WELCOME TO BENTLEY UNIVERSITY’S 2016 RESEARCH COLLOQUIUM, focusing on THE BUSINESS OF HEALTHCARE: Research, Opportunity, and Innovation.

This event is sponsored by the Bentley University Research Council.

The mission of the Research Council is to provide intellectual leadership on research at Bentley University. The council does this through the following three interrelated activities aligned with the University’s vision, mission, and strategy:

- Develop and articulate a perspective on why research is essential to continuing and enhancing the achievement of Bentley’s mission.

- Present a clear vision of what constitutes quality research at Bentley and position this vision within the broader context of faculty scholarship.

- Support Bentley faculty as they pursue and enhance the quality of their research endeavors and advise academic leadership about actions and platforms needed to further Bentley’s research agenda.

We wish you a rewarding and enjoyable colloquium!

Marcia Millon Cornett
Chair, the Bentley University Research Council
AGENDA

12:00 p.m. Opening Remarks by Research Council Chair Marcia Millon Cornett
Greeting from Bentley University President Gloria Cordes Larson
Lunch Service

Introduction of Keynote Speaker by Danielle Blanch Hartigan, Assistant Professor of Natural & Applied Sciences; Director of Bentley’s Health Thought Leadership Network

Keynote Address by Bradford Hesse, Chief of National Cancer Institute’s Health Communication & Informatics Research Branch

Formal Launch of Sessions by Marcia Millon Cornett

1:15 p.m. Session 1
Innovation and Entrepreneurship
Co-chairs: Linda Edelman (Management) Fred Ledley (Center for Integration of Science and Industry, Natural & Applied Sciences)

Systems and Information
Co-chairs: Monica Garfield (Computer Information Systems) Chris Skipwith (Natural & Applied Sciences)

2:30 p.m. Poster/Breakout Session (refreshments available)

3:00 p.m. Session 2
Outcomes and Measures
Co-Chairs: Dhaival Dave (Economics) Mingfei Li (Mathematical Sciences)

Patients and Consumers
Co-Chairs: Danielle Blanch Hartigan (Natural & Applied Sciences) Effie Stavrulaki (Management)

4:15 p.m. Poster/Breakout Session

4:45 p.m. Close of Proceedings by Marcia Millon Cornett

5:00 p.m. Reception in the Executive Dining Room
Sponsored by the Research Council
Research is an essential part of the fabric and identity of Bentley University. The scholarly work that takes place within Bentley provides value in at least four important ways to the Bentley community and our external stakeholders.

- Research is a part of Bentley’s undergraduate and graduate curriculum. Research is not something done only by faculty members and doctoral students, which keeps them out of the classroom. Many Bentley undergraduate and master’s students work with faculty members in and out of the classroom on relevant research projects.

- Research allows faculty to contribute to and keep current with the ever-growing fountain of world knowledge.

- Research is needed to develop and refresh courses and programs of study so that they will continue to meet changing societal and business needs.

- Research results in new knowledge and creative works that are documented (in journal articles, books, and other media) and shared with the world.
This new knowledge adds to the global fund, is used by educators and students around the globe, and contributes to societal welfare and economic development. In business terms, research not only supports a university’s educational mission but also generates knowledge products that are valuable in their own right.

**Three characteristics of Bentley’s research stand out:**

1. It is practically *relevant* as well as rigorous. Our researchers in both the business departments and the arts and sciences are concerned about the major problems in business and society today and are seeking new insights to help address them.

2. It is *diverse* in terms of scholarship type. A significant portion of our research output appears in academically oriented publications valued by different disciplines (whether peer-reviewed journal articles, scholarly books, or conference proceedings). In addition, our faculty and students contribute to the scholarship of education and curriculum development. Among other products, Bentley scholars have produced leading textbooks in a number of fields. Bentley scholarship also emphasizes engagement with the local community, with industry leaders, with national policy makers, and with international communities and groups. Because of this diversity of scholarship, our research can never be just about the number of publications in prestigious journals, conferences, or university presses.

3. It is often characterized by the term *transdisciplinary*. The key problems of today’s world do not fit neatly within the boundaries of single academic disciplines. Effective responses to these challenges will require creative collaborations across the business disciplines and the arts and sciences.

These characteristics of Bentley’s research and the value that it provides to the Bentley community are evident in the broad and rich set of scholarly work featured in the program of this colloquium.
MARcia Millon Cornett is the Robert A. and Julia E. Dorn Professor of Finance at Bentley University. She received her B.S. degree in economics from Knox College in Galesburg, Illinois, and her M.B.A. and Ph.D. degrees in finance from Indiana University in Bloomington, Indiana. Dr. Cornett has written and published several articles in the areas of bank performance, bank regulation, corporate finance, and investments. Articles authored by Dr. Cornett have appeared in such academic journals as the Journal of Finance, the Journal of Money, Credit, and Banking, the Journal of Financial Economics, Financial Management, and the Journal of Banking and Finance. She was recently ranked the 124th most published out of more than 17,600 authors and the number five female author in finance literature over the last 50 years. Along with Anthony Saunders, Dr. Cornett has recently completed work on the ninth edition of Financial Institutions Management (McGraw-Hill/Irwin) and the seventh edition of Financial Markets and Institutions (McGraw-Hill/Irwin). With Troy A. Adair, Jr. (Harvard University) and John Nofsinger (University of Alaska, Anchorage), she has also recently completed work on the fourth edition of Finance: Applications and Theory and the third edition of M: Finance (McGraw-Hill/Irwin). Professor Cornett serves as an associate editor for the Journal of Banking and Finance, the Journal of Financial Services Research, Review of Financial Economics, Financial Review, and Multinational Finance Journal. Dr. Cornett has also taught at Southern Illinois University at Carbondale, the University of Colorado, Boston College, and Southern Methodist University. She is a member of the Financial Management Association, the American Finance Association, and the Western Finance Association.
GLORIA CORDES LARSON was elected to the presidency of Bentley University after a prestigious career as an attorney, public policy expert, and business leader. She was drawn to Bentley because of its inventive approach to redefining business education—by fusing its core business curriculum with the arts and sciences, and its strong focus on ethics and social responsibility.

During her tenure, the institution has reached a number of milestones centered on the content and value of a business education in the 21st-century marketplace. President Larson also launched the Center of Women and Business at Bentley in 2011, with a mission to advance shared leadership among women and men in the corporate world and to develop women as business leaders. Currently, she serves on the board of directors of two public companies, Unum Group and Boston Private, as well as on a number of non-profit boards.

Before joining Bentley, President Larson was co-chair of the Government Strategies Group at Foley Hoag LLP. She led a business advisory cabinet for Massachusetts Democratic Governor Deval Patrick and served as Secretary of Economic Affairs under Massachusetts Republican Governor William Weld.

President Larson also oversaw business and regulatory issues as Deputy Director of Consumer Protection at the Federal Trade Commission in Washington.

President Larson has been named among Boston magazine’s “50 Most Powerful people” in 2015; the Boston Business Journal’s “Power 50: Influential Bostonians”; and Boston magazine’s “50 Most Powerful Women in Boston.” She is also the recipient of the Greater Boston Chamber of Commerce’s inaugural “Collaborative Leadership Award” and “Academy of Distinguished Bostonians Award.”
BRADFORD (BRAD) HESSE is Chief of the National Cancer Institute’s Health Communication and Informatics Research Branch. Dr. Hesse received his degree in social psychology from the University of Utah in 1988 with an accompanying internship in the nascent field of medical informatics. After completing his degree, he served as a member of the Committee for Social Science Research on Computing at Carnegie Mellon University, and then went on to co-found the Center for Research on Technology at the American Institutes for Research in Palo Alto, California. For almost three decades since that time, he has been conducting research in the interdisciplinary fields of social cognition, communication, and health informatics. Dr. Hesse was recruited to the National Cancer Institute in 2003 and has since been focusing his energies on bringing the power of evidence-based health communication to bear on the problem of eliminating death and suffering from cancer. He continues to direct the Health Information National Trends Survey (HINTS), a biennial general population survey designed to monitor the public’s use of health information during a period of enhanced capacity at the crest of the information revolution. From 2004 to 2013 he served as the program director for the Centers of Excellence in Cancer Communication Research, a cutting-edge research initiative aimed at expanding the knowledge base underlying effective cancer communication strategies. In his current assignment, he is working with the President’s Cancer Panel on their report on “Connected Health and Cancer.” When completed, the report should provide direction to the President of the United States for how to bridge the gaps experienced by cancer patients and survivors in the 21st Century. Dr. Hesse has authored or co-authored over 170 publications, including peer-reviewed journal articles, technical reports, books, and book chapters. In 2009, his coauthored book titled “Making Data Talk: Communicating Public Health Data to the Public, Policy Makers, and the Press” was named Book of the Year by the American Journal of Nursing. His newest edited volume, “Oncology Informatics: Using Health Information Technology to Improve Processes and Outcomes in Cancer” published by Elsevier in April 2016, has brought together some of the best and brightest thinkers from across disciplines to create a blueprint for accelerating progress against cancer through the health information technologies being woven into the modern care system.
THEME-BASED

PANEL THEME

1:15-2:30 p.m.
Session 1

INNOVATION AND ENTREPRENEURSHIP

Theme co-chairs:
Linda Edleman, MGT
Fred Ledley, CISI, NAS

Naeimah Alkhurafi, MGT
Signals of Quality in the Medical Sector

Jennifer Beierlein, CISI
Cardiovascular Diseases Therapeutics—From Tree Bark to Statins and Monoclonal Antibodies

Liz Brown, LTFP
Can You Afford Health Privacy at Work?

Anthony Kiszewski, NAS
A Spatially Explicit Model of Lethal Homing Endonuclease Genes Against Mosquito Vectors

Helen Meldrum, NAS
Recruiting for Resilience: C-Suite Leaders in Life Science Share Lessons Learned

Robert Schultz, CISI
Case Study on Development of the World’s Most Successful Drug (Humira)

Chenguang Shang, FI
Political Connections and Corporate Innovation Productivity

Chris Skipwith, NAS
Improving the Dynamic Range for Comparison Standards in Point-of-Care Diagnostics

1:15-2:30 p.m.
Session 1

SYSTEMS AND INFORMATION

Theme co-chairs:
Monica Garfield, CIS
Chris Skipwith, NAS

Chris Skipwith, NAS
Machine Learning in Meta-Analysis of Gene Expression Data to Identify Endophenotypes

Deborah W. Gregory, FI
Optimizing Cash Flow from the OR Suite: An Integrative Behavioral Approach

Jennifer Xu, CIS
Deep Learning Based Topic Identification and Categorization: Mining Diabetes-Related Topics on Chinese Health Websites

Ekaterina “Kat” Galkina, CISI
Creating a Big-Data Management System for Data on Biopharmaceutical Development

Mystica Alexander, LTFP
Privacy and Law in a Technology-Driven Economy

Alina Chircu, IPM
Real World Awareness (RWA) Systems for the Pharmaceutical Value Chain

David Murungi, IPM
The Role of Emotion in the Discursive Practices that Underlie the Adoption of an Electronic Medical Record

Monica Garfield, CIS
Seeing the Pupils of the Patient’s Eyes: System Trust and Interpersonal Trust in Health Care
2:30-3:00 p.m.  
*Poster/Breakout Session*

### SESSIONS

#### 3:00-4:15 p.m.  
*Session 2*

**OUTCOMES AND MEASURES**

Theme co-chairs:  
Dhaval Dave, EC  
Mingfei Li, MS

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#### 3:00-4:15 p.m.  
*Session 2*

**PATIENTS AND CONSUMERS**

Theme co-chairs:  
Danielle Blanch Hartigan, NAS  
Effie Stavrulaki, MGT

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<td>Mark M. Davis, MGT</td>
<td>A Systems Approach to Creating Great Patient Experiences</td>
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4:15-4:45 p.m.  
*Poster/Breakout Session*
Signals of Quality in the Medical Sector

Naeimah Alkhurafi*1 (Presenter), Tatiana Manolova1, Linda Edelman1, Candida Brush*2

Drawing on signaling theory, we examine how new ventures credibly communicate their underlying quality, using a unique dataset of 739 new ventures that sought investment from a prominent angel group located in the greater Boston, MA area during 2007-2010. Findings suggest that signals of quality are multi-dimensional, and that they are dynamic, with different types of signals of quality mattering at different times in the angel investment decision-making process. With respect to the industry sector, we find subtle but significant differences between signals sent from firms in the medical sector when compared with firm in the other sectors. Implications are discussed.

1 Management
2 Entrepreneurship Division, Babson College
* Doctoral student

Cardiovascular Diseases Therapeutics—From Tree Bark to Statins and Monoclonal Antibodies

Jennifer M. Beierlein1,2 (Presenter), Fred D. Ledley1,2,3, Kenneth I. Kaitin4, Joseph A. DiMasi4

One of the most heralded successes of modern medicine is the dramatic reduction in morbidity and mortality from cardiovascular diseases in developed nations since the 1960s. Cardiovascular therapeutic development encompasses technologies that spans the modern era of FDA regulation and reform, and a period of time that spans the emergence of cell and molecular biology, genomics, and biotechnology. Some of the earliest therapeutics were developed from phenotypic observations of blood clotting. This includes the observation of the medicinal benefits of willow bark, from which aspirin was isolated, and that sweet clover, containing a derivative of warfarin, was responsible for spontaneous bleeding in cattle. Since then, many technological advances have occurred, leading to the development of innovative therapies, particularly in the area of cholesterol-lowering agents. Categorizing and mapping the technological maturity of cardiovascular therapeutics show that 1) there has been a distinct transition from phenotypic methods for drug discovery, which peaked in the 1980s, to targeted drug discovery since the 1990s, 2) the durations of the clinical and regulatory processes were both significantly influenced by changes in FDA practice, and 3) the longest phase of the translational process was the time required for technology to mature from the point of initiation to a statistically defined established point.

This analysis demonstrates that translational medicine might be accelerated by focusing on the protracted phase of basic and applied science leading up to the initiation of clinical trials, during which targets, disease associations, and promising compounds are discovered and characterized.

1 Center for Integration of Science and Industry
2 Natural & Applied Sciences
3 Management
4 Tufts Center for Study of Drug Development
Can You Afford Health Privacy at Work?

*Liz Brown, Law, Taxation, and Financial Planning*

Workplace wellness programs, which offer rewards for providing health information to an employer, are increasingly ubiquitous but create significant financial and privacy risks for employees. This presentation summarizes a paper that examines the legal and social impacts of regulations that encourage employers to offer health insurance programs requiring the disclosure and monitoring of health data.

As a result of both rising health insurance costs and recent regulatory changes, more employers are offering financial incentives of up to 30% of employees’ health insurance costs to employees who participate in workplace wellness programs. While these programs are technically required to be voluntary, they may not be voluntary in practice when there is a significant cost associated with nonparticipation. Lower-income employees then effectively may be compelled to participate in these programs, and therefore to disclose more health data, than they might choose to do. There are significant downsides to these data disclosures, including potentially harmful yet legal consequences, for employees who refuse to provide this data. In addition, the promised benefits of wellness programs are questionable at best. This presentation will highlight research that explores the costs and benefits of workplace wellness programs in this light and suggests improvements to the existing regulations.

Recruiting for Resilience: C-Suite Leaders in Life Science Share Lessons Learned

*Helen Meldrum, Natural & Applied Sciences*

The leaders of life science companies face numerous challenges as they move a drug or device from exploratory research to market placement. Pharmaceutical development has a long and expensive trajectory, with some estimates of a billion dollars on average to debut a new product. A major challenge is hiring and retaining dedicated professionals who will persevere through this marathon-like process. Interviews with 44 CEOs, CMOs, and CSOs highlight their efforts to engage team members who can support their organizations’ strategic direction and needs.

These C-Suite directors routinely go beyond a review of technical skills to probe candidates about how they have handled adversity in the past. Several executives mentioned emotional maturity as an essential quality in remaining steadfast through the long process toward FDA review and product positioning. There was also a recognition that a productive workplace culture is enhanced by a diversity of experience and personal temperaments, and that these differences generate creative energy. These prominent leaders employ colleagues with a deeply ingrained sense of purpose that sustains their focus and energy. The executives paint a picture of passionate team members who do not think of set-backs as obstacles, but rather as challenging problems to be solved on the way to providing life-altering options.
for patients. Some chief officers noted that a shared vision for improving quality of life plays a greater role in predicting outstanding performance than any particular skill-set discernable from a resume.

Case Study of the World’s Most Successful Drug (Humira)

Robert Schultz¹,³ (Presenter), Laura M. McNamee¹,², Fred D. Ledley¹,²,³

The world’s most successful drug (Humira, annual sales >$12 billion) arose through an uncommon alignment of business, scientific, and government interests. This alignment enabled an uncompromising focus on product development, which resulted in a technically innovative product that has improved the lives of millions of patients with rheumatoid arthritis, Crohn’s Disease, Ulcerative Colitis, and other inflammatory disorders.

¹ Center for Integration of Science and Industry
² Natural & Applied Sciences
³ Management

Political Connections and Corporate Innovation Productivity

Chansog (Francis) Kim¹, Matthew M. Ross², Chenguang Shang³ (Presenter)

Previous literature has documented that corporate political connections play an important role in explaining firm value. In this study, we examine the potential impact political connections may have on corporate innovation, a crucial economic driver that greatly influences the value of a firm. Using publicly available data collected from various sources, we find that political connections are positively associated with corporate innovation productivity among public firms in the United States over the period between 1999 and 2010. Our results are robust to the use of different proxies for political connections (directors with political background on the board, lobbying expenditures, and campaign contributions) and innovation productivity (patent count for innovation quantity and citations per patent for innovation quality). We adopt a Heckman two step procedure to control for firms’ endogenous decisions to establish political connections. To further mitigate the endogeneity concern, we employ a difference-in-difference approach where we use the addition of politically connected directors to firms with no previous connections as an exogenous shock to the political environment. Our results still hold after these additional analyses to address endogeneity. We also find that the positive effect of political connections on corporate innovation output is more pronounced for firms in the high-tech sector, facing greater financial constraint, and operating in competitive environments. We demonstrate that politically connected firms outperform their peers with regard to federal grant awards, which are shown to improve innovation productivity. This innovation amplification channel illustrates an important mechanism linking political influence to corporate innovation productivity.

¹ Accounting, State University of New York at Stony Brook
² Finance, Western Michigan University
³ Finance

Improving the Dynamic Range for Comparison Standards in Point-of-Care Diagnostics

Marc Custodio⁰,¹, Ming Quan⁰,¹, Christian Belger˚,², Yi Luo*,², Ali Sahara*,³, Chris Skipwith¹ (Presenter), Kevin J. Cash³, Heather A. Clark²

Introduction of medical devices into the market requires a careful analysis of the clinical potential of the devices. For point-of-care diagnostics, sensitivity, selectivity, modularity, broad dynamic range, and the ability to provide quantitative values are of the utmost importance in evaluation. One of the final analytical measures in device validation is to compare the experimental technology to established clinical standards. For many novel molecular targets, the clinical standards are either insufficient or unreliable. We have
developed a numerical method to quantify targets in very disparate concentrations using peak reconstruction of very sensitive mass spectrometry measurements. This method can be used for relative quantification in complex samples (serum, blood, other body fluids), and serves as a sensitive and quantitative standard for novel medical device development.

1 Natural & Applied Sciences
2 Northeastern University
3 Colorado School of Mines
* Doctoral student
† Postdoctoral fellow
Ω Undergraduate researcher

Value Creation by Biotechnology Companies with IPOs Between 1995-2015

Laura M. McNamee1,2 (Presenter), Usama SalimΩ,1, Fred D. Ledley1,2,3

This comprehensive study examines the value creation and product development by all biotech companies that had an initial public offering (IPO) from 1995 to 2015. Metrics of valuation, capital raised, clinical pipeline development, merger and acquisition activity, and research and development expenditure will be described. While the IPO represents an important milestone for private/venture investors, occurring a median of 6 years after company founding, it is not a predictor of longevity, with the median length of listing as a public company being only 5 years. The implications of the IPO for innovation in the biopharmaceutical industry is discussed.

1 Center for Integration of Science and Industry
2 Natural & Applied Sciences
3 Management
Ω Undergraduate researcher
Machine Learning in Meta-Analysis of Gene Expression Data to Identify Endophenotypes

Chris Skipwith\(^1\) (Presenter), Jared Abbruzzese\(^2\)

Endophenotypes are quantitative measurements that are correlated with phenotypes via shared genetic causes. The use of shotgun metagenomic analysis is a useful tool in identifying the strength of potential endophenotype-phenotype associations. However, there is a lack of validated computational tools for learning tasks. Furthermore, in the absence of clinical partners, it is difficult for researchers to develop robust meta-analyses due to lack of sufficient data. In this project, we use a recently-released tool, called OMics Compendia Commons (OMiCC) ([https://omicc-niaid-nih-gov](https://omicc-niaid-nih-gov), that uses crowdsourcing to provide existing gene expression data sets. We develop a computational framework for prediction tasks using quantitative genomics data in cardiovascular disease and thrombosis patients, which will allow a comprehensive meta-analysis of endophenotypes arising from clinical thrombosis tests.

\(^{1}\) Natural & Applied Sciences
\(^{2}\) Northeastern University

Optimizing Cash Flow From the OR Suite: An Integrative Behavioral Approach

Deborah W. Gregory\(^1\) (Presenter), Brian D. Gregory\(^2\)

Making use of OR assets in place (both capital assets and labor) to generate more cash flow is of strategic importance for hospitals under pressure to curtail and reduce costs. On the surface, maximizing cash flows from the OR suite appears to be a simple optimization problem across several variables, subject to multiple constraints. Doing so in a manner akin to maximizing shareholder wealth disregards the interests of key stakeholders, who both effect and are affected by the proscribed maximization model. The goals/agendas and reactions of the various stakeholder groups must be taken into account when formulating a best practices model for cash flow optimization in the OR suite. Furthermore, the interface between hospital personnel, patients, and hospital tangible assets requires more flexibility than in the typical systems engineering optimization situation.

Our model is informed by both behavioral accounting and behavioral finance in selecting which variables need to be measured; how to quantify those variables being measured; and how to present the variables in a way that achieves buy-in from primary players to avoid system sabotage. Application of manufacturing-based theories to OR scheduling assists in providing data that is user-friendly and extremely flexible to allow for real time modifications to schedules. Based on this value-added approach, simulations based on actual OR data show a significant increase in cash flow from OR assets in place.

\(^{1}\) Finance
\(^{2}\) King Fahd Medical City
Deep Learning Based Topic Identification and Categorization:
Mining Diabetes-Related Topics on Chinese Health Websites

Jennifer Xu, Computer Information Systems (Presenter), Xinhuang Chen1, Yong Zhang1, Chunxiao Xing1, Hsinchun Chen1,2

As millions of people are diagnosed with diabetes every year, the demand for diabetes related information (e.g., causes, symptoms, treatments, and complications) continues to increase. China is one of the countries with a large population of diabetic patients. Although many Chinese health websites provide diabetes related news and articles, users often have great difficulty finding their topics of interest effectively and efficiently, because most of these online articles are uncategorized or lack a clear topic and theme. This problem cannot be resolved by simply applying existing topic identification and categorization approaches and methods, which have been used primarily for English documents. To address this problem and meet users’ information needs, we propose a machine learning based framework to identify and categorize topics related to diabetes in online Chinese articles. This framework includes a Deep Belief Network (DBN), a Latent Dirichlet Allocation (LDA) model, and a Chinese lexicon of diabetes that we developed. Our experiments using datasets with over 19,000 online articles showed that the framework outperformed most of the state-of-the-art benchmark approaches in effectiveness and accuracy for the identification and categorization of diabetes related topics in Chinese online articles.

1 Tsinghua University
2 University of Arizona

Creating a Big-Data Management System for Data on Biopharmaceutical Development

Ekaterina “Kat” Galkina1 (Presenter), Jennifer Beierlein1,5, Michael J. Walsh1, Christopher Bresten*,1,2, Nilam Shete1,3, Navleen Khanuja6,1,3, David Oury4, R. Mark Adams1,5, Fred D. Ledley1,5,6

A vast amount of research data is acquired by institutions requiring persistent access and maintenance over time. A centralized data center is necessary for sustainable data curation, to ensure quality control and standardization, and to provide a platform for data mining. The Center for Integration of Science and Industry is building such an infrastructure for storing and analyzing its core data on biopharmaceutical development and the business of biotechnology. A dedicated space for housing data from multiple projects has been established on Bentley’s computer cluster. This virtual personal server is equipped with 12 cores and 144 GB of RAM, and authorized for remote access by all team members. Data currently stored on numerous spreadsheets is being transitioned into comprehensive databases alongside the code used for analytic processing involving natural language processing and machine learning. Reconciling data into a localized database with access to high performance computing is the more effective and permanent solution for facilitating version control and improving runtime of statistical analyses. The design of an organizational platform for linking heterogeneous data will facilitate subsequent natural language processing, which aims to relate how scientific terminology trends through time and contributes to technological innovation.

1 Center for Integration of Science and Industry
2 University of Massachusetts Dartmouth
3 Business Analytics
4 Mathematical Sciences
5 Natural & Applied Sciences
6 Management
* Doctoral student
∆ Masters student
Privacy and Law in a Technology-Driven Economy

Mystica Alexander¹ (Presenter), Cheryl Kirschner², Patrick Scholten³, David Yates⁴

Technology has fundamentally changed the way that consumers and businesses interact within economies around the world. Consumers can search vast amounts of information and engage in transactional relationships. Hypertext transfer protocol (HTTP) and tracking cookies are communication mechanisms between a website and a user’s computer designed to store stateful information and record a user’s browsing activity. While such cookies originally were designed to facilitate efficient communication between a website and computer, the evolution of more sophisticated, third-party cookies, and tracking scripts—all designed to track long-term individual browsing histories—have raised significant privacy concerns.

Law seldom keeps pace with technological advances. At present, no comprehensive federal law exists to protect the online tracking, collection, and use of such data, although certain sectors, such as healthcare, may receive more heightened protection than others. This study proposes to empirically examine the extent to which incidental third-party cookie tracking information mechanisms violate the spirit, if not the letter, of the law in the healthcare sector by using the collected information as the basis for targeted advertising. We propose to automate independent browsing activity and determine how browsing behaviors alter the subsequent directed advertising content. At a minimum, we argue that the legal framework needs to catch up to the ever-evolving technology-based economy to protect individual privacy.

1 Law, Taxation, and Financial Planning
2 Babson College
3 Economics
4 Computer Information Systems

Real World Awareness (RWA) Systems for the Pharmaceutical Value Chain

Alina Chircu¹ (Presenter), Carsten Brockmann², Eldar Sultanow²

The pharmaceutical industry today faces several transparency challenges related to tracking and tracing products along the entire supply chain in order to prevent drug counterfeiting, parallel imports and quality issues during storage and transportation. However, existing research has so far neglected one of the main components of pharmaceutical industry transparency: the real-time identification and advanced anticipation of events that are relevant to managers of pharmaceutical organizations. This ability to scan a company’s environment, collect real-time information, and respond to it efficiently and effectively has been called real-world awareness (RWA). This presentation discusses a novel RWA prototype and its application in the pharmaceutical industry value chain. The presentation builds on a paper previously presented by the authors at the 2015 International Conference on Information Resources Management (Conf-IRM).

1 Information and Process Management
2 Capgemini Deutschland GmbH
The Role of Emotion in the Discursive Practices that Underlie the Adoption of an Electronic Medical Record

David Murungi¹ (Presenter), Marco Marabelli¹

While much research has been conducted to examine the role that emotions play in the practice of medicine and its general role in healthcare management practice, much less work has been done to examine its role in the management of health information system implementation projects. To address this gap in knowledge, our research examines the role that emotions play in the implementation of health information systems at two hospital systems. The research uses discourse analysis and argument theory to study how conflicting affective or emotional responses to an IS implementation initiative are negotiated within these organizations. In particular the research traces and contrasts the differing trajectories and impacts of rhetorical versus dialectic argument strategies as they are used to manage the emotional conflicts that emerge in hospital IS implementation efforts. Preliminary findings suggest that efforts to resolve emotional conflicts in IS implementation is impeded by an overreliance on dialectic discourse whose argument structures make it difficult both recognize as well as respond to emotional conflict in the project. Indeed, a core potential insight of this study is a narrative that describes the discursive formation of emotional “blinders” or “barriers” in healthcare information systems implementation projects.

¹ Information and Process Management

Seeing the Pupils of the Patient’s Eyes: System Trust and Interpersonal Trust in Health Care

Monica Garfield¹ (Presenter), Janis Gogan², Ryan Baxter³

Prior studies report that interpersonal and organizational trust are affected by propensity to trust and beliefs about others’ benevolence, competence, and integrity. Less is known about system trust, a controversial construct. One school of thought says that trust only applies between humans, while others propose that users may form emotional attachments to IT application features that exhibit qualities that mimic human benevolence, competence, and integrity. Few studies have examined how system trust develops, how and why it changes with usage, and how interpersonal trust and system trust affect one another. In this paper we examine the interplay of system and interpersonal trust issues in five case studies of IT-supported clinical care. Two cases, tele-dermatology and tele-psychiatry, involved routine consultations and three cases involved acute care: tele-pediatrics, tele-stroke, and tele-trauma services.

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Is Patient Satisfaction the Answer to the Dilemma of Measuring Quality in Hospitals?

Swati Mukerjee\textsuperscript{1} (Presenter), Mingfei Li\textsuperscript{2}

The need for measurement of quality in hospitals is crucial for informed decisions by patients and families as well as for targeted efforts for improvement. Quality measures enable comparisons both intertemporally as well as between institutions. Quality is a multi-dimensional aspect, and currently there are different quality measures available from both government and private agencies. Some, like patient assessments, have been tied to CMS payment to hospitals and the recent focus on patient satisfaction scores and subsequent ranking of hospitals has been controversial. Available measures are restricted to certain types of hospitals, or to particular aspects of quality. Based on existing work to date, we propose to create a composite index of quality that takes into account both patient satisfaction data as well as structure, process, outcome and safety aspects of care. Then we will conduct a sensitivity analysis of our measure and link the rankings to some standard measure of quality such as 30-day readmission data.

\textsuperscript{1} Economics
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Mining Biomedical Literature to Develop a Technology Forecasting Model for Drug Development

Nilam Shete\textsuperscript{4,\textdagger} (Presenter), Jennifer Beierlein\textsuperscript{1,2}, Akshay Prakash\textsuperscript{\textdagger,1}, FredLedley\textsuperscript{1,2,3}

Innovation theory highlights the importance of technological maturity in successfully getting a product to market. Patterns observed in FDA drug approvals support the requirement of having a mature biotechnology before the drug is approved to go to market. The biomedical literature, compiled and indexed in the National Center for Biotechnology Information Medline database, offers a rich source of data representing biotechnology knowledge. Through natural language processing, we observe the change in what is being discussed around a specific topic over time. Further utilization of NLP and Machine Learning tools should help identify important milestones in biotechnology maturation and drug development, allowing for better understanding of this process. Ultimately this information will allow for the development of a quantitative technology forecasting tool, aiding strategic decision making in the development of innovative therapeutics.

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Indicators and Agenda Setting: An Empirical Analysis of Preparedness Policymaking

Rob A. DeLeo, Global Studies

Extant theories of government agenda setting and policy change emphasize the importance of problem indicators, which refer to numeric measures of a policy problem. However, few studies empirically examine the agenda setting dynamics associated with these and other type of quantitative metrics. Using the pandemic influenza and Ebola cases as examples, this study shows the rate of indicator accumulation—how quickly measures amass—can induce distinctive policymaking patterns. Although rapid accumulation almost always captures policymaker attention, prolonged agenda activity is more likely during periods of gradual accumulation. Focusing events, notably large-scale disasters, can expedite the agenda setting process by facilitating linkages to dominant policy narratives or “principles.”

Impact of Corporate Finance on the Healthcare Innovation Ecosystem

Fred Ledley1,2,3 (Presenter), Laura McNamee2, Roger Du1, Jonathan Lee1

The biopharmaceutical industry provides the largest fraction of funding for research and development on new drugs, one of the factors frequently cited as justification for high drug prices. This study examines the financial statements of all healthcare companies (82) listed in the S&P 500 or Fortune 2000 between 2000 and 2015, including 48 companies producing drugs, biological products, or medical devices. Over this interval, these 82 companies generated $21.2 trillion in revenues and $1.8 trillion in net income, invested $1.9 trillion in expensed R&D, distributed $1.6 trillion to investors through dividends ($700 billion) or stock buybacks ($900 billion), increased debt by more than $650 billion, and increased their composite market value in proportion to major market indices. These results are discussed in terms of the enormous capacity of the biopharmaceutical industry to mobilize the capital resources required for R&D and innovation in healthcare, but also the magnitude of capital resources that flow out of the innovation ecosystem to shareholders. Ongoing studies are examining factors that influence R&D spending by the major biopharmaceutical companies as well as the impact of R&D spending on product development pipelines and revenues.

1 Center for Integration of Science and Industry
2 Natural & Applied Sciences
3 Management

Effectiveness of Second-Generation Antipsychotics vs. Older Anti-Manic Medication in Treating Bipolar Disorder

Mark S. Bauer1,2, Christopher J. Miller1,2, Mingfei Li3 (Presenter), Laura A. Bajor1,2, Austin Lee4,6

Numerous anti-manic treatments have been introduced over the past two decades, particularly second-generation antipsychotics (SGAs). However, it is not clear whether such newer agents provide any advantage over older treatments. A historical cohort design investigated the nationwide population of outpatients with bipolar disorder treated in the Department of Veterans Affairs who were newly initiated on an anti-manic agent in 2003-2010 (n=27,727). The primary outcome was likelihood of all-cause hospitalization during the year after initiation, controlling for numerous demographic, clinical, and treatment characteristics. Potential correlates of effect were explored by investigating time-to-initiation with a second anti-manic or antidepressant. After control for covariates, those initiated on lithium or valproate monotherapy, compared to those beginning SGA monotherapy, were significantly less likely to be hospitalized, had longer time-to-hospitalization, and had fewer hospitalizations in the subsequent year. Those on combination treatment had significantly higher likelihood of hospitalization, although
they also had longer time-to-addition of an additional anti-manic or antidepressant. This analysis of a large and unselected nationwide population provides important complementary data to that from controlled trials. Although various mechanisms may be responsible for the results, the data support the utilization of lithium or valproate, rather than SGAs, as the initial anti-manic treatment in bipolar disorder. A large-scale, prospective, randomized pragmatic clinical trial comparing initiation of SGA monotherapy to lithium or valproate monotherapy is a logical next step.

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Alcohol Consumption in Thailand

Pannapa Changpetch1 (Presenter), Dominique Haughton1,2,3,4, Mai T. X. Le5, Sel Ly6, Phong Nguyen7, Tien T. Thach6

This research provides a thorough study of alcohol consumption in Thailand in terms of the relationships between this activity and tobacco consumption, gambling consumption, socioeconomic status, and demographic factors. Three statistical models and data-mining techniques—logistic regression, Treenet, and directed acyclic graphs—are used to analyze datasets drawn from socio-economic surveys of 43,844 Thai households conducted in 2009. From logistic regression, we found that the region where the household is located, urban/rural location of the household, household income, tobacco household expenditure, gambling household expenditure, education, religion, marital status, gender, age, and work status of the household head are all associated with the alcohol consumption of households. From Treenet, we found that the proportion of tobacco expenditure is the most important factor in explaining the proportion of alcohol expenditure. From the directed acyclic graph (DAG), we found that the proportion of alcohol expenditure has a direct effect on both the proportion of tobacco expenditure and the proportion of gambling expenditure. We expect our results to be useful to both researchers and government practitioners in their efforts to design and implement programs targeting households that include alcohol-dependent members and to thereby reduce alcohol consumption in Thailand.

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6 Ton Duc Thang University
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Effects of the Minimum Wage on Infant Health

Dhaval Dave1,2,3 (Presenter), Robert Kaestner2,4, George Wehby2,5

The minimum wage has increased in multiple states over the past three decades. Research has focused on effects on labor supply, but very little is known about how the minimum wage affects health, including children’s health. We address this knowledge gap and provide an investigation focused on examining the impact of the effective state minimum wage rate on infant health. Estimates are based on a difference-in-differences (DD) research design, which adjust for unmeasured factors and confounding trends, in order to identify plausibly causal effects. Using data on the entire universe of over 90 million births in the US over 25 years, we find that an increase in the minimum wage is associated with an increase in birth weight driven by increased gestational length and fetal growth rate. A $1 increase in the minimum wage increased birth weight by nearly 11 grams, which suggests that raising the minimum wage from its current federal level of $7.25 to $15 would increase birth weight by 85 grams on average. We also find a significant effect on the likelihood of low birth weight (<2500 grams), which declines by 2% with a $1 increase in the minimum wage. Such “average” effects mask heterogeneous responses. We find that the effects are larger for groups most affected by minimum wages (younger and non-white low-educated mothers). We also find evidence of an increase in prenatal care use and a decline in smoking during pregnancy, which are some channels through which minimum wage can affect infant health.

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Objects at Work: The Role of Digital Materiality in Healthcare Networks

Marco Marabelli¹ (Presenter), Danielle Blanch Hartigan²

In this study we examine the role of objects in promoting communication processes between providers and parents of children with complex care needs at a healthcare network in Ottawa, Ontario. In particular, drawing on longitudinal and qualitative interview data with both parents and members of the clinical team (July 2014–July 2016) we focus on the use, in practice, of digital materiality, a boundary object that mediates the two-way communication between providers and parents, including emails, web-based interfaces to access medical records, social media apps and the hospital’s websites. We refer to this as “internal” digital materiality—in contrast with “external” digital materiality, which refers to online generic medical information/resources, commonly studies in the healthcare communication literature. With respect to internal digital materiality, while before its introduction parents “trusted” mainly physicians, they now rely mostly on nurses (the primary “users” of digital materiality, along with patients), who act as knowledge brokers. Through materiality-mediated interactions parents perceive the role of clinical staff (i.e., nurses) as more authoritative (and trustworthy) than it would be (and it was) in face-to-face interactions. Interview data suggest practical consequence related to the decreased frequency of patient-physician interactions, increased frequency of patient-nurse online interaction and reduction of ER admissions/year. The novelty of this study rests on the theorization and role played by internal digital materiality, a type of boundary object that supports knowledge brokering practices in complex care settings. We extend the theory of the role of boundary objects in mobilizing medical knowledge between patients and providers.

¹ Information and Process Management
² Natural & Applied Sciences

Environmental Degradation and Medical Services for Residents of Volta River Estuary Islands

Diane M. Kellogg, Management

The 4,500 residents of the 22 estuary islands of the Volta River live in an especially unhealthy environment, causing the incidence of disease and death to be disproportionately high as compared to equally poor people who do not live on the Volta River. Riverside villages and the estuary islands rely on the Volta for drinking water, cooking, bathing and for defecation. Even human waste deposited on dry land ends up in the river during the rainy season. Bacterial and viral infections lead to persistent GI symptoms, diarrhea and dehydration, which can lead to acute kidney failure and death. Babies and children under the age of 5 are especially vulnerable to death from diarrhea. Medical services are overwhelmed with the care and treatment of symptoms, and left unable to address the root causes. This presentation will provide a comparison of the cost of medical care as opposed to the cost of providing an off-grid water purification solution and an off-grid household toilet solution to prevent disease and further environmental degradation.
To Know a Patient’s Pain: Meta-Analysis of Healthcare Providers’ and Caregivers’ Pain Assessment Accuracy

Danielle Blanch Hartigan¹ (Presenter), Mollie A. Ruben², Jillian C. Shipherd³

Acute and chronic pain affects millions of adults, yet it is often inadequately assessed and treated. To avoid over— and under treatment of pain, providers and their caregivers must accurately assess patient’s pain. However, assessment of patient pain can be challenging given that pain is an inherently subjective experience. The purpose of the present meta-analyses was to examine the overall level of pain assessment accuracy among caregivers and providers and identify patient, observer, and assessment level factors that moderate pain assessment accuracy. A systematic literature search was conducted in PubMed and PsycINFO to identify studies addressing providers’ pain assessment accuracy, or studies that compared patients’ self-report of pain with observers’ (healthcare providers, caregivers, and strangers) assessment of pain. We present two separate meta-analyses examining the overall effect of under-/overestimation of pain and correlational pain assessment accuracy. Seventy-six articles meeting inclusion criteria yielded 94 independent effect sizes for the correlational accuracy meta-analysis. Ninety articles yielded 103 independent effect sizes for the paired comparison meta-analysis. The correlational pain assessment meta-analysis showed that in general, observers were significantly better than chance when assessing pain; however, the paired comparison meta-analysis showed that providers significantly underestimated patients’ pain and caregivers significantly overestimated pain. Patient age and gender, pain type and provider type moderated these effects. Training healthcare providers and caregivers to accurately assess patient pain, particularly for certain patient groups, may lead to more appropriate pain treatment.

¹ Natural & Applied Sciences
² Massachusetts College of Pharmacy and Health Sciences
³ VA Boston Healthcare System

Medical Marijuana: A Shift in the Paradigm of Patient-Centered Care

Miriam Boeri, Sociology

Medical marijuana (cannabis) is legal in 24 states and Washington DC; yet it is still a stigmatized drug and remains on the Drug Enforcement Agency’s Schedule 1, indicating it has no medical purposes. Researchers and doctors disagree on the health benefits of cannabis. Dr. Sanja Gupta, Chief Medical Correspondent for CNN and a practicing neurosurgeon and professor at Emory University, won an Emmy for his documentary on medical marijuana. At first opposed to using marijuana as medicine, he changed his mind on the medical benefits of cannabis after speaking to patients around the world who benefitted from using cannabis for health problems. In his words, “I spent time with them and came to the realization that it is irresponsible not to provide the best care we can as a medical community, care that could involve marijuana.” Based on in-depth interview data, I discuss the benefits of marijuana from the perspectives of medical marijuana patients (n=11) and medical marijuana certifying physicians (n=2) in Massachusetts. Patients report using cannabis for a variety of physical and mental health problems that prescription drugs and other medical remedies could not alleviate. However, patients say they are stigmatized for using cannabis legally, and physicians say they are ostracized by the medical community for certifying patients. Should we listen to patients? What are the positive and negative consequences of considering their views? The dilemma of medical marijuana in contemporary society is discussed.
Managing Co-Opetition for Shared Utility in Dynamic Healthcare Environments

Jill A. Brown¹ (Presenter), Peter Gianiodis², Michael D. Santoro³

Industry changes have prompted new organizational structures in the U.S. hospital sector. For example, some nonprofit hospitals have converted to integrated nonprofit/for-profit structures, fostering intra-firm co-opetition (simultaneous competition and collaboration) between units. We examine this phenomenon and provide recommendations regarding controls and incentives that can help administrators actively manage co-opetition and promote shared utility between the nonprofit hospital and for-profit physician practices. Despite competing characteristics between units, and tensions in managing powerful physician stakeholders, the active management of co-opetition between units in integrated hospitals can be a strategic tool to navigate competitive forces in the hospital industry.

¹ Management
² Duquesne University
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Avoiding the Introduction of Toxic Chemicals to Early Education Environments

Ryan M. Bouldin¹ (Presenter), Danielle Blanch Hartigan¹, Vanessa Coloma Gonzalex²

Many environmental toxins are introduced to childcare and early education facilities through the products care providers purchase. This type of behavior can be described as regrettable product purchasing; the products may perform their intended function, but they also introduce unintended chemical exposures. Regrettable product purchasing may occur for a number of reasons, including the need to meet ambiguous state regulations, a perception of increased cost for safer products, a lack of education concerning environmental toxins, and a lack of experience purchasing materials that are environmentally preferable. The project has built a purchasing guide for all childcare providers in Massachusetts that demonstrates the pitfalls that lead to purchasing problematic products and recommends environmentally preferable alternatives. In addition, a manuscript analyzing survey data about the relationships between childcare providers’ knowledge, risk perceptions of toxic chemicals, and their purchasing behavior is being developed.

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A Systems Approach to Creating Great Patient Experiences

Mark M. Davis¹ (Presenter), Patrick Jordan, III²

The healthcare industry in the United States is undergoing dramatic changes that will continue for the foreseeable future. As in the past, politics and economics will continue to play a significant role in the overall structure of the healthcare system in the United States. This is especially true at the macro level with respect to healthcare provider reimbursement and government program eligibility requirements for patients. However, regardless of the political decisions made going forward and their implications at the macro level, patient expectations for the actual services and care that they receive will continue to increase. This presentation discusses the major operational challenges confronting today’s healthcare managers and introduces specific recommendations on how they can, even must, focus on achieving operational excellence in the delivery of health care to their patients, even with the continuing pressure to reduce costs. This is accomplished by taking a systems perspective in identifying the major factors that affect a healthcare organization’s ability to deliver great patient experiences. These factors include: (a) adopting the proper technology, (b) understanding the role of senior management,
(c) creating a patient centric culture, (d) defining service quality, and (e) selecting the right performance measures.

1 Management
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