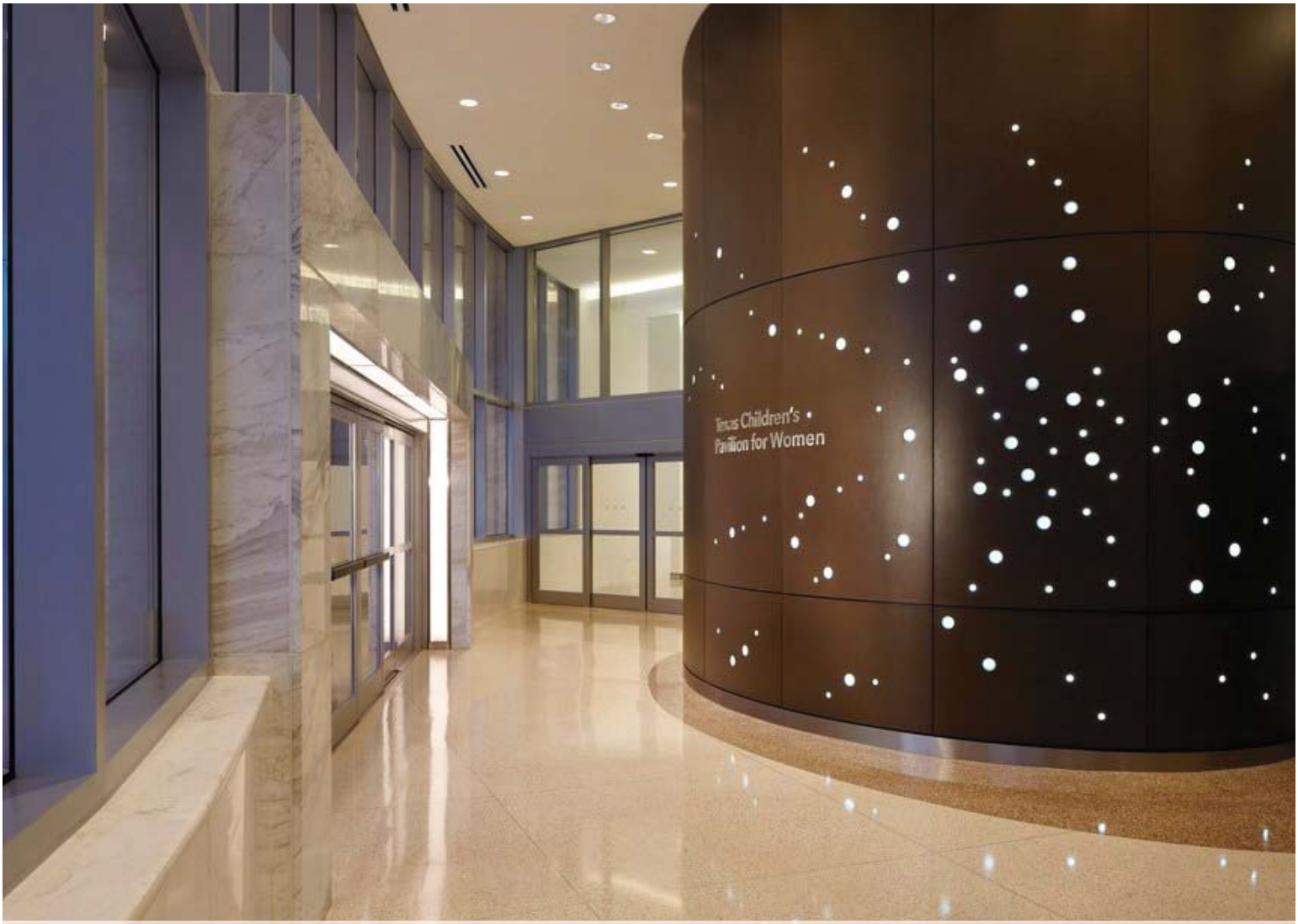
Spring 2016 Research Proposals

Proposal #	Research Cluster	RFP	Title
1.1	Access & Efficiency	Operations	Health IT: Enhancing Quality & Safety through Improved Access
1.2	Access & Efficiency	Care Coordination	Cost and Consequences of Poor Care Access
1.3	Access & Efficiency	Operations	Avoidable Admissions: The Role of Non-urgent Emergency Visits
1.4	Access & Efficiency	Population Health	Exploring Future Models of Care Delivery for Texas
1.5	Quality and Safety	Operations	Customer Service at Central Texas VA Austin Outpatient Clinic
2.1	Enabling HIT and Care	Population Health	Integration of Genomic Data for Precision Health Decision Support
2.2	Enabling HIT and Care	Population Health	Evaluation of Patient Monitoring Technology in Various Settings
2.3	Enabling HIT and Care	Home Care	Virtual Care Clinics: What Can We Learn from Early Adopters?
2.4	Macro/Policy	Population Health	Machine Learning: Knowledge Discovery and Best Practices
2.5	Macro/Policy	Workforce Training	System Analysis of Graduate Medical Education Processes
3.1	Patient-Centered Care	Care Coordination	Multi-Criteria Evidence-Based Healthcare Delivery
3.2	Patient-Centered Care		Precision Medicine: Personalized Drug-Effect Treatment
3.3	Patient-Centered Care	Home Care	Safely Aging in Place: Understanding Informal Caregiver Teams
3.4	Patient-Centered Care	Home Care	Demand Management for Community Paramedicine
3.5	Patient-Centered Care	Care Coordination	A Person-Centered Approach for Individuals with MCCs
3.6	Patient-Centered Care	Home Care	Sensing Systems for Personalized Telehealth Wellness Management
3.7	Patient-Centered Care	Population Health	Diabetes Education: The Role of CHWs and Variations in Outcomes
3.8	Patient-Centered Care	Operations	Future Models of Cancer Care Implications for Space and Design
4.1	Access & Efficiency	Operations	Optimizing Care Delivery with Minimal Disruption
4.2	Enabling HIT and Care	Operations	The Cost of Postoperative Delirium
4.3	Quality and Safety	Operations	Falls Prediction and Causality Models in Inpatient Settings
4.4	Macro/Policy	Payment Models	Value Based Care: Challenges of a Changing Care Paradigm



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Research Proposals

Meeting Clusters

Cluster #1

Access and Efficiency

Quality and Safety

Cluster #2

Enabling HIT and Care

Macro/Policy

Cluster #3

Patient-Centered Care

Cluster #4

Collaborative Projects

Cluster #1: Access & Efficiency and Quality and Safety

Chair: Harriet Nembhard, Penn State University

Access & Efficiency

1.1 Health IT: Enhancing Quality & Safety through Improved Access
RFP: Operations
Eva Lee & William Wang, Georgia Institute of Technology

1.2 Cost and Consequences of Poor Care Access
RFP: Care Coordination
James Benneyan, Northeastern University

1.3 Avoidable Admissions: The Role of Non-urgent Emergency Visits
RFP: Operations
Alva Ferdinand, Farzan Sassangohard, Abdulaziz Tijjani, Sarah Mack, Texas A&M University

1.4 Exploring Future Models of Care Delivery for Texas
RFP: Population Health
Bita Kash & Elizabeth Popp, Texas A&M University

Quality and Safety

1.5 Customer Service at Central Texas VA Austin Outpatient Clinic
RFP: Operations
Bita Kash, Darcy McMaughan, Molly McKahan, Texas A&M University

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title:Health IT: Enhancing Quality & Safety through Improved Access

Proposal Number: 1.1	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Lee, Li, Wang (GIT)		**Project Budget:** $60,000
Research Cluster: Access and Efficiency	**RFP:** Operations	

Description:
The 2015 Institute of Medicine report on "Transforming Health Care Scheduling and Access -- Getting to Now" highlights the challenges in scheduling healthcare services. The data on access and wait times in health care are limited. There is a prominent deficiency in research, evidence-based standards, and metrics for assessing the prevalence and impact of these issues. Extended wait times and delays for care have been shown to negatively affect morbidity, mortality, and the quality of life via a variety of health issues, including cancer; heart disease; hip, knee, and spinal fractures; and cataracts of the eye. The timely delivery of appropriate care has also been shown to reduce the mortality and morbidity associated with a variety of medical conditions, including kidney disease and mental health and addiction issues This study focuses on scheduling challenges in the primary, OR, and specialty service settings at multiple clinical sites, including adult and the pediatric population.

How this is different than related research:
Most scheduling is done based on availability of physician's preference time. The patients are then offered the best possible time that may fit his/her doctor's schedule. This study will identify the needs of patients and develop a predictive model to estimate the individual needs (and thus LOS for the appointment). This information is then incorporated within a scheduling optimization framework for dynamic optimization. This allows for optimizing the scheduled service as well as unexpected emergency service.

Experimental Plan:
This study will cover 6 clinical sites (including pediatric) and involves 10 different hospital units. For each site, we perform observational time-motion studies, structured interviews, charts review (from EMR), and predictive analysis of appointment complexity and resource needs. This information will be coupled with patient schedule preference. The team will then develop a dynamic system scheduling model and optimization engine to determine the best possible schedule. We anticipate the system to be real-time and adaptive as schedules are being updated.

Major milestones expected:
- Complete analysis of scheduling gaps in 6 clinical sites.
- Complete predictive analysis of patient needs and service complexity and LOS.
- Design of dynamic optimization-based scheduling system.
- Development of a computational solution engine.
- Validaton of results against existing schedules.
- Impletment and test performance of the new system.

Project benefits to industry:
- Improve access and timeliness of care
- Improve quality of care
- Improve scheduling, utilization, and reduce waste
- Improve safety and satisfaction of patients
- Improve moral of providers

Expected Deliverables:
- A profile of patient care characteristics vs resource usage
- A clinical-decision support for dynamic clinical scheduling
- A training guideline for scheduler

Project Title: Costs and Consequences of Poor Care Access

Proposal Number: 1.2	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Benneyan, Jacobsen, Cyr-Patota, Chicklis (NEU)		**Project Budget:** $40,000
Research Cluster: Access and Efficiency	**RFP:** Care Coordination	

Description:
This project responds to the recent IOM Access to Care report and aims to develop a methodology to better understand, define, and quantify poor access to care and its consequences on cost, flow, and patient health. Delays in access to healthcare and extended wait times have been shown to be associated with multiple consequences, including but not limited to poorer health outcomes, financial burden from seeking non-network care, higher rates of appointment no-shows, unnecessary ED visits, frustration, inconvenience, and dissatisfaction with the healthcare system. While preventing delays and reducing wait times are particularly critical for many health services, to improve or optimize access by any method requires understanding what defines bad access and how to quantify its consequences. The purpose of this project therefore is to design and conduct an analytic study of consequences of delayed care in multiple settings starting with 3 pilot specialties – dermatology (melanoma), mental health, and neurology.

How this is different than related research:
While it is well established that delays in access to care have multiple causes and consequences, including negative effects on health outcomes, patient satisfaction, healthcare utilization, costs, and organizational reputation, very little scientific evidence exists on what defines bad access and how to quantify its impact on cost, flow, and health consequences. This project aims to take a systematic approach and develop approaches to better understand, define, and quantify access to healthcare and its consequences in various settings, initially focusing on 3 different specialties. This also includes research to apply and evaluate statistical modeling and quality engineering methods.

Experimental Plan:
1. Conduct literature review on timely access to care and its consequences within each specialty
2. Conduct data analysis to better understand the access issues and consequences within each specialty
3. Identify methods to be used and develop a methodology to better define timely access to care and quantify its consequences
4. Develop recommendations for future research and disseminate our findings

Major milestones expected:
- Literature review completed (8/1/16), IRB approval received (6/1/16)
- Data obtained from health systems (6/1/16), initial data analysis completed (8/1/16)
- Methodology developed to quantify the consequence of timely access to care within each specialty (10/1/16)
- Analysis completed (2/1/17), standardized measures within each specialty developed (4/1/17)
- Journal manuscript draft completed (4/1/17), final 1st manuscript completed (5/1/17)

Project benefits to industry:
- Better understanding of access to care and its consequences
- Development of standardized measurement approaches and benchmarks
- Quantify impact on over utilization, costs, outcomes, patient satisfaction

Expected Deliverables:
- Documentation and analysis of access issues and consequences for each specialty
- Development of standardized measures and evaluation of alternate approaches
- Development of journal-ready publication(s) to disseminate findings

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **Avoidable Admissions: The Role of Non-Urgent Emergency Visits**

Proposal Number: 1.3	**Multi-Site Project?** No	**Continuing Project:** Yes
Project Leader: Ferdinand, Sasangohar, Tijjiani, Mack (TAM)		**Project Budget:** $ 100,000
Research Cluster: Access and Efficiency	**RFP:** Operations	

Description:

Many CHOT industry members are health systems, such as Main Line Health, who have been faced with increased emergency department (ED) utilization in recent years, partially due to the Medicaid expansion efforts in many states. Therefore, these systems are potentially dealing with avoidable admissions via the ED. The research question to be addressed is: What percentage of these admissions through the ED are avoidable admissions and how can we redesign the system to assure the most appropriate level of care for patients? Some health systems have developed "ED rerouting" initiatives to urgent care centers as part of addressing this problem, but access to the most appropriate level of care still remains a problem in the U.S.

How this is different than related research:

In this study, CHOT researchers will first inform industry about factors associated with admission decisions and analyze variations based on patient and provider characteristics. Once practice patterns and variations in admission decisions through the ED are explained in Year 1 of this study, CHOT researchers will focus on understanding and re-designing the ED patient flow process to assure the most appropriate level of care for patients in the system. This study is focused on not only a better understanding of what is going on in a costly care setting, but will also provide industry members with strategies for cost savings by the end of Year 2.

Experimental Plan:

Year 1: The research team will conduct a systematic literature review of admission decisions through the ED and identify sources of variability in admission decisions via the literature first. Next, the research team will use ED visit and admissions data to analyze factors identified in the literature review and explore prediction models of admission decisions using this data. Results will inform the engineering research team in Year 2.
Year 2: The research team in Year 2 will engage in primary data collection to gain a better understanding of patient flow and admission decisions in the ED. The researchers will also engage in patient interviews to understand patient decision process to visit the ED. Results from Year 2 research activities will result in mapping an optimized ED patient flow decision process.

Major milestones expected:

- Months 1-4: Systematic review and meta-analysis of the literature on factors influencing primary care-treatable ED visits and admissions decision-making.
- Months 4-8: Analysis of MLH data that identifies individual characteristics associated with seeking care for primary care-treatable conditions in EDs.
- Months 9-10: Identification of predictors affecting suboptimal admissions decisions among physicians staffing EDs at MLH.
- Months 10-12: Secondary data analysis is further refined based on industry feedback and key-informant interviews. Start manuscript development.
- Year 2: Cognitive work analysis; primary data collection; apply data-based queuing science to inform the design of an optimized ED patient flow decision process.

Project benefits to industry:

- Hospitals participating in the ACO payment model can benefit from the results
- Benefits to patients: improved access to appropriate level of care
- Potential design of system to improve triaging before the patient enters the ED

Expected Deliverables:

- Identify patient conditions that are associated with likelihood of admission
- Understand variations in practice patterns in the ED and by admitting physicians
- Develop decision process improvement tool to achieve appropriate levels of care

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: Exploring Future Models of Care Delivery for Texas

Proposal Number: 1.4	**Multi-Site Project?** Select	**Continuing Project:** No
Project Leader: Kash, Popp (TAM)		**Project Budget:** $50,000
Research Cluster: Access and Efficiency	**RFP:** Population Health	

Description:

The healthcare delivery system is evolving from a reactive delivery model to a more coordinated and proactive model of care. Today, practice guidelines, chronic disease prevention, diagnostic and treatment technologies, and an increasingly engaged population present the healthcare delivery model with a unique opportunity to reinvent itself. Primary care (PC) is a key player in the future models of care and can be the anchor of an effective healthcare delivery model. PC providers are now pursuing strategies to engage patients earlier and more often by using innovative technologies. Further, PC networks stand to benefit from improved integration with specialty care. Finally, PC networks are becoming increasingly proactive with their high acuity patients through the use of remote monitoring technologies and mobile health. In designing these new care models it is important to make informed judgments on what is best suited for well-defined population segments within a state. The purpose of this study is to identify best practices of innovative PC models (IPCM) and to describe a potential future PC model for Texas.

How this is different than related research:

The IPCM is a product of a new environment of care concerned with improved access, effectiveness, timeliness, patient/parent engagement, and efficiency of pediatric care. IPCM calls for evolving care teams and professional leadership in the re-engineering of work processes. Thus, this research is heavily driven by both theory and practice to more clearly define IPCMs and their variants across the U.S. Results of this research will provide a model for IPCM for the state of Texas first and guide CHOT members in IPCM planning and implementation in other states. In addition, we will focus on mechanisms to place and retain care-givers in rural communities.

Experimental Plan:

1. Conduct an iterative scientific- and professionally-guided literature review; 2. Identify and study 5 to 10 "best practices" identified from the search. The first aim will be completed by four months and refined by the sixth month of the project, while supplying CHOT members with monthly updates of the findings resulting in refinement of search criteria. The second aim will require the identification of key informants in about 5 to 8 potential "best practices" to be further studied. Key informants identified and contacted to secure participation in in-depth personal phone interviews. These professional key informants will be asked to serve as advisers to the CHOT research team. Other key informants will be identified by the CHOT industry members.

Major milestones expected:

- Initial literature search is completed by month 4 and refined periodically
- Identification of key informants at 5 to 8 potential "best practices" for further study by month 4
- Interview questions are developed with help of CHOT IAB members to include team composition and operationalization of a potential IPCM by month 5
- Key informant interviews at 5 to 8 "best practices" completed by end of month 7
- A report of the qualitative analysis of these results will be presented to the sponsor by March 2017; Research results and report writing - month 8 to 12

Project benefits to industry:

- Clear understanding of the nature, evolution and design of a IPCM
- Describe characteristics of the IPCM for implementation purposes
- Potential to redesign PC services across health systems and other states

Expected Deliverables:

- Identify best practices and insights from systemic literature review on IPCMs
- Describe the ideal teams to implement the IPCM for the Texas population
- Facilitation of research-informed strategic planning towards a IPCM for Texas

Project Title:Customer Service at Central Texas VA Autsin Outpatient Clinic

Proposal Number: 1.5	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Kash, McMaughan, Tomaszewski, McKahan (TAM)		**Project Budget:** $50,000
Research Cluster: Quality and Safety	**RFP:** Operations	

Description:
The Austin Outpatient Clinic provides a full spectrum of multi-specialty care to about 30,810 unique veterans annually. The clinic's outpatient workload is 271,872 visits a year and requires a multi-disciplinary team of care providers. The clinic's mission and vision focus on "honoring veterans with quality healthcare services." Currently, the clinic has identified customer service as one of the key issues to be addressed by clinic management and staff. In order to develop and implement a customer service improvement plan for the clinic, the clinic leadership will turn to the clinic physicians, nurses, and staff for insights, ideas, and opportunities for improvement. This process of quality improvement, focused on customer service performance metrics, will be facilitated by a third party academic research partner in order to assure confidentiality, reduce bias, and enhance transparency and engagement from clinic staff and leadership.

How this is different than related research:
By applying Lave and Wenger's Communities of Practice model to the physicians and healthcare professionals working within Austin Outpatient Clinic, CHOT researchers will be able to develop a thorough understanding of each group's perspective of customer service expectations, gaps, and goals in order to create the unified vision and purpose for clinic's customer service improvement program.

Experimental Plan:
First, conduct personal interviews with key informants to develop a data gathering approach through systematic discussion group design. Second, supervise 15 group discussions with clinic's physicians, nurses, and other healthcare professionals and staff related to state of customer service, perceived quality, and how to improve patient experience. Third, collect and transcribe group discussions and group interactions. Fourth, use thematic data analysis while applying the Communities of Practice theatrical framework to identify shared language, behaviors, and inductive qualitative analysis methodology. Fifth, share preliminary results with leadership team to receive feedback on relevant areas of findings and focus. Lastly, prepare final report after two iterations of draft report review and revisions.

Major milestones expected:
- Months 1-2: Conduct systematic literature review and prepare initial report on models of practice
- Months 3-4: Develop discussion group questions and conduct initial personal interviews with key informants and 15 discussion groups
- Month 5-6: Prepare discussion group transcripts, conduct thematic analysis, and share preliminary findings with leadership team
- Month 7: Develop refined and final vision, purpose, and customer service improvement strategies
- After Month 7: Dispersion of customer service improvement strategies to other VA clinics

Project benefits to industry:
- Determine organizational and cultural barriers
- Create a unified vision, purpose, and strategies
- Overall improvement to customer service

Expected Deliverables:
- Transcripts of discussion groups
- Unified vision and purpose for clinic
- Customer service improvement strategies

Cluster #2: Enabling HIT and Care and Macro/Policy

Chair: Eva Lee, Georgia Institute of Technology

Enabling HIT and Care

2.1 Integration of Genomic Data for Precision Health Decision Support
RFP: Population Health
Chris DeFlitch, Harriet Nembhard & Michel Hoffman, Penn State University

2.2 Evaluation of Patient Monitoring Technology in Various Settings
RFP: Population Health
Bita Kash & Elise Davis, Texas A&M University

2.3 Virtual Care Clinics: What Can We Learn from Early Adopters?
RFP: Home Care
Cynthia LeRouge & Ryan Sterling, University of Washington

Macro/Policy

2.4 Machine Learning: Knowledge Discovery and Best Practices
RFP: Population Health
Eva Lee, Cody Wang & William Wang, Georgia Institute of Technology

2.5 System Analysis of Graduate Medical Education Processes
RFP: Workforce Training
James Benneyan, Northeastern University

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **Integration of Genomic Data for Precision Health Decision Support**

Proposal Number: 2.1	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: DeFlitch, Nembhard, Hoffman (PSU)		**Project Budget:** $50,000
Research Cluster: Enabling HIT and Care	**RFP:** Population Health	

Description:

The combination of electronic health record (EHR) data, known information about genetic findings, and core genomic data is key to the evolution of precision medicine. The EHR presentation of combined data can be used to support provider decision making. Genomic data is one source of information that is being generated rapidly as the barriers to genome sequencing are reduced. Data obtained from mapping a patient's genome can be used to diagnose a specific genetic disease, determine the patient's risk of developing a disease in the future, or predict the effectiveness of a medication or treatment for the patient. This information, along with other clinical information, will allow healthcare providers to effectively administer treatment to patients on an individual basis in order to improve healthcare outcomes. The objective of this research is to determine methods of identifying relevant genomic data and integrating that data into the clinical workflow with the EMR. Patient attitudes, expectations, and outcomes regarding genetic testing and use of genomic data will also be evaluated.

How this is different than related research:

While there has been much research in genomics in recent years, there has been little investigation into methods that will translate the data that is generated into clinical action using electronic medical records. By considering a patient's genomic data along with other information included in the EHR, healthcare providers will be able to effectively make decisions regarding patient treatment. There is also a significant opportunity to gauge patient attitudes and expectations regarding the use of their genetic data for provider decision making.

Experimental Plan:

The first stage of this project will focus on determining which known genomic findings can be used and gathering data for decision support. Once identified, the project can focus on how this information can be integrated with existing data in the EHR. Patients will also be interviewed in order to assess their expectations of genetic testing and findings. The second stage will focus on developing the decision making structure to use of the genetic data and other patient attributes to provide precise decision support for providers. These tools will be integrated into the EHR. The third and final stage will be based on the evaluation of the patient experience, including an assessment of their experience with genetic testing and a comparative analysis of changes in outcomes for patients with and without genetic data.

Major milestones expected:

- Determine which genomic tests and findings are available for decision support and patient data that will affect the specific genomic finding
- Interview patients to assess their expectations and opinions on genetic testing and the use of genetic data for decision support
- Develop advanced decision support infrastructure and mechanisms that make use of genetic data and patient attributes and incorporate these tools into the EHR
- Interview patients to evaluate their experience with using genetic data to inform medical decisions
- Structure a patient-level comparative analysis for assessing the change in outcomes with and without the use of genetic data

Project benefits to industry:

- Use the increasing volumes of genetic data to support provider decision making
- Integrate genetic data into the EMR and workflow of healthcare practices
- Improve patient outcomes and support the development of precision health methods

Expected Deliverables:

- A logic model for tests, data, and decision interactions and implications
- Workflow analysis and EHR modules that incorporate genomic results into practice
- Guidelines for clinicians to help patients make decisions regarding genomic data

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: Evaluation of Remote Patient Monitoring in Various Settings

Proposal Number: 2.2	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Kash, Davis (TAM)		**Project Budget:** $50,000
Research Cluster: Enabling HIT and Care	**RFP:** Population Health	

Description:

Numerous CHOT IAB members and health providers in the U.S. and internationally are engaged in various post-operative and chronic disease care coordination initiatives that use some type of remote patient monitoring technology. These technologies vary in terms of cost, patient adherence and utility, and effectiveness in terms of implementation success, desired health outcomes, and impact on capacity. The multi-institutional research team will explore the benefits of patient monitoring in various settings, including complex pediatric patients and patients with chronic diseases in both the U.S. and Africa. The research team will focus on identifying the cost of benefits of leading remote patient monitoring practices by measuring implementation success, potential cost savings, population health outcomes, and improvements in access to care and health organization capacity (bed capacity) dependent on data availability from participating CHOT industry members, such as Texas Children's Hospital and UBRICA.

How this is different than related research:

This evaluation of remote patient monitoring technologies is aimed at improving care coordination and reducing visits to costly healthcare facilities (hospitals). The study takes a comprehensive approach in terms of patient populations studied by disease category, complexity, and patient segment. Results from this research can inform both hospitals and clinics as well as health technology developers in how to best achieve desired health outcomes and cost savings by designing the most appropriate remote patient monitoring innovation by patient segment. The research team will also focus on implementation effectiveness and process in Kenya.

Experimental Plan:

1) Comprehensive systematic literature review for U.S. and Africa covering complex and chronic pediatric inpatient and outpatient, chronic disease management (diabetes and asthma), and primary care. The literature will include U.S. and international studies relevant to the U.S. and Africa. 2) Cost and outcomes data on complex and chronic disease patients from TX Children's Hospital (post-operative), TX Children's Pediatrics Associates (diabetes & asthma), and chronic disease and primary care patients in Kenya will be explored for potential research methodologies to address cost-benefit analysis. 3) Selected cost benefit and/or economic impact analysis to inform CHOT industry members of initial results. 4) Implementation effectiveness. 5) Refinement of research approach for publication in peer-reviewed literature.

Major milestones expected:

- Evaluate the process of implementing remote patient monitoring technologies, including a patient health record that is populated by the CHW (Kenya focus)
- Evaluate impact of current remote patient monitoring practices on efficiencies such as bed capacity (TCH focus)
- Evaluate the educational and behavioral elements of the remote patient monitoring initiatives
- Evaluate describe best practices for specific patient populations: complex pediatric patients, children with chronic diseases, general primary care
- Recommendations on how to operationalize remote patient monitoring programs for U.S. children's hospitals and Kenyan healthcare organizations

Project benefits to industry:

- Research informed strategy for remote patient monitoring initiatives
- Develop most effective technology with highest impact on targeted results
- Results from this study will inform at least three industry sectors

Expected Deliverables:

- The financial case for remotepatient monitoring in U.S. and Africa explained
- Estimated long-term cost savings of monitoring initiatives for complex patients
- Estimated long-term cost savings of monitoring for complex and chronic patients

Project Title: Virtual Care Clinics: What Can We Learn from Early Adopters?		
Proposal Number: 2.3	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Sterling, LeRouge (UW)		**Project Budget:** $50,000
Research Cluster: Enabling HIT and Care	**RFP:** Home Care	

Description:
Virtual care clinics (VCC), one form of telemedicine, provide patient-initiated primary and urgent care services using real-time, interactive technologies (e.g. video, phone). The potential value proposition for health systems to offer VCC services include: emergency department diversion, expansion and extended reach of convenient services to satisfy today's health consumers; and as a means of patient acquisition. As VCCs are in the early adoption stage, there is opportunity and need to learn from early adopter organizations if this promising technology is to cross the boundary between the early adopters and early majority stages. The inability to bridge the chasm between these two stages is known to impact the success of high-tech, disruptive innovations. In response to current gaps in knowledge related to VCC adoption, the proposed study aims to: (1) Examine implementation, operations, and patient engagement practices and processes from the perspective of early VCC adopter organizations; and (2) Use findings from Aim 1 and evidence-based literature to provide insights to key VCC challenges and best practices.

How this is different than related research:
There is a dearth of practical knowledge and empirical data regarding early adopters of VCCs. Furthermore, minimal information is currently available from the telemedicine literature to guide health organizations as they launch VCC service lines. Although some findings from this limited body of telemedicine literature may hold in the VCC context, nuances likely exist, given such factors as a) the general structure of VCC as an outsourced service, b) VCC services are initiated by a patient or caretaker making contact for services (as opposed to a referral by physician), and c) the competing options for care in a non-critical situation. This proposal aims to address these gaps in knowledge.

Experimental Plan:
To meet Aim 1, we will conduct in depth interviews with representatives from at least 10 early adopter organizations of VCCs. Interviewees will include VCC managers and others engaged in VCC implementation and ongoing operations. Organizations will include health systems and independent VCC vendors. To meet Aim 2, we will conduct an environmental scan of practice-based and peer-reviewed literature related to adoption, diffusion, and implementation science to identify best practices and critical success factors for early adopters from the broader evidence base. Using findings from our in depth interviews, we will then filter our review of the literature to provide practice recommendations and other insights regarding VCC implementation, operations, and patient engagement practices for health organizations.

Major milestones expected:
- Month 1 - Protocol development and completion of IRB approval
- Month 6 - Intial environmental scan of literature complete (performed from months 1 to 6)
- Month 9 - Completion of interviews (conducted from months 2 to 9)
- Month 10 - Integration of interview and literature review findings for key challenges and best practice complete
- Month 12 - Journal article and summary for CHOT partners complete (performed from months 11 to 12)

Project benefits to industry:
- Provide relevant and timely insights to future and current adopters of VCCs
- Inform wider adoption practices and processes of innovative telemedicine delivery models
- Extend reach of care at reduced cost to support population health management priorities

Expected Deliverables:
- White paper of project findings.
- Manuscript for submission to a peer-reviewed journal

Project Title:Machine Learning: Knowledge Discovery and Best Practice		
Proposal Number: 2.4	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Lee, Wang, Hagen (GIT)		**Project Budget:** $60,000
Research Cluster: Macro/Policy	**RFP:** Population Health	

Description:
Advances in machine learning techniques offer reliable means to extract useful information from large-scale, high-dimensional datasets. Electronic medical records (EMRs) have been widely adopted across providers within the healthcare industry, opening opportunities for exploratory analysis based on patient diagnosis and treatment history. The project focuses on practice patterns across hundreds of care sites. Using machine learning techniques, we build classification models to predict patient treatment outcome based on features extracted from the EMR. We then identify critical variables that affect treatment outcome and best practice characteristics. Using this information, we design evidence-based treatment plans and optimize site performance and disseminate results for knowledge and best practice transfer. This increases quality and timeliness of care, maximizes financial performance, and decreases practice variability across the organizations.

How this is different than related research:
Although adoption of EMR is spreading, many providers continue to document clinical findings, procedures and outcomes with “free text” natural language on their EMRs. Clinical terminology have standardized terms and are essential to facilitating interoperability between medical systems by the seamless sharing and exchange of healthcare information. This study establishes interoperability among EMRs from 737 providers (with 2.7 million patients) by developing a system that can accurately map free text to concise structured medical concepts. These standardized terms can be used to improve classification models for outcome prediction, discovery and dissemination of optimized treatment plans.

Experimental Plan:
We will map free-structured text extracted from EMRs of 737 providers including 2.7 million patients' laboratory phrases, medication phrases, and diagnosis ICD-10 codes to Systematized Nomenclature of Medicine (SNOMED) concepts. A graph database will be used to generalize these SNOMED concepts into higher level terms in the hierarchical ontology. Machine learning will be performed to build classification models using these standardized concepts. We will then uncover treatment outcome and best practice characteristics based on these models to design and optimize evidence-based treatment plans. Finally, we disseminate this knowledge and transfer best practice to improve site performance.

Major milestones expected:
- A relational database containing patient records pertaining to procedures, demographics, diagnosis codes, laboratory measurements and medications.
- Mapping of diagnosis, medication, and laboratory phrases to standardized SNOMED concepts.
- Removal of redundancy by reducing the specificity of mapped SNOMED concepts for selecting effective features used in machine learning.
- Optimized classification model for prediction of treatment outcomes and identification of best practice characteristics.
- Design of optimized evidence-based treatment plans and dissemination of this knowledge and best practice transfer across multiple sites.

Project benefits to industry:
- Improve quality and efficiency of care across patient population
- Identify best pracice, offer evidence-based care
- Reduce waste, maximize financial performance, decreases practice variability

Expected Deliverables:
- Identification of effective treatment plans and best practice characteristics.
- Optimization of evidence-based treatment plans.
- Detailed plans and methods for best practice transfer across provider sites.

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: Systems Analysis of Graduate Medical Education Processes

Proposal Number: 2.5	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Benneyan, Chen, Brito (NEU)		**Project Budget:** $40,000
Research Cluster: Macro/Policy	**RFP:** Workforce Training	

Description:

As medicine becomes more advanced and graduate medical education (GME) more densely packed, there is increasing recognition of the need to re-examine resident training processes, methods, and content. By example, the Accreditation Council for Graduate Medical Education (ACGME) recently released its new Clinical Learning Environment Review (CLER) guidelines and a call for proposals for innovative redesign of GME. In support of this, this project will conduct normative work to apply systems engineering to define and analyze current GME systems from a formal systems design perspective. The work will be conducted with one or more CHOT health system partners involved in GME, with a focus on applying formal systems tools to analyze current GME processes, explore alternatives, and identify areas of greatest need and opportunity for further systems work. Pilot results from this work will inform a larger anticipated subsequent body of research and redesign activities.

How this is different than related research:

Few published studies on graduate medical education have used a systems-based perspective, and even fewer have utilized systems engineering analytic methods. This project will involve several systems analysis and design methodologies including but not limited to engineering design, Functional Resonance Analysis Method (FRAM), axiomatic design, and Systems Modeling Language. This work is motivated by the growing industry need to re-examine and innovate new models for achieving GME design specifications, in particular interdisciplinary training in systems methods.

Experimental Plan:

1. Develop an understanding of current GME systems by conducting a targeted review of literature and conducting interviews with various stakeholders in GME
2. Apply several systems-based engineering tools in a pilot study to analyze current GME systems, with emphasis on a design perspective
3. Draft recommendations for GME redesign and for future work
4. Disseminate findings to CHOT members and to the wider community peer-reviewed journal

Major milestones expected:

- Completion of literature review (8/1/16)
- Identification of potential systems of systems methods to help inform GME redesign (6/1/16)
- Completion of pilot application testing of identified methods within one partnering health system (10/1/16)
- Development of recommendations for a larger body of work surrounding redesign of GME (12/1/16)
- Development of a journal manuscript draft and external proposal for funding (4/1/17)

Project benefits to industry:

- Understanding of current GME processes from a systems analysis perspective
- Identification of potential opportunities for redesign
- Improved ability of graduate medical education to meet its objectives

Expected Deliverables:

- Documentation of systems-based approaches applied to current GME practices
- Development of recommendations for redesign of GME
- Development of journal-ready publication(s) to disseminate findings

Cluster #3: Patient-Centered Care

Chair: James Benneyan, Northeastern University

Patient-Centered Care

3.1 Multi-Criteria Evidence-Based Healthcare Delivery
RFP: Care Coordination
Eva Lee & Ken Lee, Georgia Institute of Technology

3.2 Precision Medicine: Personalized Drug-Effect Treatment
RFP: N/A
Eva Lee & Xin Wei, Georgia Institute of Technology

3.3 Safely Aging in Place: Understanding Informal Caregiver Teams
RFP: Home Care
James Benneyan, Northeastern University

3.4 Demand Management for Community Paramedicine
RFP: Home Care
Mahmet Kilinc, Linlin Ma & Harriet Nembhard, Penn State University

3.5 A Person-Centered Approach for Individuals with MCCs
RFP: Care Coordination
Lisa Korman, Harleah Buck & Harriet Nembhard, Penn State University

3.6 Sensing Systems for Peronalized Telehealth Wellness Management
RFP: Home Care
Conrad Tucker, Sunghoon Lim, Yifeng Yu & Harriet Nembhard, Penn State University

3.7 Diabetes Education: The Role of CHWs and Variations in Outcomes
RFP: Population Health
Bita Kash & Juha Beck, Texas A&M University

3.8 Future Models of Cancer Care Implications for Space and Design
RFP: Operations
Bita Kash & Abigail Gonzalez, Texas A&M University

Project Title: Multi-Criteria Evidence-Based Healthcare Delivery

Proposal Number: 3.1	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: E. Lee, K. Lee, Malecki, Naresh, Liu (GIT)		**Project Budget:** $60,000
Research Cluster: Patient-Centered Care	**RFP:** Care Coordination	

Description:
Evidence-based optimization of healthcare delivery is a concept centered around treatment design for patients. For many diseases, the optimal treatment varies significantly based on the patient's specific clinical situation. In addition, it is especially important to consider not just what treatment is optimal, but how and when it is delivered. In certain cases, it may be preferable not to treat the condition at all and adopt an active surveillance regimen. The decision process is further complicated by the fact that there are multiple stakeholders, each with their own objectives (e.g. patients vs. providers). Using machine learning techniques, electronic medical record (EMR) data, and systems process observations, a patient disease/clinical workflow and outcome prediction model will be developed. This will help clinicians evaluate the potential efficacy of various treatment options and decide on the best treatment course for each individual patient.

How this is different than related research:
To date, the majority of machine learning research has focused on diagnosis and prognosis rather than treatment. Evidence in our study will be drawn from the wide range of EMR data. This data contains not just common clinical factors associated with the diseases but also factors such as procedures performed, timing of treatment, and comorbid conditions. Observing patient-provider interactions offers an additional perspective on the decision process and the patient experience. By combining these two approaches, treatment modalities can be assessed through a comprehensive comparison of both the patients' medical conditions and their experiences with their healthcare providers.

Experimental Plan:
Study will focus on prostate cancer and chronic kidney disease (CKD) patients. A system decision flow model will be constructed for each group that describes the patient flow from diagnosis to post-treatment. This model will be constructed with the help of direct observations and EMR data. Machine learning-based predictive models will be generated from the EMR data associated with these patients. These models will be used to develop a decision-support tool that can be used by clinicians (along with patients). This tool will be designed and validated using evaluated real patient data.

Major milestones expected:
- Complete observation of clinical processes for treating prostate cancer and CKD patients at multiple sites
- Analyze EMR data for prostate cancer and CKD patients, uncovering trends in treatment and outcome using machine learning
- Analyze patient provider interplay, decision making interplay, and behavior characteristics
- Identify key factors that positively impact efficacy of treatment delivery
- Implement adjusted treatment selection model (choice & timing) within current clinical decision process

Project benefits to industry:
- Improved outcomes and patient experience through timely selection of best treatment
- Cost savings - non-optimal treatment can be extremely expensive
- Improved quality of life for patients
- Improved patient satisfaction

Expected Deliverables:
- Decision support tool comparing treatment options and predicting outcome
- Process map describing process/clinic/decision flow for prostate cancer and CKD patients
- Previously unobserved factors affecting optimal treatment

Project Title:Precision Medicine: Personalized Drug-Effect Treatment		
Proposal Number: 3.2	**Multi-Site Project?** No	**Continuing Project?** Yes
Project Leader: Lee, Wei (GIT)		**Project Budget:** $60,000
Research Cluster: Patient-Centered Care	**RFP:** N/A	

Description:
The term "personalized medicine" is often described as providing "the right patient with the right drug at the right dose at the right time." More broadly, personalized medicine (also known as precision medicine) may be thought of as the tailoring of medical treatment to the individual characteristics, needs, and preferences of a patient during all stages of care, including prevention, diagnosis, treatment, and follow-up. The project focuses on evidence-based approach where treatment design and management is personalized. Particularly for the treatment of chronic diseases where multiple conditions exist and multiple drugs are used, drug-drug interactions and side effects will be modeled to reduce unnecessary drugs and minimize negative effect. The objective of this study covers both the clinical visits, and a patient-home-centric approach to optimize the outcome and sustained health of individual patients.

How this is different than related research:
Project focuses on personalized treatment design and will accommodate potential co-existing multiple conditions, rather than a single disease. Evidence will be uncovered from real-patient data to establish the relationship between drug prescription and patient response. A treatment design model based on math programming will reduce the negative effect of individual provider's subjectivity on decision making process in prescribing treatments and drug therapy. The project will bring together multi-team of providers to identify guidelines of multiple disease treatment. It provides an analytic tool that assists doctors to perform patient-centered complex treatment management.

Experimental Plan:
Omics data from drug designs to the treatment of chronic diseases will be analyzed. Previous successful predictive PK/PD drug-effect model (Lee, Wei, et al 2015) will be expanded to include multple drugs and diseases. Optimal treatment plans will be designed based on drug-effect evidence, disease characteristics, and objectives of patient (and family) and a care-team of providers. Machine learning and optimization tools will be used to uncover drug-dose-treatment efffect for individual patients. Treatment plan will be personalized and designed for individual patient for his/her conditions, with the goal to maximize the success of treatment outcome while avoiding overdosing and minimizing drug-drug interactions.

Major milestones expected:
- Complete analysis of polypharmacy and drug-drug interction for chosen disease types (hypertenion, diabetics, and heart diseases)
- Establish PK-PD treatment effect predictive models
- Establish mathematical treatment planning models that incorporate individual patients PK-PD effect
- Establsh outcome evaluation and cost effectiveness of resulting optimized individualized treatment plans (as compare to current clinical plans)
- Understand applicability of methodologies by analyzing other disease conditions

Project benefits to industry:
- Better decision making in drug prescription and dose escalation
- Better understanding of drug effect in the process of drug design
- Improve quality of care and quality of life of patients

Expected Deliverables:
- Predictive drug effect model characterizing personalized drug response.
- Outcome-driven treatment plan with lower cost and better control of symptoms

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **Safely Aging in Place: Understanding Informal Caregiver Teams**

Proposal Number: 3.3	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Benneyan, Ilies, Musdal (NEU)		**Project Budget:** $40,000
Research Cluster: Patient-Centered Care	**RFP:** Home Care	

Description:

A national study published in 2014 by the US Department of Health and Human Services, estimates that 18 million informal caregivers (family and friends) provided 1.3 billion hours of care per month to over 9 million elderly adults in 2011. The substantial burden on these informal care networks supporting elderly individuals aging in place is beginning to be reported in the literature and anecdotally. Excessive burden and stress can impair the ability of caregivers to maintain high-quality care as well as negatively impact the health and well-being of the caregiver. The purpose of this project is to analyze data from a sample of such caregiver networks to develop a better understanding of burden, activities, and patterns associated with the informal caregivers. Results will be used to inform subsequent work to optimize, predict/detect rising burden and patient risk, reduce caregiver burden, and improve decision support for more appropriate transition timing to other settings such as assisted-living facilities or nursing homes.

How this is different than related research:

Recent research on informal caregiver burden has largely focused on psychological, behavioral, and financial stress, often associated with specific areas of care such as dementia. This project seeks to leverage systems-based methods (such as social network analysis, pattern mapping, data analytics, etc) to develop a novel understanding of caregiver burden, networks, and interaction patterns associated with individuals aging in place. In addition, we will compare low- versus high-performing caregiver teams in terms of patient outcomes and appropriateness of transitions to better understand possible predictors of increased patient and caregiver safety risk.

Experimental Plan:

1) Review literature to understand any previous methods used to analyze informal caregiver burden/networks
2) Identify and apply methods to analyze informal caregiver networks (including but not limited to social network analysis and pattern mapping)
3) Compare characteristics of low- versus high-performing caregiver teams in a pilot study to inform future work on predicting changes in patient and caregiver burden
4) Develop recommendations for future research and disseminate our findings

Major milestones expected:

- Completion of targeted literature review (8/1/16), obtainment of data from health systems (6/1/16)
- Development and refinement of social network analysis, pattern mapping, and other methods (10/1/16)
- Final analysis of burden, activities, and patterns of informal caregivers (2/1/17)
- Completion of pilot study designed to compare low versus high performing teams (4/1/17)
- Draft of a manuscript for submission to a peer-reviewed journal (4/1/17), final draft (5/1/17)

Project benefits to industry:

- Better understanding of informal caregiver burden & network interaction behavior
- Analysis of changes in these longitudinally over time
- Improvements in patient health and outcomes

Expected Deliverables:

- Documentation of any previous methods used to analyze informal care networks
- Documentation and analysis of informal care networks using methods identified
- Development of journal-ready publication(s) to disseminate findings

Project Title:Demand Management for Community Paramedicine		
Proposal Number: 3.4	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Ma, Kilinc, Nembhard (PSU)		**Project Budget:** $50,000
Research Cluster: Patient-Centered Care	**RFP:** Home Care	

Description:
Chronic diseases (such as chronic heart failure (CHF)) impose a tremendous burden on healthcare delivery costs. This is attenuated in medically underserved areas (MUAs) where healthcare resources are more limited because patients in MUAs are more likely to be older and in poorer overall health than their suburban and urban counterparts. Moreover, care gaps such as lack of post-acute transitional care and limited access to clinics make preventable readmissions a virtual inevitab ility that is both expensive and disappointing to patients, caregivers and the healthcare system. Community Paramedicine (CP) is an emerging intervention that can provide patient-centered care in the out-of-hospital environment for discharged patients. It uses paramedics to provide post-discharge follow-up and collect feedback for care providers in order to enhance self-management and reduce readmission risk. We will investigate demand and patient transition when the intervention of CP is applied to CHF patients. Within this, we will assess the CP intervention for IAB healthcare organizations in MUAs.

How this is different than related research:
CP is an important healthcare delivery method as it has the potential to reduce readmissions and ED visits. However, there has been limited research on the impact of CP on demand management. The proposed research aims to provide evidence on the impact of CP on leveraging demand to match limited healthcare capacity.

Experimental Plan:
Conduct literature review on CHF and readmissions.
Obtain and analyze CHF patients' records to develop a demand estimation model for CHF patients who will potentially benefit from CP service.
Identify CHF patient groups at high readmission risk.
Measure, evaluate and compare CP outcomes (e.g. quality of life, self-management, adherence, and readmission).
Build a customized CP model to support care management for various patient groups.

Major milestones expected:
- Obtain IRB approval.
- Identify critical factors predicting high readmission risk.
- Implement a small scale CP program for CHF.
- Review and evaluate the outcomes of CP program.
- Present findings in a national conference. Prepare project update report.
- Prepare and submit a manuscript.

Project benefits to industry:
- Understanding risk factors for readmission
- Understanding CP intervention outcomes
- Reducing readmission risk and CMS penalty

Expected Deliverables:
- A decision support tool that estimates readmission risk for all discharges
- Identify barriers that prevent patients from effective self-management

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **A Person-Centered Approach for Individuals with Multiple Chronic Conditions**

Proposal Number: 3.5	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Korman, Buck, Nembhard (PSU)		**Project Budget:** $50,000
Research Cluster: Patient-Centered Care	**RFP:** Care Coordination	

Description:

Currently 26% of U.S. adults have multiple chronic conditions (MCCs). In those who are 65 and older, the prevalence increases to 68%. MCCs are managed by a combination of self-care practices and community based services. The majority of health systems across the U.S. are facing financial strains due to ever-increasing costs related to MCCs. Since CMS is now penalizing hospitals for readmissions there is a need to better understand the impact of personal preferences and what contextual factors shape preferences. Preference congruences has the potential to move beyond a quality indicator. Lack of preference congruence may also serve as an easily assessed indicator of patients at risk for non-adherence resulting in readmissions. Assigning interventions to the right person at the right time in the right context is essential to improve resource allocation, decision-making, and care coordination.

How this is different than related research:

Person centered care models suggest that aligning care with personal preferences may result in improved decision making, care coordination, and greater motivation to adhere (a key part of self-care) to care goals. However, we have not yet identified the relevant contextual factors that leverage personal preferences in community based individuals with MCCs. Our research will explore the interface of individuals and organizational context in shaping preferences to understand the impact of person, provider, and environmental level factors on shaping preferences and preference congruence.

Experimental Plan:

Step I: Synthesize current knowledge of patient (person level factors such as gender, age, particular chronic condition, length of time since diagnosis), organizational (urban/rural location, agency size, access and control of EHRs), and environmental (home ownership, access to transportation, distance from health care provider) factors impact on preferences
Step II: Examine whether certain groups, in certain contexts, express certain preferences
Step III: Explore whether preference congruence results in greater motivation to adhere to care goals

Major milestones expected:

- Conduct a systematic review of the empiric literature
- Obtain IRB approval and access population
- Interview 30 community based older adults
- Conduct qualitative analysis of interview data
- Code interviews for preference congruence and adherence and analyze the co-occurrence of the two coding structures

Project benefits to industry:

- Satisfy needs of patients in the home environment (post-acute care)
- Improve resource allocation, decision-making, care coordination
- Provide actionable cost-effective solutions

Expected Deliverables:

- Multilevel logic model of contextual factors and interface with preferences
- Community informed testable model of the human-context-preference interface
- Dissemination of findings via the PORH quarterly meetings and CHOT

Project Title:Sensing Systems for Personalized Telehealth Wellness Management		
Proposal Number: 3.6	**Multi-Site Project?** No	**Continuing Project?** No
Project Leader: Tucker, Lim, Yu, Nembhard (PSU)		**Project Budget:** $50,000
Research Cluster: Patient-Centered Care	**RFP:** Home Care	

Description:
Personalized healthcare delivery systems are emerging with the goal of managing and improving wellness. In accordance, devices, technology, and applications for smart home-care have proliferated. The availability of telehealth systems means that solutions are scalable and can be disseminated across a wide range of patients in a timely and efficient manner. However, the use of this technology is not ubiquitous nor consistent. Additionally, cybersecurity and healthcare data protection pose challenges to balance usability and access with security. Research in telehealth will therefore explore the sensor based systems suitable for testing research hypotheses, the mathematical models needed for making sense of the data generated by these sensors, and the visualization techniques suitable for communicating knowledge both to healthcare decision makers and to patients. Researchers will explore ways in which personalized telehealth wellness management can reduce the need and time for hospitalization and rehabilitation.

How this is different than related research:
Current telehealth systems are designed with minimal input from patients or healthcare providers. As a result, when these systems are launched into the market, they often fail to address several important attributes expressed by the end user. Furthermore, existing appraoches do not provide an end-to-end solution that directly connects patients to their physicians. Advancements in network infrastructure is opening the possibilities for real time acquisition and storage of patients data that can potentially be integrated into a physician's workflow.

Experimental Plan:
1) To explore what motivates both patients and healthcare decision makers to adopt and consistently use a given technology or system. There is often a disconnect between a proposed technology, use as a healthcare solution and a patient's adoption of that solution. 2) To mitigate these challenges by designing patient-centered systems, where the patient assumes ownership of the data that is acquired by the system, the wellness feedback provided by the system and even how that wellness feedback is provided (e.g., via visualizations on a screen, smartphone, etc.), towards more customized modes of healthcare delivery. The telehealth sensing systems will be used to capture patients' interaction data using non-wearable, non-invasive sensors.

Major milestones expected:
- Obtain IRB approval and explore different telehealth systems needed to achieve real time, personalized wellness management
- Determine constraints on sensors and sensing systems
- Explore network based solutions for connecting patients' data with healthcare provider systems
- Quantify the factors that influence patients' adoption of telehealth systems
- Demonstrate and end-to-end setup of a patient connected with their healthcare provider

Project benefits to industry:
- Expanding the use of telehealth in inpatient, outpatient and ED patient care
- Potentially reduce unplanned readmissions, as part of value based purchasing
- Network providers will expand their customer base

Expected Deliverables:
- Sensor based solutions that are feasible for telehealth operations
- Model that predicts patients' adoption of a given telehealth system
- Proposed telehealth system that is adopted by both patients and physicians

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **Diabetes Education: The Role of CHWs and Variations in Outcomes**

Proposal Number: 3.7	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Kash, Baek (TAM)		**Project Budget:** $ 50,000
Research Cluster: Patient-Centered Care	**RFP:** Population Health	

Description:

In 2012, the estimated total cost for diabetes treatment (including both direct and indirect costs) was $245 billion in the U.S. Further, the cost of diabetes related treatment has increased rapidly from $98 billion in 1997 to $174 billion in 2007 (American Diabetes Association, 1998, 2013). Considering the number of people diagnosed with diabetes is projected to reach 29 million in 2050, the total healthcare related costs for diabetes are expected to increase even further. Without proper treatment, lifestyle changes, and monitoring, diabetes complications can be severely disabling and even life-threatening. Research in the area of diabetes management and education (DME) interventions shows that some DME programs can improve patients' self-management.This study will analyze the role of community health workers (CHWs) and type of technologies used by the CHWs in explaining variations in outcomes across DME sites in Texas. DME program participants' data collected at the Texas A&M Health Science Center's Coastal Bend Health Education Center (CBHEC) will be used for this study.

How this is different than related research:

- This project has potential for substantial cost savings when it comes to preventable hospital admissions and other costs of care for the U.S. healthcare system.
- The impact of various types of education programs and technologies used by CHWs has not been very well studied in the DME literature
- Results from this study will help with the design of appropriate DME programs that engage CHWs for eduction and outreach

Experimental Plan:

1. Systematic review of literature to better understand the role of CHWs in DME programs internationally; this will include the evaluation of various technologies and intensity of technologies used by CHWs
2. Systematic review of literature to better understand various educational programs implemented and associated outcomes of these different types of programs
3. Secondary data from CBHEC on types of educational programs, level of CHW engagement in programs, patient outcomes, patient characteristics, provider characteristics, and geography will be cleaned and prepared for analysis
4. Analytical approach is developed based on literature review results

Major milestones expected:

- First round of systematic review of literature is completed by month 3
- IRB application and approval from TAMU IRB by month 4
- Data cleaning and analytical approach refined based on literature review and data availability by month 6
- Data analysis and output reporting for feedback months 6 to 8
- Report writing, manuscript development and other dissemination months 8 to 12

Project benefits to industry:

- Potential for cost of care savings related to diabetes population management
- Clear direction on how to deploy CHWs into the community to produce outcomes

Expected Deliverables:

- Understanding of variations in outcomes of the DME programs
- Clear direction on design of most effective DEM program and the role of the CHW
- Recommendations on how much and what type of technologies to equip CHWs with

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: Future Models of Cancer Care: Implications for Space and Design

Proposal Number: 3.8	**Multi-Site Project?** No	**Continuing Project:** No
Project Leader: Kash, Nanda, Gonzalez (TAM)		**Project Budget:** $25,000
Research Cluster: Patient-Centered Care	**RFP:** Operations	

Description:

CHOT researchers will work with HKS's research arm, CADRE, to translate emerging models of cancer care to space and design. In the traditional model of cancer care, the patient and patient's family navigate across disconnected clinical teams (clinical microsystems) to not only access information about diagnosis, treatment options, and next steps, but also ensure that critical information exchanges are taking place between the clinical microsystems. Cancer patients move through these often highly effective clinical microsystems horizontally. In the case of cancer care, research shows that effective patient-centered care requires clinical teams (clinical microsystems) and macro systems (health systems) that allow for information sharing, transparency, and empowered care team members. Further, the evolution toward personalized/precision medicine in cancer treatment methods has transformed the way we care for patients. Future models of cancer care will be enabled by new emerging clinical and social technologies. Personalized medicine and team-based care will have implications for the design of facilities for cancer care.

How this is different than related research:

Translation of new emerging cancer care models to space and design requirements has not been yet accomplished. The National Institute of Health (NIH) has made major investments in personalized medicine based on genetics. The National Cancer Institute (NCI) has recently made an effort to improved knowledge about effective team-based care for cancer patients. Both of these fields have contributed greatly to transforming the clinical care path and organization of care teams for cancer patients. This study will examine recent developments in these areas of research and translate them into space requirements, characteristics, and research-informed design options for the future cancer center.

Experimental Plan:

This study will first explore various future models of cancer care by patient segment and disease by performing several systematic literature reviews. Emerging models of care will be analyzed and described in terms of team composition and design, type of personalized medicine, care processes, patient flow, technologies used, patient experience, and space requirements. Next the CHOT research team, in collaboration with the HKS researchers, will design a survey tool that is informed by the literature review results. The target population for this survey is expected to include physicians, other key clinicians, hospital administrators, and facility planners. Results from the literature review and the survey will then be translated to space requirements and research-informed design with the help of the HKS team.

Major milestones expected:

- First round of systematic review of literature is completed by CHOT team month 3
- Survey draft developed by CHOT team and sent to HKS team for review and feedback by month 4
- Revised survey tool is operationalized via Qualitrics by CHOT team by month 5
- IRB application and approval by CHOT team by month 6; first manuscript draft by CHOT by month 7
- Survey administration, data cleaning, survey and lit review data analysis, write-up by CHOT team by month 9. HKS produces report by month 12

Project benefits to industry:

- New knowledge about space and design requirements of emerging models of care
- Hospitals and industry members will be informed about effective use of space
- Contribution to the field of evidence-based design for cancer centers

Expected Deliverables:

- Organized write-up of literature review and survey results (CHOT)
- Report generation and visualization (HKS)
- Manuscript development for peer-reviewed journal (CHOT)

Cluster #4: Collaborative Project Proposals

Chair: Bita Kash, Texas A&M University

Access & Efficiency

4.1 Optimizing Care Delivery with Minimal Disruption
RFP: Operations
Eva Lee, Georgia Institute of Technology
James Benneyan, Northeastern University

Enabling HIT and Care

4.2 The Cost of Postoperative Delirium
RFP: Operations
Harriet Nembhard, Penn State University
Bita Kash & Terri Menser, Texas A&M University

Quality and Safety

4.3 Falls Prediction and Causality Models in Inpatient Settings
RFP: Operations
James Benneyan, Iulian Ilies, Karen Chen, Northeastern University
Tapan Mehta, University of Alabama at Birmingham

Macro/Policy

4.4 Value Based Care: Challenges of a Changing Care Paradigm
RFP: Payment Models
Harriet Nembhard, Penn State University
Bita Kash, Texas A&M University
James Benneyan, Northeastern University
Eva Lee, Georgia Institute of Technology

Project Title: Optimizing Care Delivery with Minimal Disruption

Proposal Number: 4.1	**Multi-Site Project?** Yes	**Continuing Project?** No
Project Leader: Lee, Thaker (GIT); Benneyan, Musdal (NEU)		**Project Budget:** $60,000
Research Cluster: Access and Efficiency	**RFP:** Operations	

Description:
Increased length of stay (LOS) due to inefficient healthcare delivery systems and hospital acquired conditions (HACs) results in negative effects on health outcomes, patient satisfaction, health care utilization (waste), and institutional reputation. The study aims to reduce average LOS, for our partnered hospital's surgery patients, through optimizing the care delivery process by utilizing systems analysis and medical and computer simulation, and process optimization. We will explore the development and use of minimally disruptive optimization models to limit the amount of change from current practices or processes. The project brings together multidisciplinary researchers with complementary expertise in medical simulation, systems engineering simulation, surgical quality improvement, and organizational performance excellence, creating the opportunity to address safety, quality, patient-centered care, and efficiency from a whole system perspective.

How this is different than related research:
Studies have looked at different aspects of a care delivery process. However, this is a comphrensive study looking at all aspects that can be optimized in a system view, from improved scheduling to reduced HAC rates. As there are multiple causes at the root of the problem resulting in increased LOS, a comprehensive study must be used to achieve an optimized care delivery process. This work is also the first that links computer simulation with medical simulators. The study design aims not only at optimizing the system alone, but also in training the workforce to adapt effectively and successfully to these changes using medical simulators. Minimal disruptive models have not yet been adapted.

Experimental Plan:
The team will completely immerse themselves in day-to-day processes at all stages of the surgery patient's care delivery process and observe clinicians perform patient care as part of process mapping. Data access will include EMR and other records that allow us to establish patient risks factors, in addition to providers' practice and hospital environment. The team will utilize optimization and simulation tools to construct models for an improved care delivery process. Medical simulators will be used to validate recommendations and to establish training and clinical guidelines for their adoption.

Major milestones expected:
- Complete process and systems map of the entire care delivery process
- Document HAC noncompliance through observations
- Design optimization and simulation models, and integrate with medical simulator experiments.
- Develop a minimal disruptive model and experiment its feasibility
- Documentation and report findings

Project benefits to industry:
- Reduce LOS, reduce HAC
- Improve health care utilization
- Improve quality care and treatment outcome for patients
- Improve patient satisfaction
- Improve training and compliance of personnel

Expected Deliverables:
- improved practice process and systems disseminate to providers.
- Risk factors for HACs and methods for reducing them
- Education documents for training purpose
- Generalizable modeling framework

Project Title: The Cost of Postoperative Delirium

Proposal Number: 4.2	**Multi-Site Project?** Yes	**Continuing Project?** No
Project Leader: Kash, Menser (TAM); Nembhard (PSU)		**Project Budget:** $100,000
Research Cluster: Enabling HIT and Care	**RFP:** Operations	

Description:
Patients with postoperative delirium recover more slowly, increasing length of stay and associated costs; developing treatment protocols for delirium may reduce the risk of incidence (Rudolph & Marcantonio, 2011). Evaluating the costs associated with postoperative delirium is necessary as it is a common surgical complication; five to 50 percent of older adults experience this condition (TAGSE Panel, 2015). Only one known study examines longitudinal costs associated with postoperative delirium using 1995-1998 data (Leslie et al., 2008). There are numerous diagnostic tools used to assess postoperative delirium in intensive care units, including: the confusion assessment method modified for the intensive care unit (CAM-ICU), the intensive care delirium screening checklist (ICDSU), the cognitive test for delirium (CTD), nursing delirium screening scale (Nu-DESC), and the delirium rating scale (DRS). This will be a two-year project.

How this is different than related research:
The current literature has well-documented the incidence of postoperative delirium. It is established that clinical evaluations without objective criteria underestimate incidence and subjective estimates may lead to over estimation of incidence, highlighting the importance of a systemic approach to diagnosis of postoperative delirium (Bilotta et al., 2013). This study would assess patients for postopertive delirium, collecting data on an identified cohort of individuals for a year following disacharge. This study will provide more current information, which will help us update estimates of cost associated with postoperative delirium and other issues that are experienced post discharge.

Experimental Plan:
1) Identify the diagnostic tool to be used to assess postoperative delirium 2) Identify a hospital partner to collaborate with to achieve set goals 3) Develop a detailed study protocol 4) Identify an expert in postoperative delirium, preferrably within the collaborative organization 5) Develop the follow-up patient survey 6) In Spring 2017, begin primary data collection which will continue into Year 2.

Major milestones expected:
- Review of postoperative delirium diagnostic tools (1-2 months)
- Obtain IRB approval for patient study (3-10 months)
- Plan and coordinate primary data collection procedures to be implemented (5-10 months)
- Begin implementation of primary data collection (assessment and follow-up survey) in Spring of Year 1 (10-24 months)
- Disseminate the preliminary results by journal publications or conference presentations (TBD)

Project benefits to industry:
- A better understanding of issues associated with postoperative delirium
- A longitudinal perspective on costs associated with postoperative delirium
- Recommendations based on findings

Expected Deliverables:
- Current cost estimate of postoperative delirium
- A report on issues patients encounter after experiencing postoperative delirium
- A journal publication to disseminate our findings

I/UCRC Executive Summary - Project Proposal
Spring 2016

Project Title: **Falls Prediction and Causality Models in Inpatient Settings**

Proposal Number: 4.3	**Multi-Site Project?** Yes	**Continuing Project:** No
Project Leader: Benneyan, Ilies, Chen (NEU); Mehta (UAB)		**Project Budget:** $40,000
Research Cluster: Quality and Safety	**RFP:** Operations	

Description:

This is a collaborative project of UAB, NEU, and multiple industry members. The objective is to research and integrate existing and new methods for predicting, understanding, and preventing inpatient falls. Falls are a ubiquitous problem across healthcare often leading to patient injury, prolonged stays, and additional costs, totaling $34 billion in 2013. In many settings (rehabilitation, geriatrics, etc) patients can vary in their fall risk and causality. Our combined research team will assess fall prediction and diagnostic methods, compare and validate these in multiple contexts, and extend and integrate them based on results. These will include patient and unit risk prediction models based in regression and machine learning, and complexity systems failure analysis methods from the emerging "Safety-2" field such as HFACS, STAMPS, and FRAM, building on a past CHOT project (16-0515151.NEU: "Improvements to Root Cause Analysis of Patient Safety Events"). The integrated team will meet virtually bi-weekly via standing conference call and web working meetings.

How this is different than related research:

While fall prediction itself is not new, falls remain a significant problem across healthcare and our project is unique in four respects: (1) seeking to compare and combine them with more modern methods (Bayesian belief networks, etc), (2) considering combined prediction of both individual-level and unit-level risk, (3) investigating in parallel the use of retrospective causality and prospective context assessment methods from the emerging "safety-2" field, and (4) integrating the two approaches into a unified model that can be used to better understand, predict, and prevent falls.

Experimental Plan:

1. Conduct literature review of fall prediction methods, including regression and machine learning methods
2. Conduct comparative evaluation of the relative predictive accuracy of each method using retrospective electronic health record data from multiple health systems at both the unit and patient level
3. Apply FRAM (function resonance analysis method), HFACS (human factors analysis classification system), and related "safety-2" methods to each member setting and fall events
4. Integrate both sets of results (eg as inputs to each other or as a 2-pronged approach to fall prevention)
5. Assess utility of final methods via mixed methods evaluation (process measures, outcomes, structured interviews)

Major milestones expected:

- Literature review completed (8/1/16), IRB approval received (6/1/16)
- Data obtained from health systems (6/1/16), Initial comparative study completed (10/1/16)
- FRAM analysis of each health system context completed (8/1/16), HFACS analysis of falls at each system completed (10/1/16)
- Methods integration completed (12/1/16), testing & refinement of combined approach (12/1/16-4/1/17)
- Journal manuscript draft completed (4/1/17), final 1st manuscript completed (5/1/17)

Project benefits to industry:

- Reduction of falls and associated improvements in cost, flow, and patient health
- Ability to focus more targeted interventions to prevent patient falls
- Improved understanding of predictors, reasons, and context leading to falls

Expected Deliverables:

- Literature review and comparative evaluation of fall prediction methods
- Application and evaluation of "safety-2" methods to assess fall risks and causes
- Integration of the two approaches into a unified approach to reduce fall risks

Project Title:Value Based Care: Challenges of a Changing Care Paradigm		
Proposal Number: 4.4	**Multi-Site Project?** Yes	**Continuing Project?** No
Project Leader: Nembhard, Swenson, Bastian (PSU); Kash, Menser (TAM); Benneyan (NEU); Lee (GIT)		**Project Budget:** $68,000
Research Cluster: Macro/Policy	**RFP:** Payment Models	

Description:
Pay-for-value (P4V) or value-based care models are the latest attempts from commercial and government healthcare insurers to shift the care paradigm from episodic towards comprehensive care. Unlike fee-for-service models, P4V models reward quality care, penalize readmissions, and encourage comprehensive healthcare coverage that aligns quality measures with reimbursement. Under P4V, patients would spend less time in the hospital and receive more routine care from primary care practices. Although P4V programs - such as Pay-for-Performance (P4P), Patient Centered Medical Homes (PCMHs), and Accountable Care Organizations (ACO) - have shown success, full implementation will require a fundamental shift in how healthcare is delivered and how healthcare workers are organized, trained, and compensated. Applying stakeholder analysis, CHOT will evaluate the challenges of implementing P4V from the perspective of hospitals, physicians, insurers, medical colleges, and patients. Findings will reflect the concerns of stakeholders, facilitators and barriers to implementation, and help inform future health policy decisions.

How this is different than related research:
P4V is not widely implemented nor tested. There is scant research on pros and cons of implementing it, and there are numerous new variants of P4V models each year. The comprehensive care for joint replacement (CJR) P4V bundle is the latest from the Centers for Medicare and Medicaid Services (CMS); however, its success hinges on a hospitals ability to reduce costs and prevent readmission. This multi-university research team will document the concerns of stakeholders from across the healthcare industry including most CHOT industry members. The researchers will also learn from the Mass BCBS "alternate quality contract" experience. All CHOT university sites are contributing to this project.

Experimental Plan:
Conduct a systematic literature review on existing P4V initiatives and their documented pros and cons. Develop a series of questionnaires to query healthcare professionals from physicians and medical school administrators to insurers and patients. Conduct key informant interviews with these stakeholders. Collect and analyze the concerns, barriers, and facilitators to successful P4V model implementation. Analyze and categorize results from systematic review and key informant interviews using the disruption in business and payment conceptual framework with a focus on three value models: 1) solution shop, 2) value-added process shot, and 3) the integrated network model. Finally, CHOT researchers will expand the surveys to multiple sites to capture a wide-range of inputs and experiences in P4P payment models.

Major milestones expected:
- Systematic literature review on P4V payment models, principles, and outcomes
- Obtain IRB approval
- Develop questionnaires tailored to various sectors of the healthcare community
- Conduct key informant interviews and deploy surveys at atleast two NSF-CHOT sites
- Publish results in a white paper for dissemination to interested NSF-CHOT partners

Project benefits to industry:
- Consolidated list of stakeholder concerns
- Understand/predict future healthcare direction
- Share challenges and successes of P4V model implementation

Expected Deliverables:
- Systematic literature review on P4V models
- White paper with health policy recommendations
- Submitted peer-reviewed journal article