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MISSION
The mission of the Center for Health Organization Transformation (CHOT) is to advance the knowledge and practice of transformational strategies in evidence-based management and clinical practice.

CHOT conducts cooperative research among universities, health systems and other health-related industries. The Center relies on multi-disciplinary approaches to advance and link system design and organizational technologies in innovation research. The three main areas in which CHOT conducts research are:

- Developing research-informed strategy
- Validating innovations in healthcare delivery
- Implementing evidence-based innovation across settings

CHOT UNIVERSITY SITES

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<tr>
<td>Texas A&amp;M University</td>
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<tr>
<td>Georgia Institute of Technology</td>
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<tr>
<td>Northeastern</td>
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<tr>
<td>PennState</td>
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PROSPECTIVE UNIVERSITY SITES

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<tr>
<th>University Name</th>
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<tbody>
<tr>
<td>The University of Alabama at Birmingham</td>
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<tr>
<td>Florida Atlantic University</td>
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CURRENT CHOT INDUSTRY MEMBERS—THE INDUSTRY ADVISORY BOARD (IAB)

- Alabama Quality Assurance Foundation
- Alacare Home Health & Hospice
- American Society of Anesthesiologists
- Children’s Healthcare of Atlanta
- Grady Health System
- HealthSouth
- Highmark
- Main Line Health System
- Morehouse School of Medicine
- Northside Anesthesiology Consultants, LLC
- Our Lady of the Lake Regional Medical Center
- Partners HealthCare
- Restore Medical Solutions
- Siemens Medical Solutions USA, Inc.
- Studer Group, LLC
- Texas Children’s Hospital
- UAB Health System
- Ustawi Biomedical Research Innovation and Industrial Centers of Africa (UBRICA)
- Verizon
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James V. Gagliotti
Industry Advisory Board Chair
james.gigliotti@highmark.com

FOLLOW US ON LINKEDIN

Additional information on CHOT research projects from previous years are available to our members at www.chotnsf.org.

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As a National Science Foundation industry-university cooperative research center (I/UCRC), CHOT follows a model of an industry-academic partnership that has benefited industry-focused research across more than 50 disciplines. Of the 70 I/UCRCs within the United States, CHOT is the only one focused on innovations in healthcare delivery. CHOT researchers work alongside the Industry Advisory Board (IAB) to conduct research that supports the implementation of evidence-based transformational strategies within the healthcare sector. CHOT creates a safe, mutually beneficial, cooperative environment where leading healthcare industry members can come together to collaborate and to innovate.

Our research model relies on the knowledge and experience of healthcare leaders to guide academic research. This cooperative model ensures that the research is both meaningful and applicable to the healthcare industry and provides immediate decision support.
BECOMING AN INDUSTRY MEMBER

Most observers agree that the old ways of delivering healthcare services are no longer adequate, so stakeholders are increasingly exploring innovative approaches. Industry membership allows partners to be on the forefront of leading that innovation. Our research model relies on the knowledge and experience of healthcare leaders to guide academic research. This cooperative model ensures that the research is both meaningful and applicable to the healthcare industry and provides immediate decision support for CHOT industry members.

The CHOT industry advisory board (IAB) defines the research agenda and annual research cycle for CHOT researchers on a yearly basis using a project voting mechanism developed by the IAB.

ANNUAL RESEARCH CYCLE:

<table>
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<th>FALL MEETING</th>
<th>POST FALL MEETING</th>
<th>SPRING MEETING</th>
<th>POST SPRING MEETING</th>
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<tr>
<td>- IAB members share research ideas and develop RFP’s</td>
<td>- CHOT research proposals developed with IAB input</td>
<td>- CHOT researchers present research proposals</td>
<td>- CHOT sites conduct collaborative research projects</td>
</tr>
<tr>
<td>- CHOT researchers present on project deliverables</td>
<td>- CHOT sites develop collaborative research projects</td>
<td>- IAB provides feedback and ranks proposals</td>
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BENEFITS OF CHOT MEMBERSHIP FOR INDUSTRY

RESEARCH:
- Gain a competitive advantage on evidence-based innovations in healthcare delivery specific and relevant to industry
- Pre-publication access to CHOT research findings at least two years ahead of publication
- Access to CHOT university sites’ resources and facilities at discounted university overhead
- Leverage credibility of the NSF CHOT research methodology and rigor to engage physician leaders
- Engage in a multidisciplinary approach to research
- Have a valid, neutral third-party perspective by using university researchers to collect and analyze data

NETWORKING:
- Work along with other industry members to develop CHOT’s research agenda
- Develop working relationships with leading researchers from internationally recognized academic institutions
- Access to top graduate students from CHOT university sites

PROFESSIONAL DEVELOPMENT:
- Co-author and publish peer-reviewed articles with CHOT researchers
- Co-present at professional conferences with CHOT researchers

MEMBERSHIP

- $42K Research Staff
- $2K Materials & Travel
- $5K University Overhead

BONUS

- $5K CHOT Director
- $5K CHOT Innovative Researcher
- $5K Additional University Researchers
- $10K University Resources & Facilities

YOU PAY $50K + YOU GET $30K TOTAL VALUE $80K
“CHOT organized a multi-disciplined research team that is focused on the needs of our organization. If we were to have developed this team using consultants, it would have taken more time to assemble the team and would have cost more than our membership cost. In addition to this, the CHOT research team develops evidence-based work, because they have the expertise and the resources to look at things critically.”

Macharia Waruingi, MD
UBRICA

“At Texas Children’s we find CHOT to be an important venue to focus research on hospitals themselves and how we can improve the ability to serve our patients. The methodical and rigorous nature with which CHOT studies these subject areas provides reliable and valuable conclusions which we use to make decisions.”

Alec King, Senior Vice President, Finance
Texas Children’s Hospital

“Verizon’s involvement with CHOT researchers offers great discovery opportunities as Verizon continues to build out its Healthcare practice. The Verizon technology and strategy teams have been able to shape some of the research projects through our participation as the industry partner to Penn State University. We expect these research engagements will provide unique insights for commercializing our healthcare solutions.”

Nancy Green, Global Practice Lead–Healthcare Strategy & Thought Leadership
Verizon
SELECTED PUBLICATIONS


The Affordable Care Act is producing a shift in focus for many large health systems from a sickness model to a wellness model. Caring for patients outside the confines of a hospital and beyond acute episodes of care is proving to be challenging for organizations built upon incentive systems that traditionally reward more sickness and more interventions. In learning to communicate and better manage patients beyond the hospital walls, the utilization of inexpensive technologies (e.g., apps) to manage patient populations shows some promise. The main objectives of the project are to: 1) identify mobile apps that can be utilized in managing specific patient populations, 2) educate clinical staff and physicians on the appropriate indications for each app, 3) “prescribe” one of the selected apps to a sample of patients and 4) evaluate the effects of the technology on patient engagement and health management.

Understanding how inexpensive technology can be used to manage chronically ill patients is the goal of this research, so the targeted patient population includes diabetic and pre-diabetic patients. The incidence of diabetes is higher in the United States located in the Deep South region, where UAB’s industry partners are located, compared to the rest of the country. Engaging patients to participate in the management of their own health is very important with the diagnosis of diabetes.

How this is different than related research:
A 2012 report by the Pew Research Center suggests that 85 percent of American adults own a cell phone, and 53 percent of those own smartphones. Smartphone owners routinely gather health-related information on their phones, and this type of health information seeking behavior is increased in individuals with some sort of medical crisis or condition. Almost 20 percent of smart phone owners have at least one health app on their phone; however, no research exists to assess the way that using such widespread technology influences health behaviors or outcomes. Simple, inexpensive technology has great potential to improve disease management of chronically ill patient populations.
While staff scheduling and other optimization models are seemingly useful in healthcare, a ubiquitous problem is either accounting for uncertainties in the optimization algorithms and/or developing staff schedules that are robust to uncontrollable exogenous events. In the operating room, examples include uncertainties in the number of surgeries that ultimately will be scheduled, their times and days of week, their durations and changes in staff schedules such as due to sickness or other reasons. Since staff schedules are set several weeks or months in advance, the result typically is schedules with excessive overtime, case delays, last minute call-ins at greater costs and less than ideal skill matches and safety concerns. Since operating rooms and staffing both represent significant portion of hospital costs, this research will focus on operating room nurse scheduling. This project will develop and test several robust optimization approaches to staff scheduling, using operating room nurse staffing as an initial test-bed. Results and the developed general methodologic approach also may be generalizable to many other contexts in healthcare, such as outpatient scheduling, capacity planning, inventory management and others.

How this is different than related research:
Almost all staff scheduling (and optimization models more generally) in healthcare are classic deterministic models, with fewer venturing into stochastic programming and recourse types of formulations. These models assume for the most part that events are known and deterministic, whereas over the past several years (mostly outside of healthcare) significant advances have been made in robust optimization methods and applications. Due to this, there is an opportunity to contribute both to staff scheduling problems of CHOT members as well as to more general methods research in the use of operations research in healthcare.

**Value Proposition:**
- Generate cost savings from more robust operating room nurse staff schedules with less overtime, fewer last minute scrambles and better skill matches
- Extend potential for similar approaches to increase flow and decrease case delays

**Description:**
While staff scheduling and other optimization models are seemingly useful in healthcare, a ubiquitous problem is either accounting for uncertainties in the optimization algorithms and/or developing staff schedules that are robust to uncontrollable exogenous events. In the operating room, examples include uncertainties in the number of surgeries that ultimately will be scheduled, their times and days of week, their durations and changes in staff schedules such as due to sickness or other reasons. Since staff schedules are set several weeks or months in advance, the result typically is schedules with excessive overtime, case delays, last minute call-ins at greater costs and less than ideal skill matches and safety concerns. Since operating rooms and staffing both represent significant portion of hospital costs, this research will focus on operating room nurse scheduling. This project will develop and test several robust optimization approaches to staff scheduling, using operating room nurse staffing as an initial test-bed. Results and the developed general methodologic approach also may be generalizable to many other contexts in healthcare, such as outpatient scheduling, capacity planning, inventory management and others.

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Telehealth is the use of electronic information and telecommunications technologies to support long-distance clinical healthcare, patient and professional health-related education, public health and health administration. Telehealth could be as simple as two health professionals discussing a case over the telephone or as sophisticated as doing robotic surgery between facilities at different ends of the globe. It encompasses preventive, promotive and curative aspects. Within the clinical usage, it has been widely used in diagnosing via medical images, conferencing between patient and healthcare provider for assessments and history taking, exchanging health services or education live, diagnosing and disease managing via medical data, advice on prevention of diseases and promotion of good health by patient monitoring and follow up and health advice by telephone in emergent cases (tele-triage). In multiple U.K. clinical trials, it has been reported that its usage has led to a 45 percent reduction in mortality rates, 20 percent reduction in emergency admissions, 15 percent reduction in A&E visits, 14 percent reduction in elective admissions, 14 percent reduction in bed days, 8 percent reduction in tariff costs and 95 percent cost reduction for patients suffering from infertility. Although these studies have demonstrated a positive impact from the use of telehealth and remote patient monitoring, there are dissenting studies. A 2012 U.S. study of 205 elderly patients with a high risk of hospitalization showed a significant increase in the mortality rate over 12 months, with rates over 12 months for the telemonitoring group at 14.7 percent, compared with 3.9 percent for the usual care group. Compounding the challenges on evidence of positive outcome are the federal requirements of efficiency, economy, and quality of care for reimbursement. This study attempts to combine social-economic and demographics demands, hospital resources and evidence of tele-health to assess the value and implementation challenges of tele-health for quality and effective healthcare delivery.

How this is different than related research:
Since its introduction almost 20 years ago, the adoption of telemedicine and the level of engagement and services provided across healthcare facilities remain uneven and far from optimal. There is enormous opportunity to expand the service so as to provide more timely communication and consultation to patients, reduce the face-to-face demand and the cost of delivery.
The proportion of self-employed physicians in group practices fell from 35 percent to 28 percent between 1983 and 1994, while the proportion of physicians practicing as employees rose from 24 percent to 42 percent. Today’s trends might be similar, driven by slightly different market dynamics and enablers, but are not well documented and understood yet. These changing employment structures may affect physician engagement and burnout. Thus, the overall objective of the project is to acquire a better understanding of group practice trends and the resulting effect on engagement and burnout, divided into the following three aims: 1) To profile the current physician group market in terms of group practice development and physician engagement for anesthesia professionals and two to three other specialties selected by Studer Group using secondary data, 2) To interpret these trends using qualitative content analysis and information on upcoming job openings in these specialties, 3) To recommend a general plan for the American Society of Anesthesiologists and Studer Group to gather and maintain, as an ongoing activity, key information regarding anesthesia-related and other select physician group practice development and trends.

How this is different than related research:
Currently there is no consensus about physician practice trends and the future outlook of the various specialties, and very little data on how these changes affect physician engagement. Study results and data interpretations are often conflicting and changing constantly. This study will take a segmented (by specialty), mixed methods approach relying on multiple data sources to provide a better understanding of the complexities of group practice trends today.

Value Proposition:
- Provide a more comprehensive understanding of current physician practice trends and use multiple sources of data to enhance trend analysis and prediction modeling with this mixed methods approach
- Propose an ongoing plan to maintain and update this important information set for the American Society of Anesthesiologists and Studer Group
As part of current healthcare reform trends, financial and care considerations are leading to numerous health system mergers, business relationships and couplings between healthcare organizations “across the continuum” of care and health, such as inpatient, specialty care, primary care, skilled nursing facilities, home. This has resulted in a resurgence of interest to improve the care and health maintenance of patients as they flow across these larger health/healthcare ecosystems. Very commonly, quality improvement projects are trying to improve these systems at the boundaries between the components (e.g., care transitions, care continuity, integrated primary and specialty care, etc.). This project aims to model these longitudinal and inter-organizational processes at macro level and illustrate the use of these models to improve the overall system. This project will develop and test a system-wide analytic model of patient, information and personnel flow across all aspects of accountable care organization and other loosely coupled healthcare affiliations.

How this is different than related research:
As part of healthcare reform and as accountable care organizations (ACOs) become more commonplace, more interest and attention is starting to focus on transitions between various aspects of the overall system of care, as a system, whereas in the past they often have been viewed (and optimized) as fairly disjoint entities. While an increasing topic of ACO administration, little work has been done to optimize (that is, using engineering tools) ACOs as a system.
American hospitals and health systems are pursuing strategies to improve and optimize patient flow through modeling, redesign and influencing the arrival and discharge of patients. Various operational models and case studies to address effective and efficient hospital resource management have been published in peer-reviewed literature. Despite this, hospital administrators struggle with capacity challenges. Innovative and evidence-based models of practice are needed for specific hospital types and service categories to improve hospital bed capacity and early discharge in light of recent changes in payment methodology and focus on reducing length of stay (LOS). This study will focus mainly on Acute Care in both community hospitals and academic centers and aim to identify innovative models to manage operating rooms (ORs) and the lower acuity cases.

How this is different than related research:
By assisting industry members with research-informed decision making regarding patient flow, this study will provide targeted evidence-based strategies to reduce LOS and accelerate discharge for Acute Care and find innovative models for OR scheduling to ensure expedited turnaround specific to children’s hospitals.
MACRO/POLICY CLUSTER

Translating UBRICA’s Vision for Kenya to Evidence-based Strategy and Funding

PROJECT 07-05151.TAM

Value Proposition:
- Improve quality human healthcare through collaborative efforts in research and service delivery
- Develop strategic plan to target more investors and secure additional funding sources for this project in Kenya

Description:
Ustawi Biomedical Research Innovation and Industrial Centers of Africa (UBRICA) is planning to develop a socio-economic development and human health project in the Great Rift Valley of Kenya. This planned project is referred to as UBRICA ONE and involves the use of 4,000 acres of land for development as a health sciences center. The ultimate goal is to transform UBRICA ONE into a home for world-class medical facilities, state of the science research, an industrial park and residential and recreational facilities. The vision of UBRICA is to become a leading company at creating sustained conversion of knowledge for promoting health and human development in the frontier markets. This study will be focused on critically evaluating various socio-economic development and human health improvement theories and frameworks that relate to UBRICA’s vision and UBRICA ONE’s goals to develop a final grant proposal.

How this is different than related research:
Evaluation and strategy development for environments that produce health specific to Kenya and the region of the Great Rift Valley. The goal of the framework for action will be development that creates social advancement for local Kenyans. The study will be informed by knowledge embedded on the country and region. Develop a framework for action for health production that is part of the social and ecological system.
According to a 2014 CDC study, about 1 in 25 American patients has at least one infection contracted during the course of hospital care, resulting in about 75,000 deaths during hospitalizations. The most common types of infections are pneumonia (22 percent), surgical site infections (22 percent), gastrointestinal infections (17 percent), urinary tract infections (13 percent) and bloodstream infections (10 percent).

Among the pediatric population, the highest rates of HACs occur in the Neonatal ICU, Infant neurosurgery, hematology/oncology, neonatal surgery, cardiology/cardiovascular surgery, Pediatric ICU and infant total medicine areas. HAC compromises outcome of patients and ties up unnecessary resources. Challenges include: suboptimal adherence to current prevention recommendations, limitations in surveillance strategies, lack of efficient mechanism for reporting adverse events, inconsistent metrics of measurement and, at times, lack of system-wide research. This study involves multiple hospitals, units, services, environmental service and multiple stakeholders (care givers and providers, patients and facility/cleaning workers). Terminal cleaning tools and processes will also be observed. Further, pediatric and adult population will both be analyzed and findings will be contrasted.

How this is different than related research:
Most studies are site-specific. The interdependencies and multi-faceted potential personnel and process contribution to HACs make it difficult to pinpoint sources for early detection and intervention. The study is designed to uncover susceptible areas, processes, procedures and behaviors over the entire hospital stay period where infection/conditions are acquired with the objective to cultivate a pro-active surveillance system of awareness of infection-prone situations. The team will immerse in the day-to-day processes and will map out the multi-faceted inter-dependencies across processes and systems. Multi-site comparison will be performed.
As part of a larger program to incentivize hospitals to shift from a pay-for-service to a pay-for-health-outcome model, the Center for Medicare and Medicaid Services (CMS) is penalizing hospitals with above average risk-adjusted readmission rates for TJA. Not all readmissions are preventable, but they all occur after a patient is discharged and outside the hospital’s direct control. By identifying patient readmission risk prior to discharge, hospitals can tailor effective intervention strategies to improve patient health outcomes and decrease financial risk. By incorporating past readmissions and EHR data, a predictive model can be built to determine risk stratify patients. Patient readmission risk will inform care provider decisions on appropriate techniques, technologies and intervention strategies to apply to achieve positive health outcomes. By gaining a better understanding of current trends in perioperative technology development, perioperative physician leaders can be equipped with the knowledge and understanding of the complexities of these technological trends, experiences and future demands and needs. This risk-stratification and technology trend information will allow providers to make cost-effective decisions for resource allocation, predict future readmission rates and penalties and ultimately improve coordination of care.

How this is different than related research:
A multifaceted approach employing both engineering and health services research experts will focus on understanding readmission risk and technology trends from the perspective of the end user (provider) and a general process-improvement emphasis. This differs from past research with focus on one particular risk adjustment technique or technology.
Healthcare market segmentation offers insights into healthcare consumers' behaviors and attitudes, which is critical information in an environment where healthcare is moving rapidly toward patient-centered care. Personalized healthcare considers patient data from the electronic medical record (EMR) to help diagnose diseases, predict their onset and suggest models for innovative healthcare delivery systems that better utilize resources to treat patients, while improving health promotion in the community. Although every patient is unique, there are commonalities among patient characteristics (clinical, diagnostic, demographic, etc.) that can be discovered and leveraged through statistical learning methods to improve health promotion. By learning from patient data found in EMRs, specific types of patients can be identified and targeted to develop an effective healthcare market segmentation strategy, which will improve health promotion by dividing a community into homogeneous subsets of patients who have common healthcare needs. Tailored marketing strategies can be designed and implemented to target these unique patient groups to improve health promotion in the community. Also, healthcare organizations are likely to interact with healthcare market segments, so meeting the preferences, needs and demands of each segment may require innovative and tailored products and services, marketing approaches, business strategies and new customer service models. The ultimate goal of this project is to achieve more satisfied patients, greater adherence to treatment choices, improved health outcomes and reduced overall healthcare spending.

How this is different than related research:
This research project is different from previous studies which drew on marketing science to highlight the importance of market segmentation and investigate its effects using survey data in healthcare settings: 1) it has the purpose of improving health promotion in the community and 2) it uses data from electronic medical records, which provides more reliability in terms of accuracy and sample size than self-response data. This research also differs in that it integrates unsupervised statistical learning methods with supervised methods to develop predictive models that can help in increasing the effectiveness of healthcare marketing strategies.
The Affordable Care Act and value based purchasing have placed increased urgency on providing quality health care services beyond a specific acute care episode. Hospitals are now responsible for preventing avoidable readmissions for particular diagnoses, and will be financially penalized by Medicare for not doing so in an effective manner. Patients, however, are often discharged to a variety of settings and organizations, such as home health, skilled nursing facilities, inpatient rehabilitation and home with no care, which can influence a hospital’s ability to manage the transition effectively. Understanding the frequency of different transitions of care and how successful these different transitions are in reducing avoidable readmissions for a health system can help decision makers choose the most appropriate care destination for patients and potentially target interventions to improve transitions. The main objectives of the project are to: 1) examine the settings and organizations to which patients are being discharged and 2) identify whether certain settings and strategies of outplacement are more successful in reducing avoidable readmissions for patients with a particular diagnosis.

How this is different than related research:
A variety of research is being conducted on clinical strategies to reduce avoidable readmissions. However, this work will evaluate the influence of a particular clinical setting on hospital readmission rates for particular conditions.

Value Proposition:
- Demonstrate which discharge settings minimize the likelihood of hospital readmission for a particular diagnosis as a useful tool for hospitals and health systems, particularly given the changing reimbursement environment
- Assist hospitals more effectively manage transitions of care and create appropriate discharge strategies based on patient diagnosis
- Provide an evidence base for providers of inpatient rehabilitation and home health care services to market their services by demonstrating how an appropriate transition in care for a specific diagnosis can benefit the patient
PATIENT-CENTERED CARE CLUSTER

The Clinical Staff Perception of Use of and Satisfaction with Telemedicine and Clinical Documentation in the Home Health Setting

PROJECT 12-05151.UAB

Value Proposition:
- Identify barriers to the use of technology and opportunities for training to facilitate the use of technology
- Assist home health care agencies with decision-making by knowing the barriers to the use of technology
- Improve the implementation of new technologies and improve the use of existing technologies by using findings from the clinical staff survey of technology

Description:
The use of healthcare technologies in home health has been increasing rapidly. There is an increasing availability of remote clinical data capture that can be used to manage the patient care more efficiently. Clinical staff perception of use of technology and their satisfaction with the technologies that are currently used in a large home health agency and look at geographic variation will be identified and measured. The main objectives of this project are to: 1) develop survey based on literature review and home health agency observation of issues, 2) measure use of and satisfaction with point of care technology by clinical staff and 3) identify barriers to successful technology use.

How this is different than related research:
The current related research on the use of and satisfaction with home health technology is based on the perception of the organizational leaders, while this research study will include the perception of the clinical staff users of technology. Understanding how technology is used will help inform home health agency leadership strategic planning for purchasing and implementation of technology.
Description:
Individual health systems provide various services and allocate different resources for patient care. Healthcare resources including professional and staff time are constrained. Patients are “sicker” often with a combination of chronic diseases. It would already take 16–18 hours daily to do everything the guidelines recommend that primary care provide for their patients. Patient lifestyle patterns are mostly suboptimal with adherence with pharmacotherapy is often limited. This study aims to: 1) identify critical variables that impact outcomes (e.g. control of risk factors and prevention of hospital/ED admission) and inform allocation of limited time and resources for greater effect, 2) address realistically modifiable social determinants of health that will improve community health and 3) seek greater use of treatment evidence (e.g. secondary EMR usage, “OMICs” data) to advance quality and effective of care delivery. This research aims to increase quality and timeliness of care, maximize financial performance and decrease practice variability across the organization.

How this is different than related research:
This study attempts to combine social-economic and demographic demands, hospital resources and evidence of treatment (including EMR, OMICs, and other laboratory data) to redesign the delivery process for quality and effectiveness of healthcare delivery. While efficiency is often performed via process improvement, patient risk factors, disease patterns and treatment characteristics may shed lights on resource needs and care requirement, and provide holistic health systems redesign opportunities for improving care quality and effectiveness.
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. This project focuses on evidence-based approach where treatment design and management is personalized. In the events of multiple conditions, drug-drug interactions and side effects will also be modeled to minimize its 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 patients.

How this is different than related research:
This project focuses on personalized treatment design and will accommodate potential co-existing multiple conditions, rather than a single disease. Thus, it is more challenging, interesting and clinically relevant. Evidence will be uncovered from a set of real-patient data to establish the relationship of patient characteristics versus treatment outcome. A quantitative model based on patient characteristics and clinical desirable outcome will reduce the negative effect of individual provider’s subjectivity on decision making process on managing treatments and drug therapy. The project will bring together a multi-team of providers to identify guidelines of multiple disease treatment. It will assist doctors to perform patient-centered complex treatment management.

Value Proposition:
- Return optimal outcome-driven individualized treatment with lower cost and better control of disease symptoms
- Result in a treatment that will use a minimum amount of drugs, thus reducing the risk of adverse/side effects and increasing the efficacy of the treatment (more drugs mean high risk of non-compliance)
- Translate this all to improve the quality of care and quality of life of patients
PATIENT-CENTERED CARE CLUSTER

Social Network Analysis: Examining Interactions Among Providers at the Network Level

PROJECT 15-05151.UAB-FAU

Value Proposition:
- Develop selection criteria for medical provider contracting
- Direct patient population groups to the most effective medical provider network for their disease condition
- Determine and share characteristics of effective medical provider social networks for further improvement of care coordination and delivery

Description:
Providers work predominately alone yet to accomplish their work, physicians and other providers create social networks—formed by the sharing of patients. It is within these social networks that patient care is delivered. Therefore by analyzing provider social networks (not individual providers), the effectiveness of these networks can be examined for varying population groups by disease conditions. Using social networking analysis (SNA), this project will advance the understanding of the complexity of providers’ interactions, the resulting network for delivering care to patients and the effectiveness of the networks’ outcomes regarding quality and cost.

How this is different than related research:
Previous studies that examined interactions among providers utilizing SNA focused on patient sharing and referral patterns, hypothesizing that the structure of such relationships can influence costs and clinical outcomes of healthcare services. This project will allow us to move to the next level and examine not only the developed network, but also the results obtained from these networks regarding outcomes (efficiency and effectiveness) for specific patient populations and disease conditions.
Improvements to Root Cause Analysis of Patient Safety Events

Value Proposition:
- Develop a more informative analysis of patient safety events and reduction in adverse events and associated costs

Description:
Patient safety and adverse events are a widespread problem across healthcare, with huge cost and health implications, and have been the focus of significant improvement focus for over 20–30 years. Widespread progress on patient safety, however, on average has been slow and frustrating, and thus there is increasing interest in looking beyond the basic tools used to-date for new methods that might have value. This research project will extend the body of knowledge regarding methods beyond simple root cause analysis (RCA) to analyze and reduce causes of healthcare adverse events (AEs). In addition to root cause analysis, in other industries (such as aviation) other methods have been developed to help better classify and study adverse events so as to better prevent future occurrences. Examples include the Human Factors Analysis and Classification System (HFACS), System-Theoretic Accident Model and Processes (STAMPS) and others. This project therefore will adapt these other methods for healthcare application, refine them iteratively through use, and study their relative advantages and disadvantages versus RCAs.

How this is different than related research:
Almost all retrospective analysis of safety events in healthcare is done via the gold standard of root cause analysis, which has had some value but also some limitations.
QUALITY AND SAFETY CLUSTER

Examining How Lean Six Sigma Processes Reduce Hospital-Acquired Conditions

PROJECT 17-05151.PSU

Value Proposition:
- Assist all hospitals in better utilization of Lean Six Sigma methodologies to examine deficient hospitals processes that result in HACs
- Extend previous research (2014) to offer hospitals a critical evidence-based “next-step” in utilizing the study results to improve patient care and thereby fostering greater utilization of this research

Description:
The Hospital-Acquired Condition (HAC) Reduction Program, implemented by the Centers for Medicare & Medicaid Services (CMS), serves the purpose to achieve better patient outcomes, while slowing health care cost growth. The program targets largely preventable conditions that patients did not have upon admission to a hospital, but which developed during the hospital stay. Hospital performance under the HAC Reduction Program is determined based on a hospital’s total HAC score, and all hospitals that rank in the worst quartile of HAC scores will receive a payment reduction of one percent for all CMS services. With the average American hospital earning approximately 5 percent margin on, a loss of 1 percent revenue has the potential to be a significantly negative effect on the financial viability of some hospitals. This project seeks to extend the previous work conducted by the co-investigators examining the efficacy of Lean Six Sigma processes to examine the processes and related to sources of system breakdowns that result in HACs occurring.

How this is different than related research:
Limited research exists that examines the efficacy of Lean Six Sigma processes (e.g. rapid improvement events) on quality improvement in healthcare organizations. Research evidence is needed that explores and identifies how using process improvement methodologies positively impacts HAC performance. Utilizing an extension of a previous study to test the effect of rapid improvement event on HAC frequencies will serve as a unique validation of the initial findings and provide an evidence-based foundation from which this methodology can be utilized to improve hospital HAC performance.
Main Line Health, located in Pennsylvania, serves a unique and diverse population of patients in terms of race/ethnicity as well as socio-economic status. Racial and ethnic minorities tend to experience poorer health care outcomes than their non-minority counterparts, even after controlling for access to care (insurance) and income level. Disparities in health care can result in avoidable outcomes, such as hospital readmissions within a short time frame. Factors contributing to these observed disparities are usually very complex and involve organizational and health system level factors, provider level characteristics and practice patterns and patient-level characteristics. An initial descriptive examination of the incidence of 30-day readmission differences at Main Line Health revealed that Medicaid patients experience higher rates of readmission relative to patients with commercial insurance. Main Line Health recognizes that a legitimate approach to addressing these disparities will require the empirical analysis of patient profile, regional, organizational and outcomes data that will inform the evidence-based interventions best suited for its system. This research project aims to identify the key drivers of disparities in 30-day readmission among Main Line Health’s patients using secondary data analysis and to identify plausible interventions that could be implemented in efforts to significantly reduce these disparities.

How this is different than related research:
This research study will be focused on building a disparities of care predictive model that is most relevant to the geographic region and populations served by Main Line Health. This geographically focused approach, which will be informed by prior research, will allow Main Line Health to develop more effective data collection protocols and assist in formulating strategies toward closing their disparities gaps. Results from this study can then be translated and duplicated at other CHOT industry member sites in following years.
QUALITY AND SAFETY CLUSTER

Analysis and Reduction of Practice Variation

PROJECT 19-05151.NEU-GIT

Value Proposition:
- Reduce practice variation, implementation of best practices, and improvements in associated cost, access/flow, and care coordination
- Construct internal “Choosing Wisely” campaigns

Description:
There is a significant and ubiquitous problem across almost all healthcare sectors, and many clinical societies have released consensus recommendations aligned with the national “Choosing Wisely” campaign to reduce practice variation and over/under use of unnecessary diagnostics and procedures (e.g., overuse of imaging, Doppler testing for Deep Vein Thrombosis, standing daily labs and others). This collaborative research project will use system engineering methods to study, predict and reduce practice and outcome variation. This project will be conducted in multiple healthcare organizations in Georgia and Massachusetts to apply and combine workflow analysis, statistical analysis, predictive modeling, reliability science and other systems engineering methods to develop a better understanding of causality, identify best practices, target interventions, increase compliance (reduce guideline variation) and reduce variation in both practices and outcomes. Anticipated focus areas are unnecessary referrals and imaging, obstetric practices and harm, pediatric services and anesthetic services.

How this is different than related research:
While practice and outcome variation is focus of individual quality improvement efforts, less effort has gone into more engineering-oriented methods to help understand and impact the problem, nor via a more standardized, scientific and generalizable process. There also is growing consensus on many choosing wisely guidelines, but work is only just beginning to start to work on implementation and new workflows, with numerous opportunities for systems engineering models to support this. Finally, this project will explore a more robust and generalizable approach to such problems that can be applied and replicated in other healthcare systems.
CHF, involving approximately six million people, is the most common cause of hospitalization in the United States, with subsequent costs estimated at nearly $41 billion per year. It is currently unknown how many of these people reside in rural areas. What is known is that HF patients in rural, primarily medically underserved areas are more likely to be older and in poorer overall health than their suburban and urban counterparts. Rural HF patients also frequently lack easy access to community based support, like outpatient clinics, that are taken for granted in more populous areas. Telehealth technology, by addressing geographic distance, is one potential solution to improve HF self-management, while providing added professional support as needed in rural areas. However, HF management for rural patients is challenging and in need of innovative, interprofessional management strategies and technologies.

How this is different than related research:
In an integrative research review (IRR) in 2013, only four clinical trial studies using telehealth in the management of heart failure in rural settings were found, and studies reviewed were limited to the strategies of telephone follow-up calls and internet-based virtual visits. Through comprehensive analysis of HF care disparities, specifically in rural areas, target patient groups in the most need are visualized in relation to this innovative telehealth technology for HF self-care.
The term “gamification” is an emerging paradigm that aims to employ game mechanics and game thinking to change behavior. In order to successfully employ gamification principles to change behavior in personalized self-care, researchers must understand the concepts of game design, where: mechanics represents the basic processes that drive the action forward and generate player engagement, such as challenges, competition and cooperation; dynamics represents the big-picture aspects of how a gaming system works, such as achievements, avatars, badges, levels and points; and aesthetics represents the visual stimuli that engage an individual, such as game expression, game narrative and game discovery. The authors hypothesize that statistically significant differences exist in the social network structure of patients with successful gamification outcomes versus patients with unsuccessful gamification outcomes. The above three game design concepts of mechanics, dynamics and aesthetics have a social network component, connecting individuals with one another. For example, the competition component of the mechanics concept would require that patients have someone to compete with in a meaningful way. Furthermore, the quality of competition may be just as significant as the competitive task itself. While there exist models that outline gamification features, there exists a knowledge gap in how individuals’ social networks impact their motivation to completing tasks. This research aims to fill this knowledge gap.

How this is different than related research:
The main limitations of existing techniques are that patients do not engage with such systems for a prolonged period of time. Furthermore, the individuals that typically utilize such self-improvement platforms are they themselves already committed to the success of their wellness management. This research aims to fill the knowledge gap that exists in how a patient’s social network influences their ability to adhere to wellness management protocols.
ENABLING HIT AND CARE CLUSTER

Reducing Readmission After Hip Surgery Using Statistical Process Control and Smart Home Care

PROJECT 22-05151.PSU

Value Proposition:
- Design and develop more effective and advanced home-care technologies for pre- or postoperative care
- Enhance patient adherence at the postoperative stage
- Reduce hospital readmission rate of hip replacement as well as penalty from Centers for Medicare & Medicaid Services
- Provide more coordinated and integrated care to increase patient satisfaction
- Develop effective interventions and the best practice of perioperative care for hip replacement

Description:
The unplanned readmission after hip surgery has become an increasingly serious problem. In fiscal year 2015, Centers for Medicare & Medicaid Services started to penalize hospitals for high readmissions after elective hip replacement. In addition, cause of readmission after hip surgery varies from patient to patient, involving both hospital-care and home-care problems. Thus, high-quality and more coordinated care should be provided to the hip-replacement patients. To achieve this goal, it is necessary to improve the hip-surgery process in hospitals by applying evidence-based practice. Moreover, monitoring and estimating patient recovery during the first six weeks after discharge is also indispensable for improving patient adherence to physicians’ instructions and detecting potential problems in recovery. Attempting to seamlessly integrating preoperative, intraoperative and postoperative care, it is probable that the readmission rate of hip replacement can be effectively reduced.

How this is different than related research:
Risk-adjusted control statistics and control limits are constructed for real-time monitoring of the readmission rate of a hospital (i.e., it alarms immediately if the control statistics exceed the control limits, thus root-cause diagnosis can be launched right away), the risk-adjusted control statistics enable the detection of both deterioration and improvement in the hip-surgery quality, and the smart home-care device can monitor and predict the recovery status of patients, and this information can be transferred immediately to the physicians for further feedback and instruction.
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