sure dispensing the fewest amount of opioid as possible by minimizing the amount of opioids in the system
- Possible solutions to address problem
 - Usability of PDMPs (prescription drug monitoring programs)
 - Workflow integration
 - Decision support
 - Educate/coach prescribers on alternatives to opioids
 - Technology based education for kids/families
 - Audit and feedback – transparency/visibility to detect patterns
 - EHR prompts – decision support
- Challenges anticipated:
 - Integration-technical challenges
 - Cost-resource intensive
 - Validity of PDMP
 - Patient expectations
- RFAs considered: NSF SCH, AHRQ Health IT to Improve Healthcare Quality and outcome



Theme: Addressing the opioid crisis in young people

- Specific problem addressed in project/proposal:
 - Reduce illegally obtained opioids from family and friends in young adults
- How to address problem?
 - Decrease supply from prescribers
 - Decrease leftover in patients (family and friends of young adults)
- Possible solutions to address problem
 - Return envelope to mail back unused opioids
 - Call to remind patients to bring back unused opioids to post-surgery checkup
 - Peer pressure → transparency of prescriber data
 - Algorithm of legal opioid users and create a questionnaire in EHR for risk of unintended diversion
- Challenges anticipated:
 - People hoard pain meds after surgery; no easy way to dispose left over meds
 - People won't keep track of how many they take
 - Prescriber workload incentivizes prescription of extra meds
- RFAs considered:
 - AHRQ Health IT to Improve Healthcare Quality and Outcome



Theme: Communicating and coordinating diagnosis and treatment for patients with multiple of complex conditions

- Specific problem addressed in project/proposal:
 - Providing care coordination using a system where patient is not held responsible
 - Matching resources to patients inside and outside of clinic
 - Address economic challenges
- How to address problem?
 - Shifting from acute to chronic care mentality
 - Bridge medical and social concepts
- Possible solutions to address problem
 - Technology to improve situation awareness
 - Stratifying patients by complexity
 - Cost reduction models need to be improved, incentive alignment
 - Clinics focused on chronic conditions
 - Point of contact for patient
- Challenges anticipated:
 - How to decentralize organizational structure to allow for coordinated care
 - How to reorient professional to patient rather than department
 - What is value proposition for healthcare system
- RFAs considered: N/A



Theme: Communicating and coordinating diagnosis and treatment for patients with multiple of complex conditions

- Specific problem addressed in project/proposal:
 - Communication and coordination of diagnosis and treatment for patients with multiple conditions who are discharged home after an acute event such as hip fracture
- How to address problem?
 - The goal is to maximize treatment to avoid ED and rehospitalization
 - Sensors in home feed data to AI system
 - Nurse practitioner coordinates with primary care providers and caregivers
- Possible solutions to address problem
 - Remote monitoring managed by artificial intelligence to support nurse practitioner, patient, and caregiver/decision-maker
 - Monitors and sensors are user-friendly and have data visualization
 - Simulate setting by collecting large amount of data, testing visualization, and coordinating with industry and academia
- Challenges anticipated:
 - Determining thresholds
 - Choosing appropriate sensors and ensuring proper set up
 - EHR integration and usability
 - Cost effectiveness
 - 24 hour monitoring and privacy
- RFAs considered: NSF SCH



Theme: Communicating and coordinating diagnosis and treatment for patients with multiple of complex conditions

- Specific problem addressed in project/proposal:
 - Patients are often tasked as their own care coordinators
 - Specifically, they must transfer their information across systems and cities
 - Providers defer responsibility/ownership
- How to address problem?
 - Visual timeline for past/future visits
 - Individualized patient portal for designated family/friend to engage with timeline
 - Care team innovation
- Possible solutions to address problem
 - See above
- Challenges anticipated:
 - Privacy
 - Interoperability of EMRs
 - Electronic platforms may disfranchise the most vulnerable
 - Socially isolated adults/need for surrogate
 - Staffing challenges/burnout
- RFAs considered: N/A



Theme: Support for monitoring and improving quality of care and patient safety

- Specific problem addressed in project/proposal:
 - Elderly patients after discharge / digital frailty
 - Lack of understanding of driving forces behind clinical decomposition
 - Lack of automated system to predict medical decompensation of post-discharge patients
- How to address problem?
 - Identify important data parameters
 - Collect and analyze data
- Possible solutions to address problem
 - Develop machine learning to build algorithm to help physicians train the algorithm on co-factor data
 - Develop sensors/monitors that can collect physiologic, objective and subjective data in real time
- Challenges anticipated:
 - Regulatory/legal complications
 - Patient compliance and ability to use the technology
- RFAs considered:
 - LEAP HI



Theme: Support for monitoring and improving quality of care and patient safety

- Specific problem addressed in project/proposal:
 - The need to improve compliance that enables patients to monitor their own safety and quality of care, e.g. symptom monitoring and medication adherence.
- How to address problem?
 - Understand where most readmissions occur
 - Define quality and safety for a patient-centered mobile application
- Possible solutions to address problem
 - Create an app that can be used to record symptoms and remind patient to take meds or go to appointments
 - Engage patients and providers
 - Create a common database of all medical images that can be accessed by patients, caregivers and all providers
 - Offer hands-free communication (eg. Siri, earbuds, Google glasses)
 - Create patient checklists
 - Use of the "golden sample"
- Challenges anticipated:
 - Lack of feedback loop
 - Lack of defined personalized outcomes to measure; need to collect large dataset to "gamify" healthcare
- RFAs considered: NSF SCH, ERC Planning Grant



Theme: Support for monitoring and improving quality of care and patient safety

- Specific problem addressed in project/proposal:
 - Getting better quality and patient safety data, and making sense of it as an institution
 - Improving clinical/non-clinical interventions, processes, technology, tools, and systems
- How to address problem?
 - Determine and monitor meaningful metrics
 - Identify existing systems and similar systems outside of acute care
 - Develop data fusion and analytics algorithm
- Possible solutions to address problem
 - Establish a learning health system
 - Develop integrated safety management system and situation awareness dashboards
- Challenges anticipated:
 - Ill-defined data sources
 - Magnitude of data
 - Dirty data / fragmentation of data
 - Data not always human interpretable
- RFAs considered: AHRQ Health IT to Improve Healthcare Quality and outcome



Theme: Safe care transitions for older adults

- Specific problem addressed in project/proposal:
 - Lack of patient centered information at point of care for cognitive vulnerable older adults
- How to address problem?
 - Fully identify and validate the problem by conducting interviews and observations
 - Create a longitudinal care plan and get dementia information quickly
 - Segregate dementia patients in the ED to ensure better care
- Possible solutions to address problem
 - Creating a standardized form that speaks a language everyone, including informal care givers, can understand
 - Place "navigator" in the ED to specifically handle stable, older patients
- Challenges anticipated:
 - Dementia patients are not as prioritized as patients with stroke or heart attack
 - Designing the data collection form
 - Different set of language between different care givers
 - Screening may not be taken seriously by clinicians
- RFAs considered:
 - AHRQ Health IT to Improve Healthcare Quality and Outcome



Theme: Safe care transitions for older adults

- Specific problem addressed in project/proposal:
 - Poor inter- and intra-systems communication results in less successful transitions of care
 - Providers (including formal and informal) are not always ready to receive patients
- How to address problem?
 - Create algorithms that predict who is at risk based on risk factors identified in research
 - Translate raw information into actionable advice & push it to the correct people
 - Develop a mechanism to reliably track information over time for slow age-related declines (e.g. Alzheimer's Disease)
 - Create a platform which is understandable by all parties (professional and non-professional caregivers)
- Possible solutions to address problem
 - User-centered design that involves key stakeholders, such that the interface suits a variety of needs
 - A single, unified database for each patient (a "universal system") which is accessible to everyone and contains a complete, reliable patient timeline
 - Sensors, for example, those that monitor the gait of an elderly person
- Challenges anticipated:
 - Data safety and privacy/confidentiality
 - Accuracy
 - Affordability
- RFAs considered:
 - LEAP HI, NSF SCH



Theme: Transforming data in useful and usable CDS

- Specific problem addressed in project/proposal:
 - Help patients and care providers better manage chronic health conditions and early detection of heart failure
- How to address problem?
 - Combine and integrate patient (e.g. weight, BP, etc.), provider, and healthcare systems' information [into external CDS interface] → Better insight in the different factors that contribute to the problem
- Possible solutions to address problem
 - Create engaging machine interface for patients to view and interact with
 - Provide feedback loops [patient changes behavior and sees outcome] and distributed learning
 - Create upgradable CDS architecture (learns from learning)
 - Build "virtual patient" [where can upload data, family participation, sync to Facebook]
- Challenges anticipated:
 - Extraction of health care
 - Patient adherence [Incentivize patient to participate/provide data] and central learning
- RFAs considered:
 - AHRQ Health IT to Improve Healthcare Quality and Outcome



Theme: Transforming data in useful and usable CDS

- Specific problem addressed in project/proposal:
 - Lack of comparability between outcomes and costs of various CDS interventions
 - Alert fatigue decreases effectiveness of CDS
 - No guidelines exist for institutions to develop a strategy for managing CDS
- How to address problem?
 - Define a framework for evaluation and comparative effectiveness of CDS interventions
 - Examine the effect of alerts on already effective interventions
 - Create guidelines for organizational strategies to manage CDS burden and interaction based on results from the two earlier points.
- Possible solutions to address problem
 - Conduct experiment to determine effect of various CHS strategies on workload
 - Develop simulation to evaluate the interactions and effects of CDS tools
 - Combine the data from the first two points to develop general recommendations (toolkit)
- Challenges anticipated:
 - Figuring out if the person paid attention to the BPA (measuring and data collection)
 - EHR systems don't necessarily record the response reliability
 - Effects of protocol firing
 - Can't always see the downstream consequences of a decision – could be recorded as no impact, but there could actually be an impact
- RFAs considered: AHRQ Health IT to Improve Healthcare Quality and Outcome



Theme: Transforming data in useful and usable CDS

- Specific problem addressed in project/proposal:
 - Risk prediction of hypertension for pediatric patients for physician referral and feedback
- How to address problem?
 - Collect the right data at the right time
 - Develop prediction models (including uncertainty parameters)
 - Physician type and past referral record in decision support
 - Share data for usability
- Possible solutions to address problem
 - 24 hour blood pressure monitoring → app to capture longitudinal data
 - Develop database to push and pull patient data from PCP to specialist, develop prediction models
 - Provide feedback to Primary Care Physician based on past referral record and how many referrals were diagnosed with hypertension by Specialist. Create a comparison across groups.
- Challenges anticipated:
 - Adoption of CDS
 - Data collection for prediction models
 - How to define a false-positive?
 - How does feedback work with different physician types?
- RFAs considered: NSF SCH



Appendix D

WIHSE 2018 Conference Poster Presentations

Neurosurgery Operating Room Traffic Study

Authors: John Sandgren^{1,2}, Rachel Zenker^{1,2}, Maren Anderson^{1,2}, Jordan Henry³

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison, ²Quality, Safety, and Innovation Lab, University of Wisconsin-Madison, ³Neurosurgery, UW Health

5S of Chemotherapy Carts

Authors: Bridget Roehrs^{1,3}, Therese Besser^{2,3}

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison, ²Department of Biomedical Engineering, University of Wisconsin-Madison, ³Quality, Safety, and Innovation Lab, University of Wisconsin-Madison

Exploring Primary Care RN & MA Cognitive Needs for EHR design: A Qualitative Analysis of Situation Awareness

Authors: Laura Farrell, BS¹, Linsey M. Steege, PhD^{1,2}, Douglas A. Wiegmann, PhD¹, Randi S. Cartmill, MS³, Amanda E. Hoffmann, MPH^{3,4}, Shimeng Du, MS¹, Tosha B. Wetterneck, MD, MS^{1,3}

¹University of Wisconsin (UW)-Madison Department of Industrial and Systems Engineering, ²UW-Madison School of Nursing, ³UW School of Medicine and Public Health, ⁴Wisconsin Research and Education Network (WREN)

Organizing for High Performance at the Scale of Hundreds of Healthcare Organizations

Authors: Edmond Ramly, PhD^{1,2,3}, Susan Nordman-Oliveira, MS², Jay Ford, PhD^{2,4}, David Zimmerman, PhD^{2,3}

¹University of Wisconsin Department of Family Medicine and Community Health, ²Center for Health Systems Research and Analysis, ³Department of Industrial and Systems Engineering, ⁴UW-Madison School of Pharmacy

Work System Barriers to In-Home Professional Care for Children with Medical Complexity

Authors: Nadejda L. Doucheva, BS¹, Anne S. Thurber, MS², Anna F. Jolliff, BS¹, Michelle M. Kelly, MD², Mary L. Ehlenbach, MD², Ryan J. Coller, MD, MPH², Nicole E. Werner, PhD¹

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison, ²School of Medicine and Public Health, University of Wisconsin-Madison

Towards an Understanding of Task-based Role Delineation in Informal Care of Persons with Dementia

Authors: Siddarth Ponnala MS¹, Andrea Gilmore-Bykovskiy PhD RN², Laura Block BS², Amy J. H. Kind MD³, Nicole E. Werner PhD¹

¹University of Wisconsin-Madison Department of Industrial and Systems Engineering, ²University of Wisconsin-Madison School of Nursing, ³University of Wisconsin School of Medicine and Public Health

What Information Do Physicians in Pediatric Trauma Need?

Bat-Zion Hose^{1,2}, Pascale Carayon^{1,2}, Peter Hoonakker², Abigail Wooldridge^{1,2}, Tom Brazelton³, Shannon Dean³, Ben Eithun⁴, Michelle Kelly³, Jonathan Kohler³, Joshua Ross³, Deborah Rusy³, Ayes Gurses⁵

¹Dept of Industrial & Systems Engineering, UW-Madison, ²Center for Quality and Productivity Improvement, UW-Madison, ³UW School of Medicine and Public Health, ⁴American Family Children's Hospital at the University of Wisconsin Hospitals and Clinics, ⁵The Armstrong Institute for Patient Safety and Quality at Johns Hopkins University

Evaluation of Primary Care Delivery with E-Visits

Authors: Xiang Zhong, PhD¹, Aditya M. Prakash, MS¹

¹University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, 32611

User-Centered Design in the Development of Consumer Health Information Technology

Authors: Anna Jolliff^{*1,3}, Connor Pardell^{*2}, Rachel Zenker^{*1}, Nicole E. Werner^{^1}

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison, ²School of Business, University of Wisconsin-Madison, ³Department of Counseling Psychology, University of Wisconsin-Madison

[^]Primary Investigator

^{*}All asterisked authors contributed equally

Implementation of a Patient Portal on a Tablet Computer across a Children's Hospital

Authors: Anne S. Thurber, MS¹, Peter L. T. Hoonakker, PhD², Brad D. Ehlenfeldt, BBA³, Shannon M. Dean, MD^{1,3}, Rebecca J. Rankin, MS, RN, CPHQ, PMP³, Barbara J. Byrne, DNSc³, Diane G. Heatley, MD³, Jenny A. Bunton, CPHIMS³, Michelle M. Kelly, MD^{1,2}

¹University of Wisconsin Madison School of Medicine and Public Health, ²Center for Quality and Productivity Improvement, University of Wisconsin-Madison, ³UW Health, Madison, WI

Healthcare Delivery System: Efficient and Interconnected System as a Whole

Authors: Hyo Kyung Lee¹, Jingshan Li¹

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison

Comparative Workflow Analysis: Case Study of Antibiotic Prescribing in Nursing Homes

Authors: Michelle Tong¹, Chris Crnich², Jay Ford³, Svetlana Bondar², Edmond Ramly²

¹University of Wisconsin-Madison, ²School of Medicine and Public Health, University of Wisconsin-Madison, ³School of Pharmacy, University of Wisconsin-Madison

Cognitive Task Analysis of a Primary Care Team: Exploring Cognitive Requirements for Addressing Preventive Care

Authors: Shimeng Du, MS¹, Douglas A. Wiegmann, PhD¹, Amanda E. Hoffmann, MPH^{2,3}, Linsey M. Steege, PhD^{1,4}, Laura Farrell, BS¹, Tosha B. Wetterneck, MD,MS^{1,2}

¹Department of Industrial and Systems Engineering, University of Wisconsin -Madison, ²UW School of Medicine and Public Health, ³Wisconsin Research and Education Network (WREN), ⁴UW-Madison School of Nursing

Developing a System-level Medication Safety Intervention for Older Adults: The Utility of Participatory Design

Authors: Apoorva Reddy, BS¹, Jamie Stone, MS¹, Corey Lester, PharmD, PhD², Richard Holden, PhD³, Michelle Chui, PharmD, PhD¹

¹University of Wisconsin-Madison, ²University of Michigan- Ann Arbor, ³Indiana University-Purdue University Indianapolis

Total Error Profiles – A New Method for Visualizing Product Performance

Authors: Sharon Schneider¹, Victoria Petrides¹, Sten Westgard², Brian Renley¹, Anthony Orzechowski¹

¹Abbott, Abbott Park, IL USA, ²Westgard QC, Inc., Madison, WI USA

Non-obtrusive, Non-imaging-based Monitoring System for Human Indoor Localization and Rudimentary Motion Identification

Authors: Hwei Liu¹, Hongrui Jiang¹

¹University of Wisconsin-Madison Department of Electrical and Computer Engineering

Improving Rural Access to Advanced Trauma Facilities in Wisconsin Using Maximal Coverage Optimization

Authors: Adam Schmidt^{1,2}, Laura A. Albert, PhD¹

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Developing a Survey to Characterize Fatigue in Pharmacists

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Improving Transition of Pediatric to Adult Care

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Information Fragmentation in the EHR: The Case of Pulmonary Embolism Diagnosis in the ED

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Using a Human Factors Approach to Design a Pulmonary Embolism Computer Decision Support Tool for the Emergency Department

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EHR-Supported Activities for VTE Prophylaxis: A Case Study

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Nursing Leadership: A Concept Analysis

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Nurses' Perception of Practice Change: A Descriptive Qualitative Study

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Medical Device Sandbox: A Creative Learning Experience for Biomedical Engineering Students and Healthcare Learners

Authors: John Gosbee, MD, MS^{1,2}, Rachael Schmedlen, PhD², Jan Stegemann, PhD²

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Complexity of the Pediatric Trauma Care Process: Understanding Patient Pathways

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Improving Call Center Experience in the UW Hospital Transplant Department

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Use of the Problem List to Create Automatic Data Summaries

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Reducing Patient Readmission through Machine Learning Predictive Modeling and Intervention Planning

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Disseminating and Implementing System Change (DISC): Blending Implementation Science and Human Factors Perspectives

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Staff Protocol in Rheumatology Clinics Reduces Population-Level Rate of High Blood Pressures

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Rheumatology Clinic Smoking Cessation Protocol Markedly Increases Quit Line Referrals

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Appendix E

WIHSE Inaugural Conference Evaluation Results (N=62 responses)

1. *The objective of the WIHSE 2018 Conference was to “identify challenges and opportunities to achieving smart and connected health care.”*

	Fully met		Partly met	Not met at all	
To what extent was the conference objective met?	n=26	n=25	n=3	n=7	n=1

2. *Please rate the speakers, panels and activities*

	Excellent	Very good	Good	Fair	Poor	n/a
Keynote – Dr. David Bates	n=37	n=16	n=1	n=2	n=0	n=5
Engineering Responds: Healthcare 4.0 – Professors Pascale Carayon and Jingshan Li	n=21	n=21	n=11	n=2	n=1	n=5
External Stakeholder Panel	n=27	n=18	n=11	n=1	n=0	n=3
Small group break out sessions	n=21	n=28	n=2	n=6	n=0	n=3
Gallery Walk	n=18	n=20	n=13	n=5	n=1	n=7
Keynote – Patti Brennan	n=28	n=19	n=6	n=3	n=0	n=4
Poster Session	n=22	n=19	n=6	n=0	n=0	n=10