AHRQ Health Information Technology Research

2018 Year in Review

Agency for Healthcare Research and Quality

AHRQ HEALTH INFORMATION TECHNOLOGY RESEARCH

2018 Year in Review

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I. INTRODUCTION

A. About AHRQ Health IT Research

The Agency for Healthcare Research and Quality (AHRQ) is the lead Federal agency charged with improving the quality and safety of America's healthcare system. AHRQ invests in evidence-generating research and translates research findings into practice to achieve the following goals:

1. Keep patients safe and improve their health.
2. Help health professionals improve healthcare quality.
3. Generate data to track, evaluate, and improve the healthcare system.

The AHRQ Health Information Technology (IT) Program supports AHRQ's mission by funding and disseminating **research** about how health IT can be used to improve the quality, safety, and efficiency of **healthcare.** While information technologies have reduced costs, improved the quality of services, and created transformational change in many industries, the healthcare industry was a late adopter of IT and has not yet realized its full benefit. AHRQ's Health IT Program is **producing and disseminating evidence-based research about optimizing the use of health IT to improve the quality, safety, and efficiency of healthcare.** AHRQ's Health IT Program invests in research grants and contracts awarded to researchers working across the country.

B. About This Report

This Year in Review report summarizes the research activities and outcomes funded by the AHRQ Health IT Program in 2018. The objective of this report is to support AHRQ stakeholders, including patients, clinicians, researchers, and policymakers, to:

- **Learn** about the goals of Health IT Program-funded research.
- **Discover** the innovative health technologies developed and tested by AHRQ-funded researchers, including new and emerging research in 2018.
- **Understand** how the Health IT Program improves healthcare quality and safety at the patient, provider, and health systems levels.
- **Access** learnings and products disseminated by AHRQ's health IT-funded researchers in support of knowledge transfer and replication of successful health IT strategies that improve patient safety and healthcare quality.

II. 2018 RESEARCH SUMMARY

A. Overview

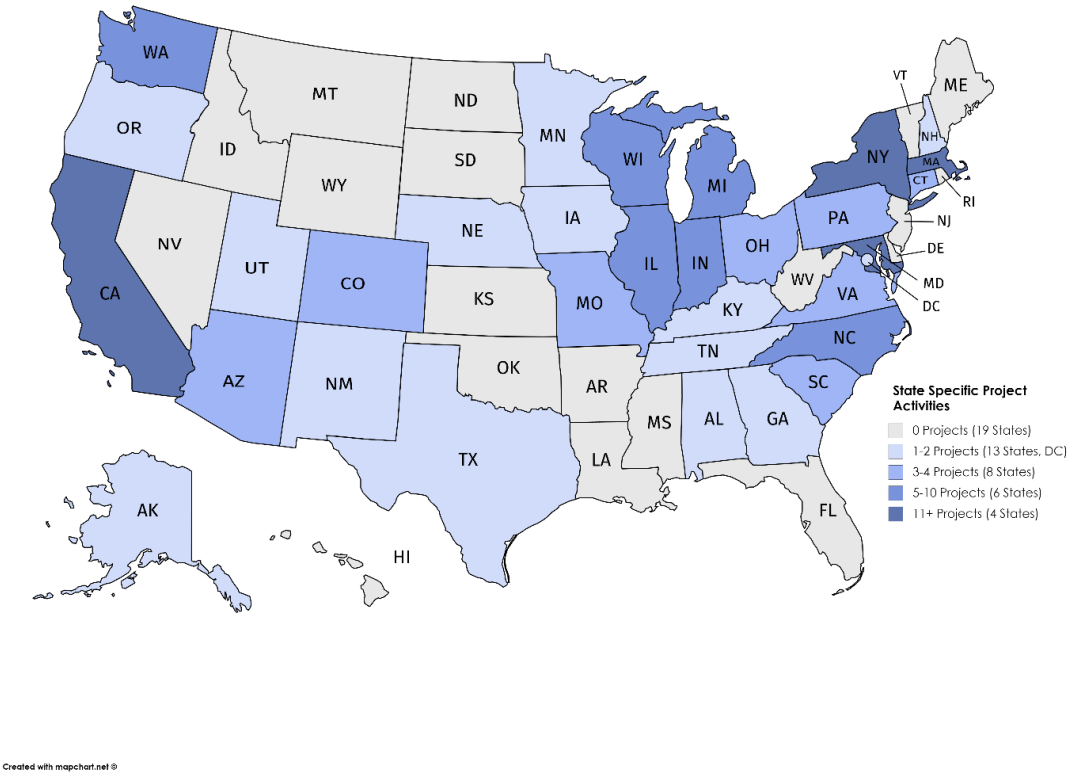
AHRQ's Health Information Technology (IT) Program's mission is directly aligned with the overall AHRQ mission. Through rigorous research, AHRQ generates the ground-breaking knowledge, tools, and data needed to improve health system performance and health outcomes. The research products yielded may be used by patients, healthcare professionals, and policymakers to make informed decisions based on the most current evidence available. Furthermore, AHRQ's cutting-edge research galvanizes collaboration across agencies within the U.S. Department of Health and Human Services and with other partners to empower evidence-based decision making at all levels of the healthcare system and to achieve the goals of high-quality care, cost-effective spending of healthcare dollars, and improved health for the American people.

In 2018, the AHRQ Health IT Program supported:

141 research grants and four research contracts

awarded to over 75 distinct institutions

in 31 States and the District of Columbia.



In 2018, the AHRQ Health IT Program continued to fund research in response to 18 past and present funding opportunities.

The AHRQ Health IT funding opportunities are designed to fund health IT research that fill gaps in the knowledge and understanding of the field, which will lead to improved design of health IT systems. The program accomplishes this through a variety of grant and contract mechanisms that support different types of health services research projects, including:

- Exploratory and developmental research grants that support research in the early and conceptual stages of development.
- Pilot and feasibility studies.
- Randomized controlled trials and other studies of technology effectiveness.
- Secondary analysis of existing data.
- Dissemination work that scales evidence-based research more broadly.

In addition, AHRQ supports the next generation of heath IT researchers by funding promising new investigators through awards intended to foster their career development in health services IT research.

In 2018, AHRQ-funded health IT researchers:

Published over 100 research articles in peer-reviewed journals and book chapters.

Presented their research at a variety of health IT, medical, and other key conferences.

B. Key Research Findings

Health IT can be a powerful enabler for patients, clinicians, and health systems working to positively affect the quality and safety of healthcare. The AHRQ Health IT Program funds research to create actionable findings around "what and how health IT works best" for these healthcare stakeholders. The following summary presents impactful health IT-funded research for each of these three focus areas.

AHRQ-Funded Research Improves Care of Patients and Their Engagement in Care

AHRQ Health IT-funded research supports patient-centered care, which includes the use of patient-reported outcomes (PROs). Also, while technology usability is a cross-cutting theme throughout most of AHRQ's health IT-funded research, 2018 findings underscored the need to recognize the unique usability requirements of priority patient populations. The following research exemplifies AHRQ's recently completed patient-focused research. Select the hyperlink on the PI's name for more information on the research.

Patient-Centered Care (PCC) is a respectful and responsive approach to fulfilling patients' healthcare preferences, needs, and values. AHRQ supports the importance of PCC through research that uses health IT to engage patients and their caregivers, and empowers them with knowledge to make more informed decisions about their care. The following research highlights key achievements in the area of PCC:

- **Dr. David Vawdrey** provided inpatients with access to a patient portal and found that it increased patient engagement with health information during hospitalizations for cardiac conditions.
- A patient-centered clinical decision support (CDS) app for management of minor head injuries was developed by **Dr. Edward Melnick** based on usability feedback from patients and providers. Giving clinicians the tools to support patient-provider communication

resulted in fewer computed tomography (CT) scans ordered, higher physician trust by patients, and greater patient knowledge. Read the impact story here!

- **Dr. Eneida Mendonca** conducted a proof-of-concept study that linked scanned models of the interior of patients' homes to the electronic health record (EHR) to ultimately support care teams in tailoring the discharge plan to the patient's home environment. Physicians participating in focus groups reacted positively to the tool and reported its potential utility to support planning and preparing patients for discharge, especially for patients with complex discharges, greater illness burden, and those requiring rehabilitation.
- **Dr. Jessica Ancker** engaged patients in managing their health and care through a patient-centric portal designed to match patients' needs. The research indicated that patients consider it too much work to track their health data and often lack a clear understanding of tasks required to manage their personal health information.

Patient-Reported Outcomes (PROs) are a component of PCC that use health information provided by the patient via technologies such as mobile apps or wearable devices to monitor disease symptoms and provide individualized care and treatment. Notable AHRQ-funded research integrated PROs into the care and management of various health conditions. Several examples are provided below:

- **Dr. Robert Rudin** developed and tested the feasibility of an app that allows patients to report and share their asthma symptoms with providers by answering five simple questions to inform clinical care. Patients reported the app was simple and easy to use, increased awareness of their asthma symptoms and flares, made them feel more connected to their providers, and avoided emergency care. Through a second grant from AHRQ, Dr. Rudin is enhancing the app and evaluating whether it facilitates enhanced asthma self-management and patient-provider communication in the primary care setting. Read the impact story here!
- **Dr. Rebecca Schnall's** "mVIP" mobile health app provided real-time symptom management strategies to people with HIV. Patients reported their symptoms in the mVIP, and the app provided customized self-care strategies based on their symptoms. The app helped patients reduce symptoms of anxiety, depression, neuropathy, fever, chills, sweating, and weight loss or wasting. Read the impact story here!
- **Dr. Bengisu Tulu** developed an app for tracking pain and activity levels among patients with osteoarthritis. Patients reported use of the app led to more data-driven conversations with their doctors and increased their active participation in the decision-making process.

Priority Populations, or groups at risk for experiencing health disparities, may have unique health IT usability requirements. Since usability is key to ensuring that health technology meets the needs of the individuals who use it, AHRQ funded the following four researchers to examine the ease and learnability of technology for priority populations.

- **Dr. Donna Kazemi** designed an app to address risky alcohol use among college students. The research indicated the app had good usability, was effective, and was more cost effective than in-person interventions. Read the impact story here!
- To support healthy food decisions, **Dr. May May Leung's** interactive nutrition comic for dietary self-management increased positive beliefs and attitudes toward fruits, vegetables, and water among minority youth. Children ate more vegetables and drank more water, as well as decreased their sugar intake, from the beginning of the study to the end of the study. Read the impact story here!
- **Dr. Rupa Valdez's** research concluded that patient-facing technology must be redesigned or enhanced to better allow individuals with disabilities to fully engage with technology and demonstrated the importance of partnering with individuals with disabilities to optimize technology design for their use. Read the impact story here!
- With extensive and iterative user feedback, **Dr. Mark Andrew Connelly** developed an app for youth with juvenile idiopathic arthritis that provided tailored information for the patient on effective pain management strategies.

Supporting Clinicians' Work

Research funded by AHRQ aims to support clinicians and other healthcare professionals in providing health services. The projects highlighted below share the goal of improving the experience of health professionals who use health IT. The featured researchers investigated how health professionals interact with technology and how technology can be optimally integrated in tasks undertaken on a daily basis. Select the hyperlink on the PI's name for more information on the research.

Human Factors Design is the study of human behavior, the environment, and technology with the goals of reducing human error and increasing productivity. In the context of health IT, human factors design focuses on healthcare professionals' abilities and limitations when interacting with computers or other technologies such as EHRs. Given the increasing role and complexity of technology in healthcare, AHRQ funded the following researchers to study the impact of technology on clinicians, and to test strategies to improve clinicians' experiences using technology in the healthcare setting.

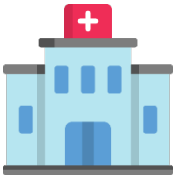
- Through focus groups and a survey of providers, **Dr. Philip Kroth** found that use of health information communication technology (HICT) contributes to work-related stress, burnout, and lack of job satisfaction. The challenges of HICT include excessive data entry, lack of work-life balance, and poor posture and physical pain from using HICT. Good self-care, exercise, and resiliency training were found to be helpful coping strategies. Dr. Kroth recommended efforts to reduce information overload and changing policy so that notes focus on documenting clinical care, rather than supporting billing.
- **Dr. Jason Saleem** tested a redesigned clinic exam room that included a mobile computer station and wall-mounted monitor for ease of repositioning. This room configuration led to

more time sharing the screen with patients, reduced workload, and gave clinicians greater situational awareness. Read the impact story here!

- **Dr. Foster Goss** developed a natural language processing (NLP) EHR search tool that automatically identifies and ranks relevant clinical information based on a patient's presenting complaint within the emergency department (ED) setting.
- To support clinician productivity, **Dr. Genevieve Melton-Meaux,** employed NLP to identify and visually distinguish new versus redundant information in clinical notes. Findings will be used to inform future EHR design considerations to improve usability and decrease clinician cognitive burden.

Clinical Work Flow is a defined series of steps taken by a clinician to provide care or treatment to a patient. With deliberate and structured planning, testing, and implementation processes, health IT can support clinical workflow and enhance clinicians' efficiency. The following two AHRQ-funded researchers investigated the impact of health IT on clinical workflow.

- **Dr. Hardeep Singh** studied how clinicians complete tasks related to laboratory test results to understand the reasons for delayed diagnoses resulting from failure to follow up on test results. Dr. Singh found that common barriers include poorly designed communication interfaces between the EHR and diagnostic services and usability challenges with the EHR. He recommended using dedicated personnel to follow up on lab results and implementing EHR designs to facilitate followup of laboratory test results.
- **Dr. Scott Ryan Levin** tested E-triage, a machine-learning algorithm, to predict the risk of adverse outcomes in the ED. E-triage improved identification of low-risk patients, allowing providers to focus their time and attention on patients with greater risk. Additionally, the algorithm reduced the time to decide whether to admit a patient by 58 minutes and the time to see a clinician by 10 minutes.



Improving the Delivery of Health Services at the Health Systems Level

AHRQ-funded research aims to improve the delivery of health services at the health systems or organizational level. Efforts to share health information across different technologies and healthcare environments, and leveraging data and technologies to strengthen the quality of services delivered were key aspects of research projects focused on health systems. Select the hyperlink on the PI's name for more information on the research.

Interoperability allows information to flow from one information system to another with the goal of improving health outcomes, quality of care, safety, cost-effectiveness, and access to health services. AHRQ funded the following research to develop interoperable systems in support of population health.

- **Dr. Brian Dixon** leveraged a health information exchange (HIE) to improve public health reporting in primary care settings. A decision support intervention delivered pre-populated

case reporting forms through the HIE when laboratory results for reportable diseases were positive. As a result, reporting rates and completeness of the forms significantly improved, and feedback from providers and public health professionals was positive.

- **Dr. Jason Shapiro** used real-time data from an HIE to validate quality measures of potentially avoidable visits to the ED. Compared to data from EHRs, data from the HIE increased the identification of early return visits and frequent ED users, thereby improving the accuracy of the quality measures. Future application of this work has the potential to reduce data fragmentation by increasing providers' access to information across the health system.
- With funding from AHRQ, the **MITRE Corporation** launched CDS Connect to facilitate translation of evidence-based care into clinical practice with interoperable CDS. CDS Connect includes an online repository of CDS artifacts—various types of evidence-based medical knowledge, such as clinical guidelines that may be used to create prototypes for sharing CDS across health settings and technologies. This work provides the framework for improving healthcare outcomes via CDS creation, discovery, integration, and implementation using evidence-based interoperable CDS artifacts. The repository of CDS artifacts is available here on the AHRQ website.
- **Dr. Kathleen Cartmell** tested an interactive voice recognition (IVR) tobacco dependence treatment service for inpatients that linked an EHR, tobacco cessation program, and statewide healthcare utilization data. At 30 days after discharge, smokers using the IVR service were significantly less likely to be readmitted compared to those who did not use the service. Their healthcare charges were also, on average, $7,299 lower. Read the impact story here!

Quality Improvement, often implemented iteratively, is the process of attaining a higher level of performance or quality compared to previous levels. In the healthcare environment, quality improvement efforts may focus on strengthening health services delivery to serve the ultimate goal of improving patients' health and experiences with the health system. The following two AHRQ-funded research projects, both conducted in pediatrics, used data in the EHR with the shared goal of improving quality. Select the hyperlink on the PI's name for more information on the research.

- **Dr. Elizabeth Alpern** developed an emergency care data registry for pediatric patients using EHRs. The registry contains data from more than two million ED visits representing more than 900,000 patients. Data from the registry have been used for quality improvement audits and feedback, as well as health services research.
- **Dr. Naomi Bardach** created and pilot tested FIQS, the Family Input to Quality and Safety tool, which allows pediatric patients and their caregivers to provide safety reports regarding their inpatient care. Participants had a positive experience using the tool. Additionally, they endorsed its continued use, thereby demonstrating the feasibility of collecting real-time safety reports from patient and family members so that health systems can readily take action based on these data.

C. Impact Stories from AHRQ-Funded Work

AHRQ-funded research generates findings that aim to make a tangible difference in patients' health and engagement in their care, clinicians' experience and effectiveness in providing care and treatment, and the overall effectiveness and quality of the services delivered through the health system. The following impact stories further amplify and demonstrate the effect of AHRQ-funded research mentioned above.

Decreasing Tobacco-Related Healthcare Costs Using Interactive Voice Response Technology

Tobacco use and its related morbidity and mortality are burdens to the U.S. health system.

Tobacco use in the United States continues to be a significant healthcare concern. In addition to causing approximately 480,000 deaths annually and resulting in nearly $300 billion in healthcare spending each year, tobacco use is also a known risk factor for hospital admissions and readmissions. The benefits of in-hospital smoking cessation programs have been documented; however, these programs can be expensive to implement. Dr. Kathleen Cartmell and her research team at the Medical University of South Carolina (MUSC) wanted to examine the cost-effectiveness of these programs and their impact on hospital readmission rates.

Using technology to follow up with in-hospital tobacco treatment services.

Implemented in 2014 to meet Joint Commission tobacco treatment standards, MUSC's automated opt-out Tobacco Dependence Treatment Service (TDTS) interfaced with the hospital's admission and discharge records to identify tobacco users and refer these patients to in-hospital tobacco cessation services. Using Interactive Voice Response (IVR), patients received automated followup phone calls to assess tobacco use and provide referrals to community tobacco cessation services at 3, 14, 30, 90, and 180 days after hospital discharge.

Smoking cessation using IVR can reduce readmission rates and lower healthcare charges.

Dr. Cartmell examined differences in readmission rates and healthcare costs between TDTS users and those who did not receive the service. Those using the TDTS service were 23 percent less likely to be readmitted to the hospital 30 days after discharge. Their healthcare charges were also, on average, $7,299 lower than smokers who did not receive TDTS. These findings suggest that an automated, opt-out inpatient TDTS service could decrease readmissions and healthcare costs for

> *"If we can show providing a tobacco cessation program is truly a driver of healthcare utilization and costs, that becomes a tremendous incentive for hospital systems to provide these kind of programs."*
> - Dr. Kathleen Cartmell

patients, increase efficiency in patient care for the hospital, and decrease claims for insurers. Dr. Cartmell wants to see additional studies to validate the findings, whose results may encourage healthcare systems to invest in TDTS programs.

Key Finding and Impact: Automated, opt-out inpatient tobacco cessation services delivered by interactive voice response decreases readmissions and healthcare charges.

PRINCIPAL INVESTIGATOR	Kathleen Cartmell, Ph.D.
ORGANIZATION	Medical University of South Carolina
RESEARCH TITLE AND PROFILE LINK	Reducing Hospital Readmission Rates by Implementing an Inpatient Tobacco Cessation Service Driven by Interactive Voice Recognition Technology

Reducing Risky College Drinking Through The Use of Cutting Edge mHealth Technology

Heavy alcohol use and its related consequences are major health problems for U.S. universities.

In addition to academic failure, the consequences of alcohol abuse can include blackouts, violence, suicide, HIV-related sexual risk-taking, and sexual assault.

High-risk drinking in college students has dangerous and numerous consequences. Addressing alcohol use in college students has often relied on in-person interventions, which are expensive, difficult to sustain, and often inaccessible. Recognizing the almost universal use of smartphones (SP) and “apps” (applications) in this young adult population, researchers at the University of North Carolina at Charlotte hoped to reduce high-risk drinking through the use of a proven, evidence-based alcohol intervention using mHealth technology.

Using an adapted Brief Motivational Interviewing Smartphone App (BMI+SP) as a real-time alcohol intervention.

Dr. Kazemi and her national interdisciplinary team of researchers, including experts in psychology, computer science, mathematics, and nursing, aimed to address the cost and accessibility challenges of in-person alcohol interventions by developing BMI+SP, a smartphone app that uses an adapted Brief Motivational Interviewing (BMI) intervention to encourage users to change their high-risk drinking behaviors. BMI+SP has multiple interactive components

designed to engage the user and provide customized messaging based on user characteristics. Dr. Kazemi and team found a significant reduction in alcohol use and alcohol-related consequences in students who used the app for 6 weeks compared to students who did not use the app.

mHealth apps can reach youth to reduce alcohol use and intervention costs.

This study suggested that mHealth apps can help to address dangerous alcohol use in young adults. BMI+SP and similar apps have the potential to reduce alcohol intervention costs, reach more individuals than traditional in-person interventions, and be adapted for use across other areas of health concerns. Dr. Kazemi reports that these findings will inform future, more extensive studies looking at the usability, sustainability, efficacy, and cost-effectiveness of mHealth interventions to address hazardous drinking among young adults. This innovative approach also has the potential to be translated to address other important health issues in vulnerable populations.

Key Finding and Impact: Apps to address dangerous alcohol use in college age adults may be as effective, and more cost-effective, as traditional in-person interventions.

PRINCIPAL INVESTIGATOR	Donna Kazemi, PhD
ORGANIZATION	University of North Carolina at Charlotte
RESEARCH TITLE AND PROFILE LINK	mHealth Delivery of a Motivational Intervention to Address Heavy Drinking Among College Freshman

Reducing Childhood Obesity Risk Using an Interactive Digital Comic Book

Childhood obesity is a serious public health issue.

Childhood obesity has significant short- and long-term health consequences. Obese children have higher rates of cardiovascular disease and diabetes in childhood, as well as an increase in morbidity and mortality in adulthood. Often associated with the consumption of sugary beverages and energy dense or low fiber foods, childhood obesity rates in the United States are highest in low-income and minority children. Dr. May May Leung wanted to address this issue using an original and culturally relevant digital health platform.

Children live in a media-saturated environment. Innovative interventions are needed to engage children and interest them in health-promoting behaviors.

Designing comic books to reach urban minority youth.

In this pilot study, Dr. Leung's multidisciplinary research team at Hunter College-City University of New York developed Intervention INC, an interactive web-based comic that addresses behaviors

associated with obesity in children aged 9-12 years. By using the individual, social, and environmental factors that affect the dietary choices of urban minority youth and the feeding practices of their parents, Dr. Leung tailored the six-chapter comic to reflect the unique cultural characteristics of the study population. Recognizing that sedentary behaviors such as using computers, tablets, and smartphones also contribute to childhood obesity rates, Dr. Leung exposed participants to a single chapter of the comic each week and designed each chapter to be read in 15-20 minutes.

Increases in healthy eating behaviors among participants.

The research team found that Intervention INC was highly acceptable among children and their parents, but more importantly, preliminary results show that participants who read the comic demonstrated significantly greater improvements in vegetable, water, and sugar intake; improved attitudes toward vegetable consumption; and showed greater self-efficacy toward fruits, vegetables, and water. Dr. Leung would like to see additional large-scale studies for the comic in real-world settings and adaptation of the tool to other ethnic groups.

Key Finding and Impact: Children who read the comic ate more vegetables and drank more water, as well as decreased their sugar intake, from the beginning of the study to the end of the study.

PRINCIPAL INVESTIGATOR	May May Leung, PhD, RDN
ORGANIZATION	Hunter College, The City University of New York
RESEARCH TITLE AND PROFILE LINK	Intervention INC: Interactive Nutrition Comics for Urban Minority Youth

When Costly and Potentially Harmful CT Scans Are Not Necessary

Is that CT scan in the patient's best interest?

While the increased use of diagnostic imaging tests like CT has outpaced healthcare growth, the use of these tests does not always reflect patient-centered care. Frequently overused in the ED setting, CT scans are often ordered in scenarios where there is no evidence of improved patient

"About 1 out of every 3 CT scans that are performed in the ER for minor head injury are not clinically indicated."
- Dr. Edward Melnick

outcomes. Additionally, non-essential CT scans can result in increased healthcare costs, exposure to unnecessary radiation, and longer hospital stays.

Aligning best practices for CT scans for patients with minor head injuries.

Dr. Edward Melnick and his research team at Yale University sought to identify the non-clinical, human factors that promote or inhibit the appropriate use of CT in patients presenting to the ED with minor head injury. They talked to patients and providers to inform the development of the Concussion or Brain Bleed application (integrated patient- and provider-facing app), an innovative CDS tool that integrated a patient-centered decision aid and CDS at the bedside for the management of minor head injury in the ED. The app was based on the Canadian Computed Tomography Head Rule (CCTHR), a clinical decision rule designed and validated to safely reduce imaging in minor head injury.

Sorry, Doctor, did you say I don't need a CT?

The team's overall goal was to better prepare clinicians to guide patients with minor head injuries on appropriate CT use and to evaluate the tool through a pilot study. When physicians expressed empathy and had increased knowledge of when CT use was appropriate, patients accepted the recommended treatment, even when not utilizing advanced imaging like CT scan. While development of CDS for minor head injuries increased the likelihood of clinically appropriate CT, implicit in this process is the time spent with the patient to assure they understand and are comfortable with a treatment plan that does not involve CT.

Key Finding and Impact: Giving clinicians the tools to support patient-provider communication could result in fewer CTs ordered, higher physician trust, and higher patient knowledge in cases involving minor head injuries.

PRINCIPAL INVESTIGATOR	Edward Melnick, MD, MHS
ORGANIZATION	Yale University
RESEARCH TITLE AND PROFILE LINK	Clinical Decision Support for Mild Traumatic Brain Injury

A Simple Mobile Application is Key to Patient Engagement in Reporting and Monitoring of Asthma Symptoms

Seeing value in using PROs data for research purposes, Dr. Robert S. Rudin from the RAND Corporation recognized that PROs data could also be used to improve patient care. People with asthma have better outcomes and fewer flareups when their symptoms are routinely monitored and managed by clinicians. Using mobile applications to report asthma symptoms to clinicians would allow for more timely management of asthma systems.

Dr. Rudin and his research team designed a patient-facing mobile phone app for people with asthma using user-centered design principles and an iterative process that engaged patients and providers. Patients received a weekly prompt to answer five standardized questions about their current asthma symptoms. A care manager, such as a nurse or medical assistant, received notifications if patient-reported symptoms met specific conditions of worsening severity.

User feedback is important to the development of mobile health apps.

Keeping patients engaged is often a challenge in healthcare; therefore, the research team knew they had to develop an app that would be of value to patients so that they would continue to use it. Dr. Rudin commented, "**Using a user-centered design process, the patients reveal to you what they want for the design. I've yet to have an interaction with a user where I didn't learn something.**" The user-centered design process informed the development of the app and the practice model for the intervention. For instance, physicians invited their patients to use the mobile app, because the researchers found during the formative research that patients are more likely to adhere to recommendations made by their physicians.

A simple solution to engage patients.

Dr. Rudin and his team conducted a 6-month feasibility study in two subspecialty care clinics, analyzing app usage logs and data from interviews conducted with patients and clinical staff. At the end of 6 months, they were surprised and pleased to find high patient engagement: 92 percent of patients were still completing weekly PRO questionnaires. Over 80 percent of patients received at least one call based on their weekly PRO responses. Patients reported that the app was simple and easy to use, increased awareness of their asthma symptoms and flares, made them feel more connected to their provider, and avoided emergency care. Providers reported minimal workflow burden.

The importance of keeping it simple

"Too often we try to load up interventions with bells and whistles, and then you don't know exactly why it works or doesn't work. For this intervention, we discovered that asking patients five simple questions once a week, with the option to call the provider, kept patients engaged in asthma management and made them feel more connected with their physicians."

- Dr. Robert S. Rudin

Scale and spread of this successful application and model.

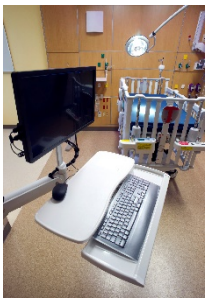
Dr. Rudin has been funded for future work by AHRQ to scale and spread this successful app and practice model. For this current research, Dr. Rudin and his team are applying user-centered design processes to enhance and adapt the app in a primary care setting, where much of asthma disease management occurs. The enhancements will include recording peak flows and details on recent symptoms and triggers, which were suggested by patients and providers during the original research project. The enhanced app and model will be rigorously evaluated with a randomized controlled trial to understand the impact of the app on quality of life and asthma-related healthcare utilization.

Key Finding and Impact: A simple app, designed with input from patients, resulted in 92 percent of patients continuing to report their asthma outcomes at the end of the study. A tool like this simple app may help patients better control their asthma and prevent emergency care.

PRINCIPAL INVESTIGATOR	Robert S. Rudin, PhD
ORGANIZATION	RAND Corporation
RESEARCH TITLES AND PROFILE LINKS	Integrating Patient-Reported Outcomes into Routine Primary Care: Monitoring Asthma Between Visits Using mHealth and Patient-Reported Outcomes to Deliver Evidence-Based Asthma Care

Using Technology to Enhance Patient Communication During Clinic Visits

Computers have advantages, but may interfere with patient communication.



Computer use by providers during clinical visits enhances how patient data are documented and organized; however, it may have a negative impact on the patient-provider relationship. For instance, providers documenting information in the electronic medical record during a visit may maintain less eye contact with the patient. Dr. Jason Saleem at the University of Louisville studied the impact of exam room layout on patient-centered care, with the goal of using technology as a mediating device between the patient and provider.

Assessing the impact of a redesigned clinic exam room on patient-provider communication.

In collaboration with the Veterans Health Administration, Dr. Saleem tested a prototype design to better incorporate computers in the clinic exam room. New wall-mounted systems allowed providers to share the computer monitor with patients while easily orienting themselves toward the patient and keeping the computer screen in view. A new mobile computer workstation allowed providers to rearrange the clinic room, including simply pushing the computer away when not useful or needed.

> *"Primary care providers are incredibly overburdened: every second counts. We can find ways to improve their experience and use technology to improve their interactions with patients."*
> - Dr. Jason Saleem

Using technology to enhance and not disrupt communication.

The standard room design and the prototype were compared through a lab simulation study. Although providers were heavily focused on the patient in both study scenarios, providers using the standard room design had less situational awareness and greater cognitive workload because they needed to more frequently change their orientation between the computer and the patient. Field observations conducted by Dr. Saleem found that both providers and patients were enthusiastic about the flexibility to move and share the computer screen. In addition to increasing patient-centeredness, this study indicated the feasibility of aligning patient technology with the model of patient care.

Key Finding and Impact: Leveraging clinic room configuration allows the computer to become a facilitator to the patient visit, rather than a barrier between the provider and patient.

PRINCIPAL INVESTIGATOR	Jason J. Saleem, Ph.D.
ORGANIZATION	University of Louisville
RESEARCH TITLE AND PROFILE LINK	Ambulatory Clinic Exam Room Design With Respect to Computing Devices to Enhance Patient Centeredness

Using Mobile Technology to Self-Manage HIV Symptoms

HIV has evolved from an acute illness to a chronic disease that requires chronic disease management.

People with HIV are living longer due to the availability of improved treatments, including medication regimes that may have symptoms and side effects. Managing these symptoms is crucial for maintaining quality of life; however, overburdened providers often have limited time to optimally manage symptoms. Racial and ethnic minorities, as well as those of low socioeconomic status, often have less access to health information and consequently experience symptoms at higher rates than other people with HIV.

Developing a health IT tool that is useful and helpful to underserved populations.

Recognizing the importance of symptom management in at-risk populations, Dr. Rebecca Schnall and her Columbia University-based research team developed an mHealth app, called the mobile Video Information Provider (mVIP), with evidence-based self-care strategies that guide people with HIV in self-managing their HIV-related symptoms. Tested using a rigorous user-centered design process, Dr. Schnall's randomized pilot study is one of the first to examine mobile app use within a population of individuals of low income and largely racial and ethnic minorities.

> *"This is an opportunity to be able to disseminate this health information to communities that are the most at risk for not being able to access their health information, are least likely to self manage their health, and have the poorest health outcomes."*
>
> Dr. Rebecca Schnall

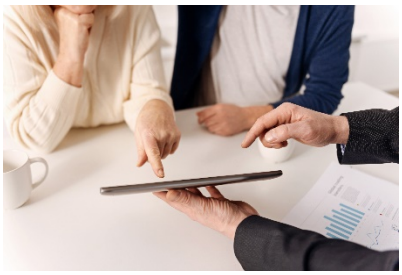
mVIP users reported a decrease in HIV-related symptoms.

mVIP use was associated with an improvement in symptoms, high user satisfaction, and a self-reported increase in medication adherence. Persons who had access to mVIP's care strategies reported less anxiety, depression, fevers, neuropathy, and weight loss than persons who did not have access to the care strategies. Technologies such as mVIP could result in increased quality of life, reduced administrative burden, and reduced health care costs due to decreased visit complexity and overall fewer visits. While Dr. Schnall recommends a larger and longer study be conducted of this app, she believes the current findings could guide future work in the application of the app to other chronic care diseases.

Key Finding and Impact: mHealth technologies can decrease HIV-related symptoms in medically underserved populations.

PRINCIPAL INVESTIGATOR	Rebecca Schnall, RN, PhD
ORGANIZATION	Columbia University Health Sciences
RESEARCH TITLE AND PROFILE LINK	Use of mHealth Technology for Supporting Symptom Management in Underserved Persons Living with HIV

Understanding and Designing Health IT for Persons With Disabilities



As individuals become more involved in the self-management of their healthcare needs, consumer health IT is increasingly tied to patient outcomes and engagement. It is well documented that people with disabilities face inequities when accessing healthcare, including consumer health IT. Little has been done, however, to address these disparities. To capture the needs of all patient populations, health IT design must be inclusive of individuals who face barriers to accessing healthcare, including those with physical, cognitive, and sensory disabilities.

Identifying the unique needs for disabled individuals.

Dr. Rupa Valdez and her University of Virginia-based research team aimed to improve access to health IT for individuals with disabilities. Dr. Valdez studied how this population communicated health information within their social networks and the challenges they encountered when accessing health IT. Individuals discussed necessary supports, conversations about how much information to disclose and to whom, statements about one's disability and their rights as a person with a disability, and how their disability impacted their health communication and decision making. Using this information, she was then able to identify which communication characteristics and health IT features needed to be evaluated to guide the design of health IT responsive to the needs of individuals with disabilities. Dr. Valdez emphasizes that the needs of this population must be considered early and often in the design process; health IT developers should view individuals with disabilities as partners in health IT design and not make assumptions about the experiences, needs, and preferences of their customers.

> *"Research has shown that the impact of someone's disability is changeable…and can be addressed, in part, through design."*
>
> - Dr. Rupa Valdez

Encouraging patient-centered health IT.

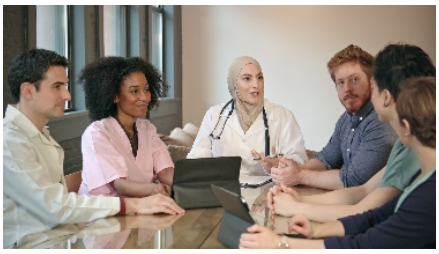
Dr. Valdez recommends that providers and healthcare administrators consider the patient's limitations when selecting or implementing technology. Her research suggests that the role of patients and the general public, as advocates for change, will be crucial in encouraging health equity and enforcing disability rights in the future.

Key Finding and Impact: Health information communication for individuals with disabilities is multidimensional and includes conversations about support, disclosure, advocacy, and logistics. Informed changes to content, functionality, interfaces, and technology platforms increases health IT usability and usefulness for individuals with disabilities.

PRINCIPAL INVESTIGATOR	Rupa Valdez, Ph.D.
ORGANIZATION	University of Virginia
RESEARCH TITLE AND PROFILE LINK	Accessibility and Beyond: Designing Consumer Health IT for Disabled Individuals

D. AHRQ's Emerging and Innovative Newly Funded Research in 2018

The Health IT Program at AHRQ continues to fund foundational research to identify solutions to ensure that health IT is designed and implemented in ways that improve quality and safety without placing excessive burden on users, including patients, physicians, and other members of the care team who use the technology. In 2018, AHRQ funded 28 new research projects to address the important priority areas described below. The importance of select recently funded research projects are highlighted, including the goals of the research and anticipated outcomes or future potential application of the work. Select the hyperlink on the PI's name for more information on the research.



Advancing Research Evidence into Clinical Practice Through Clinical Decision Support

CDS helps clinicians, patients, and others on the care team by delivering the right information at the right time so they can make the best care decisions. When developed and implemented well, CDS uses patient-specific data and is guided by evidence-based findings to improve health and enable the best possible outcomes. AHRQ has a long history of investing in research about how to make CDS more effective, usable, and shareable.

The following is an example of exciting new CDS work funded in 2018:

- A team of clinicians, researchers, and informaticists from the **MedStar Health Research Institute** is comparing CDS developed in isolation versus those developed using resources available on CDS Connect, a project funded by AHRQ to facilitate translation of evidence-based care into clinical practice with interoperable CDS. The implementation and testing will be conducted at four healthcare systems, representing different patient populations and two EHR vendors to facilitate a robust evaluation process. This systematic approach will allow for analytic comparisons within and across sites to identify efficiencies when using shareable and interoperable CDS resources.

Using Patient-Reported Outcomes to Improve Patient Care

Incorporating brief, validated PRO measures into clinical care to assess outcomes, such as changes in symptoms, emotional health and wellbeing, and physical and social functioning, is essential to high-quality healthcare. Most PRO data are collected via pen and paper, which is difficult for

patients, providers, and researchers to access and use. While some EHRs capture structured PROs, this information is not commonly collected and integrated at the point of care. AHRQ is at the forefront of funding innovative research to collect and use PROs leveraging health IT to improve patient care and wellbeing, as well as informing how to scale and spread existing health IT models. The following newly funded research incorporates PROs:

- **Dr. Elsbeth Kalenderian** and her research team at the University of California at San Francisco School of Dentistry are investigating the use of an app that collects a patient's pain experience with the goal of reducing unnecessary opioid use in patients after dental surgery. Read the emerging research story here!
- **Dr. Jinoos Yazdany** at the University of California in San Francisco is leading research to extract PROs documented in clinical notes using NLP. The goal of the research is to unlock the potential of the information in clinical notes and use that information to create an evidence-based clinical learning network to support the participation of public hospital systems in PRO measurement and improvement efforts. Another goal is to make care more patient centered by developing tools that facilitate shared decision making and monitoring the care and treatment of patients with rheumatoid arthritis. Read the emerging research story here!
- **The AHRQ Step Up App Challenge** encouraged participants to create apps that advanced the collection of standardized PRO data in ambulatory care settings. Participants used draft technical specifications employing the HL7 Fast Healthcare Interoperability Resources (FHIR) Standards to develop user-friendly apps that enable PRO data to move between IT systems both within and across different providers. Research led by MedStar Health is modifying and pilot testing an application that incorporated the draft FHIR technical specifications to enable broader PRO data sharing for clinical and research purposes. In addition, the team will pilot test the winning app from the Step Up App Challenge.

Using Artificial Intelligence to Improve Health and Healthcare

Artificial intelligence (AI), defined as the ability of computers to learn human-like functions or tasks, has shown great promise. What was previously considered the sole domain of human cognition is already being leveraged successfully across many industries, including healthcare. The rapid digitization of health data with health IT in the United States has created unprecedented opportunities in the use of AI in healthcare. The AHRQ Health IT Program is leading research efforts in this area including the following research:

- **Dr. Michael Avidan** and his research team at the Washington University School of Medicine are working to develop and evaluate an air traffic control-like command center for operating rooms. Anesthesiology Control Tower: Feedback Alerts to Supplement Treatment (ACTFAST) will apply data mining and machine learning to forecast adverse patient outcomes using data from the perioperative electronic medical record and real-time physiological data. The Anesthesiology Control Tower (ACT) will track and deliver alerts to anesthesiologists' personal communication devices and enable expert clinicians located

outside the operating room to provide attending anesthesiologists with real-time decision support.

Learning Health Systems—Applying Data and Evidence to Improve Patient Care

Health systems that effectively apply data and evidence to improve patient outcomes and care are called learning health systems (LHSs). Gathering evidence on how best to utilize health IT to generate, integrate, and synthesize disparate data is a critical step toward supporting LHSs that continuously improve patient outcomes and care. AHRQ's health IT program explores how health IT would best support LHSs, particularly in ambulatory care settings, including:

- **Dr. Charles Friedman** from the University of Michigan and researchers from the Cleveland Clinic are using LHS methods to develop an application integrated within an EHR that is capable of automatically personalizing and prioritizing preventive measures for an individual using U.S. Preventive Services Task Force evidence-based recommendations to improve health.

Engaging Patients and Families in Their Health Care

Research shows that patient and family engagement in healthcare leads to measureable improvements in safety, quality, and satisfaction of care. Health IT can facilitate patient engagement via the use of patient portals, social media, and tracking vitals or symptoms with wearable technology or mobile apps. Health IT also helps patients and their families more actively participate in their own health and wellness at any point of interaction with the healthcare system. Some funded health IT research projects that are targeting to improve patient and family engagement include:

- **Dr. Carmela Alcantara** from Columbia University is conducting research with non–English-proficient Hispanic patients with insomnia and behavioral health providers to develop a cultural adaptation of an existing cognitive behavioral therapy for insomnia program, an interactive program that can be delivered via tablet, smartphone, or computer and has been effective at reducing insomnia symptoms and co-occurring psychological symptoms. Read the emerging research story here!
- **Dr. Mary Reed** from the Kaiser Foundation Research Institute is conducting a study to understand who chooses telemedicine and for what health issues. The research also assesses whether telemedicine impacts the safety and quality of primary care by examining adherence to recommended healthcare guidelines and increased ED visits and hospital admissions. Kaiser Permanente Northern California began offering patient-initiated primary care telemedicine visits in 2016. All patients self-scheduling appointments with a primary care provider through their patient portal were able to choose from a traditional in-person visit or a telemedicine visit conducted by video or telephone. Read the emerging research story here!

The following stories exemplify in greater detail the innovative health IT that will be developed, implemented, and evaluated through the new research funded by AHRQ in 2018. The perspectives of the AHRQ-funded researchers are threaded into the following vignettes to elevate their novel methods and approaches for solving challenging problems facing the health system, fill gaps in knowledge, and respond to limitations of existing health IT.

Using eHealth to Expand Access to Behavioral Healthcare for non–English-Proficient Hispanic Patients

Access to behavioral healthcare is often a challenge but is even more difficult for non–English-proficient patients to find bilingual behavioral providers who understand how culture affects patients' interactions with the healthcare system. While cognitive behavioral therapy for insomnia (CBT-I) is an evidence-based alternative to medication, access is limited because of the lack of qualified bilingual behavioral health providers.

***Cultural adaptation** is the systematic process of modifying and adapting the intervention by integrating cultural components that align with patients' worldview. Beyond language adaptations, it includes "deep structure" cultural adaptations such as changing examples to make them culturally relevant and avoiding Spanish language regionalisms.*

Developing a cultural adaptation of an interactive digital program to deliver cognitive behavioral therapy for insomnia.

Dr. Carmela Alcantara, from Columbia University, is conducting research with non–English-proficient Hispanic patients with insomnia and behavioral health providers to develop a cultural adaptation of an existing digital CBT-I program. This intervention is an interactive program that can be delivered via tablet, smartphone, or computer that has been effective at reducing insomnia symptoms and co-occurring psychological symptoms.

Dr. Alcantara and her research team will conduct a randomized controlled trial with non–English-proficient Hispanic patients with chronic insomnia that compares the effectiveness of the culturally adapted digital version of CBT-I with enhanced usual care on reduction of insomnia symptoms.

Significance and Potential Impact: Adoption of this research will expand access to evidence-based alternatives to medication for the management of chronic insomnia and may narrow existing racial and ethnic disparities in access to high quality behavioral health care for patients.

PRINCIPAL INVESTIGATOR	Carmela Alcántara, Ph.D.
ORGANIZATION	Columbia University, New York, NY
RESEARCH TITLE AND PROFILE LINK	Using eHealth to Expand Access to Cognitive Behavioral Therapy for Insomnia in Hispanic Primary Care Patients

Using Patient-Reported Data to Reduce Opioid Use in Dental Patients

Harnessing the power of patient-reported data using health IT.

Medical providers are increasingly using PRO data collected via mobile health applications for patient care; however, use of PRO data is largely unexplored in dentistry.

> *"Patient self-reporting is important for comprehensive pain assessment given pain's subjective and multi-dimensional nature."*
> - Dr. Elsbeth Kalenderian

Dentists often preemptively prescribe opioids when the use of non-opiate medications may be more appropriate. Post-op pain generally begins when the patient has returned home and anesthesia from the dental surgery wears off, making pain levels difficult to actively assess and manage. Typically, individuals experience post-op pain for only 3 days, leaving many patients with leftover pills. These remaining pills are a potential source of drug diversion—the transfer of a legally prescribed controlled substance from the individual for whom it was prescribed to another person for any illicit use—and thus a potential contributor to the opioid crisis.

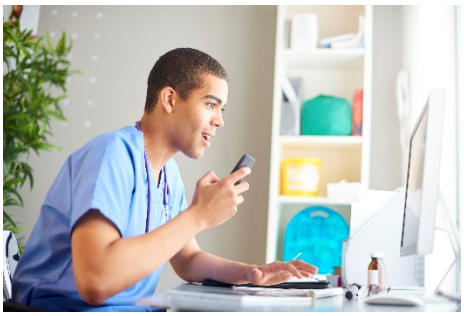
Dr. Elsbeth Kalenderian, of the University of California San Francisco School of Dentistry and Harvard School of Dental Medicine, with Dr. Muhammad Walji, from the School of Dentistry at the University of Texas Health Science Center at Houston, are leading a team of researchers to study whether pain intensity data collected from patients after dental procedures can help dental providers track patients' pain more effectively in real time and modify prescription use. Through a user-centered design process, the team is conducting usability testing and workflow analyses with providers and patients to adapt and customize the user interface of an existing mobile health platform called FollowApp.Care. Using a cluster-randomized experimental study, the team will then evaluate the impact of using mobile health technology on patients' post-op pain experiences and oral health outcomes, as well as provider acceptance of it and its impact on provider performance.

Significance and Potential Impact: Actively tracking patient-reported symptoms should decrease the number of patients who are prescribed opioids after surgery upon discharge, as well as the strength of the opioid and length of time they are prescribed.

PRINCIPAL INVESTIGATOR	Elsbeth Kalenderian, DDS, MPH, PhD
ORGANIZATION	University of California at San Francisco School of Dentistry
RESEARCH TITLE AND PROFILE LINK	Optimizing Acute Post-Operative Dental Pain Management Using New Health Information Technology

Why Do Patients Choose Telemedicine for Primary Care? The Untapped Potential of Telemedicine for Primary Care

Why do patients choose telemedicine as an alternative to an in-person primary care visit?



Telemedicine has long been used to provide access to specialty care, especially for patients living in rural areas, but its use to benefit primary care patients is less understood. In addition, little is known about its impact on quality and safety, such as on diagnoses, medications, or patient monitoring.

In 2016, Kaiser Permanente Northern California began offering patient-initiated primary care telemedicine visits. All patients self-scheduling appointments with a primary care provider through their patient portal were able to choose from a traditional in-person visit or a telemedicine visit conducted by video or telephone. Mary Reed, DrPH, from the Kaiser Permanente Northern California Division of Research, wants to know *who* chooses telemedicine and for *what* health issues. Dr. Reed and her team are prospectively comparing outcomes for patients who choose telemedicine versus an in-person primary care visit from 2016 to 2020. The research team will compare patient demographics, their reported experiences, and clinical characteristics, with the goal of identifying patterns or reasons why patients choose telemedicine versus an in-person visit. In addition, the team will evaluate whether telemedicine affects the safety and quality of primary care by examining recommended health care processes, in-person followup care, and increased ED visits and hospital admissions between those who choose telemedicine visits compared with those who choose an in-person visit.

> *"As a health services researcher, this was an exciting opportunity to research technology and how it affects patients' choices, what kinds of clinical concerns patients choose telemedicine for, and what its best uses are for in primary care."*
>
> - Dr. Mary Reed

Significance and Potential Impact: This research will provide evidence to inform emerging telehealth policies including reimbursement, technology adoption decisions, and real-world use by patients and providers.

PRINCIPAL INVESTIGATOR	Mary Reed, DrPH.
ORGANIZATION	Kaiser Foundation Research Institute; Kaiser Permanente Northern California Division of Research
RESEARCH TITLE AND PROFILE LINK	Patient Choice of Telemedicine Encounters

Unlocking the Potential of PROs in Clinical Notes for Treating Rheumatoid Arthritis

Rheumatoid arthritis (RA) affects 1.3 million Americans, and those with low socio-economic status experience disparities in outcomes. PROs are used by rheumatologists to inform the care and treatment of patients with RA. Collection of this information is not standardized and, therefore, it cannot be reliably used for population health research. Furthermore, uninsured and minority patients are under-represented in health research, and RA research in particular. In a world where copious health data are collected, it is vital that these data represent the entire population.

Using natural language processing to drive quality improvement for rheumatoid arthritis care and treatment.

Dr. Jinoos Yazdany at the University of California in San Francisco is leading research to extract PROs documented in clinical notes using NLP. As the work progresses, the team will focus their efforts on aggregating RA PROs from participating public hospitals into a database that will be used to track improvements to agreed-upon measures. Dr. Yazdany's research is aligned with AHRQ's priority areas of patient-centered outcomes research and reducing health disparities among racial and ethnic minorities. Using NLP to aggregate PROs in clinic visit notes at public hospitals provides an opportunity to improve rheumatology care and treatment, particularly for vulnerable populations that experience the most health disparities. If successful, this research has the potential to transform healthcare for RA by making care more patient centered and by providing tools to facilitate shared decision making and disease monitoring.

Significance and Potential Impact: Use of NLP and PROs has the potential to transform the care of patients with RA, and to reduce health disparities for underserved and minority populations.

PRINCIPAL INVESTIGATOR	Dr. Jinoos Yazdany
ORGANIZATION	University of California at San Francisco
RESEARCH TITLE AND PROFILE LINK	Rheumatology Informatics Systems for Effectiveness Patient-Reported Outcome (RISE PRO) Dissemination Project

III. PATIENT SAFETY HEALTH IT RESEARCH SPOTLIGHTS

A. AHRQ Health IT Safety Investigators Are Using Health IT to Make a Real Difference in Improving Patient Safety

Health IT includes numerous technologies that span from simple charting to advanced CDS. These technologies present increasing opportunities for improving and transforming healthcare by reducing human errors, improving clinical outcomes, and facilitating care coordination. Since the Institute of Medicine's (IOM) landmark report in 2001, "To Err is Human," that described using IT as a key first step in transforming and changing the healthcare environment for better and safer care, accelerated development and adoption of health IT has produced increasing amounts of evidence showing the impact on improving patient safety-related outcomes. However, some research suggests that the introduction of health IT can also potentially cause new errors and have the unintended consequences of negatively affecting patient safety. AHRQ-funded research provides critical evidence about how to identify health IT safety issues, how to remedy them, and how health IT can be safely used and implemented. The pioneering patient safety work of Drs. Raj Ratwani, Gordon Schiff, and Jason Adelman is highlighted.

Research on Health IT Safety Special Emphasis Notice (NOT-HS-16-009): AHRQ continues to fund research on safe health IT practices related to the design, implementation, usability, and safe use of health IT by all users, including patients.

This research generates new evidence on safe health IT practices to inform policy guidance.

Improving EHR Design Increases Patient Safety—Especially for Children

Poor EHR design can harm patients

Dr. Raj Ratwani and his research team identified pervasive problems with EHR systems that regularly lead to patient safety errors and other issues, regardless of vendor. **"If we don't focus on EHR technology design," Dr. Ratwani stresses, "it will harm patients."** This issue is particularly true for pediatric patients, who are more vulnerable to EHR usability and safety challenges because of different physical characteristics and developmental issues. For example, lower body weight and less developed immune systems make children less able to tolerate even small errors in medication dosing.

Dr. Ratwani and team explored how EHR usability can adversely affect safety among pediatric patients, using data from three large academic healthcare institutions. Supported by AHRQ Health IT funding, the team developed algorithms that used NLP to recognize statistical patterns in words used in patient safety reports. This NLP algorithm can identify and code a reported safety event as related or not related to an EHR issue. **They found that over a 5-year period, more than one-third of the 9,000 medication-related patient safety reports in the study were related to EHR usability issues, and nearly 20 percent of those may have harmed patients.**[1] System feedback and visual display problems were the most frequent usability issues, and they most often led to improper medication dosing, putting children at risk. In one case, the EHR did not alert a physician who ordered five times the recommended dosage of a medication for a child, which could be lethal for a child.

> *"Poor interface design and poor technology implementations can lead to errors that may result in patient harm, and that is unacceptable and completely fixable."*
>
> - Dr. Raj Ratwani

Improving EHR design and usability will reduce errors that can lead to patient harm.

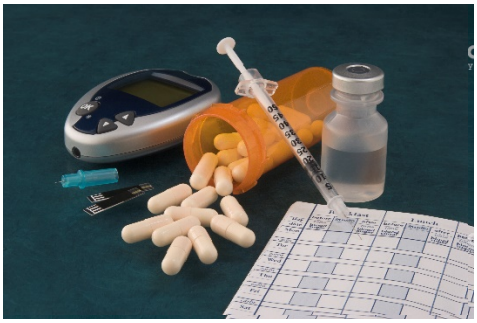
In response, Dr. Ratwani says that tools designed to assess functionality of CDS and other EHR functionality can help increase the safety of EHR systems, which will reduce errors that can lead to patient harm. Supporting more stringent policy actions is needed, such as prioritizing safety in regulating EHRs used in documenting the care of children and ensuring that data on system-related harms is collected. An end goal of his work is to establish clear guidelines for both EHR vendors and healthcare provider organizations that will lead to usability improvements and avoid harm to patients.

PRINCIPAL INVESTIGATOR	Dr. Raj Ratwani
ORGANIZATION	MedStar Health Research Institute
RESEARCH TITLE AND PROFILE LINK	Developing Evidence-Based, User-Centered Design and Implementation Guidelines to Improve Health Information Technology Usability

[1] https://www.ncbi.nlm.nih.gov/pubmed/30395517

A Prototype Computerized Provider Order Entry System Reduced Medication Errors

Mistakes made by patients and providers can lead to medication errors.



Historically, doctors wrote prescriptions in Latin so that patients could not read the reason the medication was prescribed. It was an era of medical practice that believed keeping patients in the dark was beneficial. Medicine has come a long way in terms of patient empowerment. Today, doctors help patients to make informed choices by explaining risk and benefits of medications prescribed. However, if the patient has several prescriptions, they may confuse their medications. Medication errors may also occur during the prescribing process, including prescribing the wrong medication, wrong dose, or the wrong frequency of taking the medication.

Including medical indications in the prescribing process can reduce medication errors.

In medicine, an "indication" is a condition or reason for prescribing a medication or performing a test. Specifying the indication during the prescribing process can help avoid medication errors; however, the computerized prescriber order entry (CPOE) systems used by providers to prescribe medications do not usually include indications, or the process of adding it is not easy or intuitive. If the indication was recorded in the CPOE, pharmacists would have more information about the prescription, and the indication could be printed on the label of the medication bottle to help patients understand their medications.

> *"It is important for patients to keep their medicines straight – patients stop taking medicines without realizing which one they are taking for which condition. I recently saw a patient who stopped taking a drug she thought was for one problem (depression which was better) but was actually for her diabetes."*
>
> - Dr. Gordon Schiff

Developing a prototype CPOE with indications and CDS.

Dr. Gordon Schiff and his team at the Brigham and Women's Hospital developed and pilot tested a prototype CPOE system that incorporated indications into the prescribing process. They convened six 90-minute national webinars to gather input from providers on how to develop the prototype. Additionally, they observed providers entering medication orders to understand their process and inform the features that were ultimately included in the prototype.

The prototype gave prescribers a way to record the indication, and it showed them the drug or drugs of choice for that indication. The system included a feature that not only listed recommended

medication choices, but allowed users to hover over a drug choice and read the rationale for prescribing the medication. It was also customizable such that the medication was not recommended if the patient was allergic to it.

The prototype CPOE outperformed two widely used CPOE systems.

Clinicians were then asked to test the prototype by entering information from eight test cases into the CPOE, and the results were compared to two leading commercial CPOE systems. Clinicians correctly placed 95 percent of orders using the prototype compared to 61 percent and 85 percent with the commercial systems. Those testing the system also reported greater satisfaction, noting it was easy to use and they would like to use it frequently. Preliminary findings from interviews with pharmacists indicated they almost universally supported including indications in the prescribing process because it would help them counsel patients, ensure medication errors were not made, and increase patients' understanding of their medications. The prototype developed by Dr. Schiff was superior with respect to prescribing speed, safety, and user satisfaction as compared to two leading commercial CPOE systems.

Key Finding and Impact: A prototype CPOE was developed that allowed providers to record medication indications and showed them the drug of choice for that indication. Providers testing the prototype CPOE correctly placed medication orders 95 percent of the time, compared to 61 percent and 85 percent with two commercial systems.

PRINCIPAL INVESTIGATOR	Dr. Gordon Schiff
ORGANIZATION	Brigham and Women's Hospital
RESEARCH TITLE AND PROFILE LINK	Enhancing Medication CPOE Safety and Quality by Indications-Based Prescribing

Leveraging Health IT to Test Solutions That Are Replicable, Scalable, and Improve Patient Safety

Wrong-patient errors can affect any patient in any healthcare setting for a variety of reasons. Dr. Jason Adelman, named as one of 50 experts leading the field of patient safety in 2018 by Becker's Hospital Review,[2] has led multiple AHRQ Health IT-funded research efforts centered on health IT safety. The research of Dr. Adelman, Executive Director of Patient Safety Research at

[2] https://www.beckershospitalreview.com/lists/50-experts-leading-the-field-of-patient-safety-2018.html

Columbia University Irving Medical Center/NewYork-Presbyterian Hospital, is widespread and being replicated by other organizations. Dr. Adelman is part of the ECRI Patient Safety Collaborative, where he is advising several hospitals on how to implement the Wrong-Patient Retract-and-Reorder (RAR) Measure that he developed to evaluate the frequency of wrong-patient errors that occur through CPOE systems. When a clinician places an order, then cancels the order and places the same order for a different patient within the next 10 minutes, the measure flags it as a wrong-patient RAR event. While capturing the instance of retracting and reordering mistakes does not correct or prevent errors, it provides the facility with information to discover error trends along with opportunities to intercept processes that lead to such errors. Using such data as evidence of the CPOE's potential impact on patient safety, decision makers can factor RAR measures in choosing one health IT design over another.

> *"Placing orders on the wrong patient should never happen. Yet, human error is very common in the healthcare environment. Healthcare is inherently complex and heavily reliant on people rather than technology to protect patients from harm. It will likely take a multi-pronged health IT approach to prevent these types of errors."*
> - Dr. Jason Adelman

Having multiple EHRs open simultaneously does not increase wrong-patient orders.

Dr. Adelman's AHRQ Health IT-funded research found that restricting clinicians to having one EHR record open at a time did not significantly reduce the rate of wrong-patient order errors compared with allowing up to four records to be open concurrently. His work did not support the ONC and Joint Commission recommendation that EHR systems should only allow one record to be displayed at a time. In the study, published in the May 14, 2019 issue of *JAMA,*[3] using the RAR measure, Dr. Adelman and his team compared the risk of wrong-patient orders while accessing one versus four records open in a variety of clinical settings, including hospitals, EDs, and outpatient facilities. While no differences in wrong-patient orders were observed between those clinician groups, there was considerable variation in the frequency of errors in different clinical settings. The rate of wrong-patient order errors was lowest in outpatient settings, where physicians may care for one patient at a time. The highest rates, meanwhile, were seen in inpatient critical care and obstetrics units, which reflected differences in workflows and number of patients being cared for simultaneously, researchers noted. The research offers insights for healthcare systems that are trying to balance patient safety with the needs of busy clinicians who need tools for efficient workflow.

[3] https://jamanetwork.com/journals/jama/fullarticle/2733207

"Studies like that by Adelman and colleagues point the way to the creation of a digital learning health care system, in which the results of the interactions between clinicians (and, increasingly, patients and families) and the EHR are analyzed to help guide the strategies that lead to the highest value and most satisfying care. Having spent tens of billions of dollars digitating the health care system, it is essential to take advantage of the unique capacity of digital tools to allow clinicians and health care systems to learn from every click." -editorial by Drs. Wachter, Murray, and Adler-Milstein[4]

The right patient, right dose, right medication, right route, and right frequency.

The Health IT Program has also funded Dr. Adelman to extend research on RAR, to validate and evaluate the reliability of RAR using a different EHR system, so it can be implemented and may advance interventions to prevent these serious and complicated safety issues. The intent is to develop health IT measures that identify deviations from the Five Rights of Medication Safety: right patient, right dose, right medication, right route, and right frequency.

Use of photographs to prevent errors.

An additional Adelman-led, AHRQ-funded study is assessing the effectiveness of using patient photographs as an additional identifier in the EHR system to avoid wrong-patient errors when using CPOE systems. The research team will conduct a randomized controlled trial of wrong-patient error rates between systems with patient photos and without. Ultimately, the team plans to develop a toolkit with guidance to help other health systems in implementing patient photos in EHR systems.

PRINCIPAL INVESTIGATOR	Dr. Jason Adelman
ORGANIZATION	Columbia University and New York Presbyterian Hospital
RESEARCH TITLES AND PROFILE LINKS	Assess Risk of Wrong Patient Errors in an EMR That Allows Multiple Records Open Develop and Validate Health IT Safety Measures To Capture Violations of the Five Rights of Medication Safety Providing Evidence and Developing a Toolkit to Accelerate the Adoption of Patient Photographs in Electronic Health Records

The impact of these AHRQ-funded studies will extend beyond the original research settings. Their work can be widely disseminated as vendors and healthcare organizations and systems can use their findings as they design and implement health IT to improve patient safety as well as to inform decision making at the policy level.

[4] https://jamanetwork.com/journals/jama/article-abstract/2733189

IV. RESEARCH DISSEMINATION

Dissemination of key research findings from the Health IT-funded work is critical to knowledge transfer and replication of successful health IT strategies that impact patient safety, optimize EHR design, and reduce provider burden.

The Health IT-funded researchers publicize and disseminate their research findings in many ways, such as publishing in peer-reviewed journals and presenting at health- and IT-focused conferences, as well as on AHRQ web conferences.

A. Reaching the Research Community Through Web Conferences

AHRQ convenes web-based conferences to showcase recent health IT research developments and further the dialogue on future research. In 2018, AHRQ convened two national web conferences where key findings and impacts from the research were presented. Both webinars were accredited by the Professional Education Services Group to help further dissemination. Over 900 participants attended the conferences.

Reducing Provider Burden Through Better Health IT Design

On Thursday, January 25, 2018, AHRQ hosted a web conference about the impact of health IT design on provider burden. Provider burnout is rising and EHR use is cited as one of the top reported stressors for providers. Poor EHR design can increase provider burden, and AHRQ is supporting research to alleviate provider burden as it relates to health IT design and use, including clinical workflow, physician-patient communication, cognitive load, and user satisfaction. The following presenters discussed their research on optimal design of EHRs to support clinical workflow: Dr. Pascale Carayon from the University of Wisconsin Madison College of Engineering, Dr. Zia Agha from West Health, and Dr. Lukasz Mazur from the University of North Carolina Chapel Hill School of Medicine. A brief summary of research goals and key findings from the researchers presentations are provided below:

- **Dr. Pascale Carayon's** research on health IT for venous thromboembolism (VTE) used 11 case studies and a participatory approach to identify design considerations for health IT to support the process of VTE prophylaxis. Following a sociotechnical approach, her research identified 13 categories of design considerations to be incorporated into a health IT system that supports the process of VTE prophylaxis, including the patient's journey, clinical appropriateness, role clarity among clinical team members, organizational culture, workload, and technology access.
- **Dr. Zia Agha's** research quantified EHR usability to improve clinical workflow with regard to cognitive workload and clinician-patient communication. Data were collected with video recordings of patient visits, usability software that tracked how clinicians use the EHR, and a clinician survey. Findings indicate that the EHR user interface imposed very high work burden on clinicians, and provider perception of workload is influenced by the environment and their relationship with the patient.

- **Dr. Lukasz Mazur's** research assessed the impact of an EHR that was enhanced for monitoring critical abnormal test results. A randomized controlled trial conducted using test cases in a laboratory environment suggest that the enhanced EHR contributed to improvements in clinical performance and physiological workload. The research concluded that policies and guidelines are required to improve the usability of EHRs to help ensure optimal clinical performance.

Impact: At the culmination of the web conference, participants were equipped with knowledge and approaches to: 1) identify cognitive and teamwork aspects in VTE prophylaxis and sociotechnical system design requirements to support teamwork; 2) assess EHR usability, clinical work flow, cognitive workload, and provider-patient communication; and 3) assess provider mental workload and performance with regard to EHR usability. The conference was attended by 522 participants.

How Health IT Can Improve Medication Management

On September 13, 2018, AHRQ convened a national web conference focused on the use of health IT to improve medication monitoring, adherence, and medication therapy management for patients with complex conditions. As people are living longer, many individuals have multiple chronic conditions that require accordingly complex medication management. The following presenters discussed their research on strategies to improve medication management: Dr. Karen Farris from the University of Michigan College of Pharmacy, Dr. Jeffrey Schnipper from Brigham and Women's Hospital and Harvard Medical School, and Dr. Margie Snyder from Purdue University College of Pharmacy. A brief summary of research goals and key findings from the researchers presentations are provided below:

- **Dr. Karen Farris's** research used AI to automatically adapt text messages about blood pressure medication adherence to patients' medication-taking behaviors. A randomized controlled trial found that individuals using the AI tool reported improvements in medication adherence 3 months into the trial.
- **Dr. Jeffrey Schnipper's** research tested a novel electronic pillbox that issued medication reminders and shared adherence data with the patient's provider. A randomized controlled trial was conducted among patients taking five or more medications for chronic conditions at the time of hospital discharge. The study team worked with providers and pharmacists to overcome barriers to refilling medications by using blister packs that were compatible with the pillbox, and worked with patients to help them identify locations in their homes where Wifi connectivity was adequate to transfer data from the pillbox.
- **Dr. Margie Snyder's** research investigated the alignment of CDS with established human factors principles and assessed the usability and usefulness of CDS for community pharmacists for patient care. Findings from the study are forthcoming.

Impact: By the end of the conference, participants were able to: 1) explain the benefits and challenges of using AI for generating text messages to support medication adherence; 2) discuss evaluation of a pillbox used by patients during transitions in care; and 3) describe human factors, usability, and utility of a CDS for community pharmacists. The conference was attended by 402 participants.

B. Reaching Diverse Audiences Through Conference Proceedings

AHRQ-funded researchers presented their work at a variety of health IT, medical, and other key conferences, such as the Annual Symposium for the American Medical Informatics Association (AMIA), AcademyHealth's Annual Research Meeting, the Human Factors and Ergonomics in Health Care Annual Symposium, International Conference on Healthcare Informatics, and the Health Information Management Systems Society's Global Conference and Exhibition.

At the 2018 AMIA Annual Symposium alone, AHRQ Health IT-funded research was highlighted in:

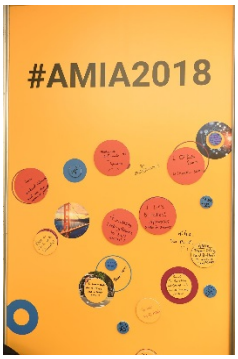
- 11 oral presentations
- 4 panel presentations
- 4 posters
- 2 systems demonstrations
- 2 instructional workshops

Table 1: AHRQ-Funded Research at the 2018 AMIA Annual Symposium

Investigator Name	AHRQ Research Profile	AMIA Title	Type
Abraham, Joanna	An Etiology for Medication Ordering Errors in Computerized Provider Order Entry Systems	Clinician Perspectives on Duplicate Medication Ordering Errors	Oral Presentation
Adelman, Jason; Patel, Vimla	Develop and Validate Health IT Safety Measures To Capture Violations of the Five Rights of Medication Safety; Assess Risk of Wrong-Patient Errors in an EMR That Allows Multiple Records Open; Impact of Meaningful Use on Clinical Workflow in Emergency Departments	Panel - EHR Log Data: An Untapped Health Data Goldmine for Clinical Informatics Research?	Panel Presentation
Blumenfeld, Barry	Patient-Centered Outcomes Research Clinical Decision Support Learning Network	From Evidence to Action: Enabling Opioid Pain Management Guidelines Through Patient-Centered Clinical Decision Support	Panel Presentation
Dixon, Brian	Improving Population Health Through Enhanced Targeted Regional Decision Support	Improving Population Health Reporting through Information Exchange Supported Decision Support: A Controlled Before-and-After Trial	Oral presentation
Harle, Christopher	Designing User-Centered Decision Support Tools for Chronic Pain in Primary Care	Information Needs and Requirements for Decision Support in Primary Care: An Analysis of Chronic Pain Care	Oral Presentation
Harle, Christopher	Designing User-Centered Decision Support Tools for Chronic Pain in Primary Care	Panel - Informatics Needs and Solutions to Support Safe Opioid Prescribing and Effective Pain Care	Panel Presentation
Jackson, Gretchen	Personal Health Information Needs and Practices for Maternal Fetal Care	Communication Technology Use and Preferences for Pregnant Women and Their Caregivers	Oral presentation
LaVallee, Danielle	Developing Design Principles to Integrate Patient-Reported Outcomes (PROs) Into Clinical Practice Through Health Information Technology: Data, User Experience, and Workflow Requirements for PRO Dashboards	Provider Perspectives of Integrating Electronic Patient-Reported Outcomes into Clinical Practice Workflow	Poster
Leroy, Gondy	Enabling Large-Scale Research on Autism Spectrum Disorders Through Automated Processing of EHR Using Natural Language Understanding	Optimizing Corpus Creation for Training Word Embedding in Low Resource Domains: A Case Study in Autism Spectrum Disorder (ASD)	Oral Presentation

Investigator Name	AHRQ Research Profile	AMIA Title	Type
Moesel, Chris	Patient-Centered Outcomes Research Clinical Decision Support Prototype Development and Dissemination	Pain Management Summary: A SMART on FHIR Dashboard for Managing Pain	Showcase - Featured Presentation
Pratt, Wanda	Patients as Safeguards: Understanding the Information Needs of Hospitalized Patients	Must We Bust the Trust?: Understanding How the Clinician-Patient Relationship Influences Patient Engagement in Safety	Oral presentation
Pratt, Wanda	Patients as Safeguards: Understanding the Information Needs of Hospitalized Patients	Exploring the Design of an Inpatient Peer Support Tool: Views of Adult Patients	Oral presentation
Pratt, Wanda	Patients as Safeguards: Understanding the Information Needs of Hospitalized Patients	Designs to support informed hospitalized patients	Poster
Pratt, Wanda	Patients as Safeguards: Understanding the Information Needs of Hospitalized Patients	Is an Emoji Worth A Thousand Words? Pediatric Inpatient Perspectives on Pictorial Modes of Emotional Subtext in Electronic Health Communication	Poster
Safran, Charles	InfoSage Information Sharing Across Generation and Environments	InfoSAGE: Supporting Elders and Families through Online Family Networks	Oral presentation
Schnall, Rebecca	The Wise App Trial for Improving Health Outcomes in PLWH	Usability and Acceptability of the mLab App for Promoting the Uptake of HIV Testing	Poster
Schnall, Rebecca	The Wise App Trial for Improving Health Outcomes in PLWH	Panel - Usability Testing Methods for mHealth Apps Designed for Disadvantaged End-users	Panel Presentation
Vawdrey, David	Addressing Hospital Patient Information Needs Using a Personal Health Record Portal	Engaging Hospitalized Patients with Personalized Health Information: A Randomized Trial of an Acute Care Patient Portal	Oral presentation
Vawdrey, David	Addressing Hospital Patient Information Needs Using a Personal Health Record Portal	Providers' Perspectives on Sharing Health Information through Acute Care Patient Portals	Oral presentation
Vawdrey, David	Addressing Hospital Patient Information Needs Using a Personal Health Record Portal	Low Screening Rates for Diabetes Mellitus Among Family Members of Affected Relatives	Oral Presentation

2018 AMIA Year in Review.



A special livestreaming event held during the 2018 AMIA Annual Symposium featured the year's most noteworthy publications. This popular Biomedical and Health Informatics Year in Review session is informed by AMIA's Working Groups, who identify papers from over 90 domains, representing the most influential biomedical and health informatics work published. It is intended to help biomedical and health informatics professionals stay current with the most **"relevant, interesting, or innovative"** papers of the year. Presented by James Cimino, MD, FACMI, FAMIA, of the Informatics Institute at the University of Alabama at Birmingham, many of the 67 papers reviewed at the 2018 Symposium were authored by AHRQ-funded health IT researchers. Papers from 45 of the domains were presented, including the following AHRQ-funded health IT research.

Patient Engagement Research

Dr. Anuj Dalal's formative research on identifying critical components for developing patient portals for use in the acute care setting and during transitions of care was highlighted. As hospitalizations have become increasingly shorter, more recovery takes place in the home, resulting in greater information burden and decision-making responsibilities on patients and their caregivers. To support patients and their caregivers with care transitions and post-discharge responsibilities, innovative information and communication tools will be critical to the delivery of safe, high-quality, accessible care. The authors held a patient care portal workshop with 71 attendees from over 30 institutions to discuss a sociotechnical and evaluation research agenda for the use of informatics to support patients and care coordination after discharge. The following areas were identified to be addressed: interoperability standards; privacy and security issues, including remote access and proxies; user-centered design to support complex data and communication; implementation factors such as adoption, cost, and technical support; data and content knowledge management in the EHR; CDS to avoid errors; and measurement standards to support formative assessments. Using these components, the authors suggest that increasing the use of patient portals in the acute care setting and during transitions of care will improve patient engagement and empowerment, and positively affect quality and safety.

Clinical Information Systems and Data Capture Research

It common for clinicians to write patient notes well after a patient visit, even hours later, including into the evenings and on weekends. **Dr. Thomas Payne's** research looked at the use of mobile phone transcription and its impact on when notes were completed and the quality of those notes. This system allows clinicians to dictate notes while they are with patients or walking around. The notes are sent to a secure server, where they are transcribed using NLP and made available for later review, editing, and a signature. Availability is within 5 minutes, which is a significant improvement over traditional dictation methods. During the 2018 AMIA Year in Review session, Dr. Payne was

featured in a video clip dictating notes for a patient encounter that he later retrieved from his inbox. The researchers evaluated the amount of time providers spent after midnight on their clinical notes and found that using mobile phone transcription reduced the amount of time compared with traditional dictation. Additionally, the dictated notes generated with the tool had more new information and far less old text carried forward.

Research Reviews

Dr. Richard Holden and his colleagues are researching the use of health IT to inform and support self-management of congestive heart failure. The AMIA Year in Review session highlighted his systematic review on the use of smartphone apps to change health status and behavior of patients. The reviewed studies had samples of up to 171 individuals, representing those with bipolar disorder, schizophrenia, and depression; older adults; and the general population. Numerous benefits to patients were found, including ability to detect changes in health status and behavior, and an increase in accountability of users. Challenges identified were related to the technology implemented, methods used, and privacy concerns.

Consumer Informatics Research

Called by Dr. Cimino "**one of the best papers in the AMIA proceedings last year**," this paper, co-authored by **Dr. Gretchen Jackson**, examined factors that influenced information seeking by pregnant patients and their caregivers. The authors found that those with a strong belief in the power of luck, as well as those who believe others are in control, sought information less frequently than their counterparts. When there are "powerful others" and luck, individuals do not see the point in looking for additional information on their care.

A second paper highlighted in this domain was authored by **Dr. David Vawdrey**, who is researching use of patient portals by inpatients. Recognizing a gap in research, he and others evaluated the impact of sharing clinical notes with hospitalized patients. Ten inpatients were given access to an acute care portal and interviewed for their perspectives around that access to their clinical information. Benefits reported included improved access to information, better understanding of their conditions, and greater appreciation for their providers. Four patients reported changing a health behavior, and two reported the possible prevention of medical errors due to the portal. Usage logs indicated that patients accessed the notes feature of the portal more frequently and for a longer duration than other portal features. Contrary to expectations, an increase in patient anxiety was not found, with the researchers theorizing that access to information reduces the uncertainty and the disempowerment commonly felt by hospitalized patients. The authors concluded that their results should encourage providers to be open-minded about patient access to inpatient notes.

Evaluation: It's About Methods Domain

Dr. Rebecca Schnall's AHRQ Health IT-funded research evaluated the use of a mobile Video Information Provider (mVIP), a mobile app targeted to those with HIV. In this paper she and her colleagues describe a usability evaluation based on the Health IT Usability Evaluation Model

(Health-ITUEM), with mVIP used as a case study. The authors described the application of user-centered design reverse card sorting, in which end users sorted features by perceived importance. In the usability lab, a think-aloud protocol with eye tracking heuristic evaluation was completed. Usability of mVIP in real-life situations was evaluated by surveys and interviews. **Dr. Cimino** described the project as a "**nice start-to-finish evaluation**."

C. AHRQ-Funded Researchers Disseminate in High-Impact Journals

In 2018, AHRQ-funded researchers published over 100 research articles in peer-reviewed journals and book chapters, including the following:

Development and Dissemination of a Novel Quality Improvement Framework to Improve Care for Children in the ICU

Dr. Anping Xie and colleagues developed and implemented a quality improvement framework to reduce unnecessary blood culture testing for critically ill children in the intensive care unit (ICU). A five-part improvement framework was implemented in three pediatric ICUs and included: 1) a work system assessment conducted during an initial site visit, 2) identification of multidisciplinary stakeholders and a project champion, 3) collection and sharing of blood culture data, 4) adaptation of clinician support tools by each unit, and 5) communication and analysis of progress throughout the implementation process. Across the three units, blood culture rates significantly decreased by 32 percent, and the rate of cultures drawn from central venous catheters decreased by 51 percent. Different approaches were followed at the three units including the identity (i.e., staff role) and involvement of the champion, adaption of clinical tools, and the monitoring and communication of progress.

Search the AHRQ Health IT Projects Publication Database, created to further disseminate work of the funded research, to find other research results!

Use of a mHealth App Can Reduce College Students Hazardous Drinking.

Researcher **Dr. Donna Kazemi** and her colleagues developed a smartphone app, "SmarTrek," designed to reduce risky alcohol use in college students. SmarTrek includes eight components that address alcohol use, including interactive games, a feature around blood alcohol content, a daily log, a virtual coach, a "My Strategies" section, the ability to receive personalized feedback, and a resources section. The app's interactive components, including text messages, incorporated motivational interviewing to facilitate behavior change and ecological momentary interventions (EMI). EMI uses technology to send information to an individual during risky behavior when there is the greater opportunity to promote healthy behaviors. The investigators found 90 percent of participants thought that the app was easy to use, provided useful information, and had a positive effect on reducing their drinking.

Understanding How Physicians Help Patients Deal with Chronic Pain

In the United States, the complexities of caring for patients with chronic pain are exacerbated by individual and public health risks associated with commonly used opioid analgesics. Chronic pain leads to reduced quality of life for patients and strains health systems in the Nation. **Dr. Christopher Harle** and his team at Indiana University–Purdue University, Indianapolis (IUPUI), are developing EHR-integrated decision support tools with the goal of increasing the quality and effectiveness of chronic pain care. To help inform their work, the team interviewed 10 primary care clinicians about 30 patients with chronic pain. They identified several patient, social/environmental, and clinician factors that influence clinicians' assessment of their patients to determine a pain management plan. Significant ambiguity and uncertainty in clinical pain management decision making was identified. Therefore, interventions to improve pain care should focus on providing context of clinical evidence rather than providing clinicians with decontextualized and/or algorithm-based decision rules.

AHRQ Health IT-funded research featured in *Health Affairs* patient safety issue.
The November 2018 issue of *Health Affairs*, "Patient Safety," includes a comprehensive look at the best and latest patient safety research. Almost 20 years after the publication of the landmark IOM report, the issue's articles examine the significant progress that has been made in the intervening years and the barriers still in place. The journal issue and the accompanying event[5] in November 2018 brought together many of the authors; explored the emerging issues in patient safety; and discussed what gaps remain in research, policy, and implementation to reduce patient harm. The articles explore a broad range of safety initiatives, including the use of health IT to reduce medication errors and emerging efforts to improve diagnoses. The research of Drs. Ratwani and Schiff, who also participated in the event, was featured in this issue.

Stay Updated! Select here to sign up for AHRQ Health IT News and Information.

[5] "Patient Safety, " Health Affairs Event, November 6, 2018. W Hotel Washington. DOI: 10.1377/he20181024.13806. available at: https://www.healthaffairs.org/do/10.1377/he20181024.13806/full/

V. CLOSING

In 2018, AHRQ-funded research continued to generate innovative tools and findings in such priority areas as improving whole-person care and patient safety, disseminating evidence-based clinical decision support, and supporting clinicians' work. The AHRQ Health IT program has an ongoing commitment to support research to understand how health IT can positively affect the quality and safety of healthcare. Visit the AHRQ Health IT website at https://healthit.ahrq.gov/ to learn about funding opportunities, read more about current research, and learn about the findings and impact of the funded work. You will also find information about program-sponsored events and health IT tools and resources.

VI. LIST OF RESEARCH ACTIVE IN 2018

Research with an asterisk indicates that the work was newly awarded in 2018.

AHRQ Health Services Research Demonstration and Dissemination Grants (R18)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Epstein, Jeff N.	Cincinnati Children's Hospital Medical Center	Improving ADHD Behavioral Care Quality in Community-Based Pediatric Settings	This project will enhance an existing Web-based portal, myADHDportal.com, to integrate behavioral tools alongside existing medication management tools for attention deficit hyperactivity disorder (ADHD).	Patient Portal, Internet
Jack, Brian	Boston Medical Center	Implementation and Dissemination of 'Gabby,' a Health Information Technology System for Young Women, into Community-Based Clinical Sites	This project will develop and disseminate an innovative communication system to identify and mitigate health risks for young African American women before pregnancy as a means of reducing health disparities in birth outcomes.	Artificial Intelligence, Virtual Reality
Kroth, Philip	University of New Mexico	Minimizing Stress, Maximizing Success of Physician's Use of Health Information	This project identified strategies that mitigate the stress associated with provider use of health information and communications technologies.	Electronic Health Record/Electronic Medical Record
McTigue, Kathleen M.	University of Pittsburgh at Pittsburgh	Maintaining Activity and Nutrition through Technology-Assisted Innovation in Primary Care	This project implemented an electronic health record-based weight loss maintenance intervention and found medium-term success for patients assigned to the intervention.	Electronic Health Record/Electronic Medical Record, Patient Portal
Solberg, Leif	HealthPartners Institute	Optimizing the Value of Patient-Reported Outcome Measures in Improving Care Delivery through Health Information Technology	This project will identify orthopedic clinical outcome measures that are most important to patients, and study the impact on satisfaction and outcomes when this information is provided to patients and their doctors.	Electronic Health Record/Electronic Medical Record, Patient-Generated Health Data

AHRQ Patient Centered Outcomes Research (PCOR) Mentored Clinical Investigator Award (K08)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Sharifi, Mahnoos H.	Yale University	Using Electronic Health Records to Support Decision-Making in Pediatric Obesity Care	This project will evaluate and compare different tools within electronic health records to assist pediatric primary care clinicians with providing higher quality childhood obesity care to help slow weight gain in children with obesity.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record
AHRQ Small Research Grant Program (R03)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Ellis, Charles	East Carolina University	Speech Telerehabilition After Stroke: Proof-of-Concept and Feasibility	This project will conduct a proof-of-concept and feasibility study of aphasia telerehabilitation for stroke patients with aphasia residing in rural North Carolina.	Telemedicine System
Mendonca, Eneida	University of Wisconsin - Madison	Virtualized Homes: Tools for Better Discharge Planning	This research linked a web viewer for 3D models of patient homes to an electronic health record so that the models could be viewable and annotated from within a patient's record for better discharge planning.	Artificial Intelligence, Electronic Health Record/Electronic Medical Record, Virtual Reality, Remote Patient Monitoring, Public Health Informatics
Saleem, Jason J.	University of Louisville	Ambulatory Clinic Exam Room Design With Respect to Computing Devices to Enhance Patient Centeredness	This project studied the impact of changing the computing layout in a clinical exam room and evaluated its impact on workflow and patient centeredness.	Electronic Health Record/Electronic Medical Record, Architecture

Disseminating and Implementing Evidence from Patient Centered Outcomes Research in Clinical Practice Using Mobile Health Technology (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Abujarad, Fuad	Yale University	Patient-Centered Virtual Multimedia Interactive Informed Consent (VIC)	This project developed the Patient-Centered Virtual Multimedia Interactive Informed Consent tool and found that patients who used the tool had increased knowledge and higher satisfaction than control patients.	Consumer Health Informatics, Mobile Device
Chrischilles, Elizabeth	University of Iowa	Design and Testing of a Mobile Cardiovascular Risk Service With Patient Partners	This project developed and tested a mobile health application for a centralized, pharmacist-managed cardiovascular risk service to improve patient engagement in self-management of cardiovascular risk.	Clinical Messaging, Mobile Device, Mobile Phone, Patient-Generated Health Data
Connelly, Mark Andrew	Children's Mercy Kansas City	Registry-Assisted Dissemination of Mobile Pain Management for Youth With Arthritis	The researchers developed a mobile health application to distribute evidence-based pain self-management strategies to patients with juvenile idiopathic arthritis.	Data Warehouse, Mobile Device, Registry, Patient-Generated Health Data
Oreskovic, Nicolas M.	Massachusetts General Hospital	An Integrated Closed-Loop Feedback System for Pediatric Cardiometabolic Disease	The project team will develop a set of mHealth tools capable of collecting health behavior information and evaluate whether providing clinical feedback on these behaviors reduces obesity and improves health behaviors among at-risk families.	Mobile Phone, Text Messaging, Patient-Generated Health Data, Mobile Device
Rudin, Robert Samuel	RAND Corporation	Using mHealth and Patient-Reported Outcomes to Deliver Evidence-Based Asthma Care	This research developed and evaluated a mobile health application for patients with asthma.	Mobile Device, Mobile Phone, Patient-Centered Health Data, Electronic Health Record/Electronic Medical Record

Disseminating and Implementing Evidence from Patient Centered Outcomes Research in Clinical Practice Using Mobile Health Technology (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Schnall, Rebecca	Columbia University	Use of mHealth Technology for Supporting Symptom Management in Underserved Persons Living with HIV	This project tested a mobile health application for HIV symptom management for people living with HIV and found an improvement in symptoms.	Mobile Device, Mobile Phone, Consumer Health Informatics
Shah, Nirmish R.	Duke University	Use of Mobile Technology To Improve Acute Care Utilization in Sickle Cell Disease	This project will evaluate the impact of a sickle cell disease mobile application on reducing acute care visits by patients with the condition.	Mobile Device, Personal Health Record, Mobile Phone, Consumer Health Informatics, Patient-Generated Health Data
Tulu, Bengisu	Worcester Polytechnic Institute	TJR Guru--a Mobile App for Shared Informed Decisionmaking in Total Joint Replacement Surgery	This project developed and pilot-tested TJR App, a mobile application designed to help patients with osteoarthritis track their pain and activity, and found that app users were more likely to track symptoms consistently, when compared to non-users.	Mobile Device, Consumer Health Informatics, Patient-Generated Health Data
AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Adelman, Jason Stuart	Columbia University Health Sciences	Develop and Validate Health IT Safety Measures To Capture Violations of the Five Rights of Medication Safety	This project will develop and validate new measures needed for automatically identifying violations of the “Five Rights of Medication Safety”: right patient, right dose, right medication, right route, and right frequency.	Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Adelman, Jason Stuart	Columbia University Health Sciences	Providing Evidence and Developing a Toolkit to Accelerate the Adoption of Patient Photographs in Electronic Health Records	This study will evaluate the effectiveness of patient photographs displayed in electronic health record systems for preventing wrong-patient errors.	Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record
Aguilera, Adrian	University of California, Berkeley	Improving Diabetes and Depression Self-management Via Adaptive Mobile Messaging	This project will develop and test a personalized motivational text messaging intervention to improve management of diabetes and depression in low-income populations.	Artificial Intelligence, Machine Learning, Mobile Phone, Text Messaging, Patient Generated Health Data
Alcantara, Carmela*	Columbia University	Using eHealth to Expand Access to Cognitive Behavioral Therapy for Insomnia in Hispanic Primary Care Patients	This project evaluates the effectiveness, barriers, and cost of a Spanish-language electronic health intervention to treat chronic insomnia in Hispanic patients.	Internet, Mobile Device, Patient Generated Health Data
Bajaj, Jasmohan S.*	Virginia Commonwealth University	Health IT-Generated PROs to Improve Outcomes in Cirrhosis	This project will test the effectiveness of using patient-reported outcomes for cirrhosis collected with Patient Buddy and EncephalApp on hospital readmissions.	Patient-Generated Health Data, Mobile Device, Secure Messaging
Bates, David	Brigham and Women's Hospital	Ensuring Safe Performance of Electronic Health Records	This project will refine the Leapfrog Computerized Provider Order Entry (CPOE)/Electronic Health Record (EHR) test – a “flight simulator” for EHRs with CPOE which evaluates the safety performance of EHRs after deployment, with a particular focus on high impact patient safety and medication safety problems.	Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Cummins, Mollie Rebecca	University of Utah	Electronic Exchange of Poisoning Information	The objective of this study is to develop, implement, and evaluate a replicable, scalable infrastructure for health information exchange supported emergency department and poison control centers collaboration.	Health Information Exchange
Grannis, Shaun	Indiana University-Purdue University at Indianapolis	Enhancing Patient Matching in Support of Operational Health Information Exchange	This project will enhance novel algorithms for matching patient health information across data sources, implement them, and evaluate their accuracy.	Health Information Exchange
Lambert, Bruce	Northwestern University	Preventing Wrong-Drug and Wrong-Patient Errors With Indication Alerts in CPOE Systems	The project will develop and test a large set of alerts at two large health systems to demonstrate that alerts can help prevent wrong-drug and wrong-patient errors and improve the completeness of the problem list.	Clinical Decision Support System, Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record
Malone, Daniel C.*	University of Arizona	Meaningful Drug Interaction Alerts	This project proposes a novel proactive system to reduce alert burden and thereby increase attention to situations in which patient safety is at risk.	Clinical Decision Support System, Computerized Provider Order Entry System, Medication Management System
Marcin, James	University of California, Davis	School-Based Tele-Physiatry Assistance for Rehabilitative and Therapeutic Services for Children with Special Health Care Needs Living in Rural and Underserved Communities	This project will determine the impact of using telemedicine to serve children with special healthcare needs living in rural and underserved communities.	Telemedicine System

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
McCarty, Carolyn A.	Seattle Children's Hospital	Improving Teen Care With Health IT	This project will develop and test a Web-based Health Assessment (iHA) for adolescents to screen for health risk behaviors, with an aim towards providing prevention and risk reduction counseling.	Clinical Decision Support System, Consumer Health Informatics, Patient-Generated Health Data, Internet
Patel, Vimla L.	New York Academy of Medicine	Impact of Meaningful Use on Clinical Workflow in Emergency Departments	This project investigates how the Meaningful Use criteria affects the information seeking, team-interaction, and decisionmaking activities of emergency department clinicians at two urban hospitals.	Electronic Health Record/Electronic Medical Record, Radio Frequency Identification Device, Standards and Classification, Clinical Documentation, Clinical Messaging, Geographic Information System
Ratwani, Raj M.	MedStar Health Research Institute	Developing Evidence-Based, User-Centered Design and Implementation Guidelines to Improve Health Information Technology Usability	This project will provide an evidence base to better inform user-centered design and implementation processes to improve health information technology, usability, and safety.	Artificial Intelligence, Machine Learning, Natural Language Processing System, Standards and Classification, Clinical Informatics, Clinical Information System
Ratwani, Raj M.*	MedStar Health Research Institute	Improving Patient Safety and Clinician Cognitive Support Through eMAR Redesign	This study will examine usability and safety hazards of electronic medication administration records, with a focus on communication and information flow between health information technology applications.	Bar Coding, Medication Management System, Natural Language Processing System, Electronic Prescribing, Computerized Provider Order Entry System, Administrative System, Pharmacy information System

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Reed, Mary*	Kaiser Foundation Research Institute	Patient Choice of Telemedicine Encounters	This project will examine the quality and safety impact of patient-initiated telemedicine visits with primary care providers.	Telemedicine System
Schiff, Gordon David	Brigham and Women's Hospital	Enhancing Medication CPOE Safety and Quality by Indications-Based Prescribing	This project convened stakeholder panels to inform the development of an indications-enabled computerized prescriber order entry system.	Computerized Provider Order Entry System, Electronic Prescribing, Medication Management System
Schmajuk, Gabriela*	University of California, San Francisco	Incorporating PRO Data Into RA Clinical Encounters Using Health-IT (PACT)	This project will develop and evaluate an electronic dashboard to display patient reported outcomes for patients with rheumatoid arthritis that will facilitate clinician and patient conversations about their care.	Dashboard, Electronic Health Record/Electronic Medical Record, Patient-Generated Health Data
Schnall, Rebecca	Columbia University Health Sciences	The Wise App Trial for Improving Health Outcomes in PLWH	This study will design a user-centered smartphone application linked to a smart pill box with the goal of improving medication adherence for people living with HIV.	Mobile Phone
Schoenthaler, Antoinette*	New York University School of Medicine	i-Matter: Investigating an mHealth Texting Tool for Embedding Patient-Reported Data into Diabetes Management	This project will evaluate the effects of a technology-based patient-reported outcomes system on patient management of type 2 diabetes in primary care practices.	Electronic Health Record/Electronic Medical Record, Mobile Phone, Text Messaging
Senathirajah, Yalini	SUNY Downstate Medical Center	Finding the Safer Way: Novel Interaction Design Approaches to Health IT Safety	This project will study the impact of design on providers' interactions with the electronic health record and identify strategies to enhance design to improve patient safety.	Electronic Health Record/Electronic Medical Record, Standards and Classification, Architecture

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Shapiro, Jason S.	Mount Sinai School of Medicine	Advancing Quality Measurement and Care Improvement with Health Information Exchange	The purpose of this project was to leverage existing health information exchange data to improve quality measurement of two measures for potentially preventable emergency department visits.	Health Information Exchange
Siegel, Corey	Dartmouth College	Evaluating a Prediction Tool and Decision Aid for Patients with Crohn's Disease	To address challenges with treating Crohn's disease, the project will develop a statistical model that predicts Crohn's disease severity and a Web-based decision tool to help patients understand their treatment options.	Consumer Health Informatics
Sockolow, Paulina	Drexel University	Information Needs of Homecare Nurses During Admission and Care Planning	This project will analyze and model the information requirements, decisionmaking, and workflow of homecare nurses admitting patients and characterize if and how health information technology systems support their needs.	Electronic Health Record/Electronic Medical Record
Stockwell, Melissa S.	Columbia University	PRISM: Personalized Reminders for Immunizations using Short Messaging Systems	This study will compare the use of personalized HPV vaccine text message reminders to conventional text message reminders among minority adolescents in a randomized trial.	Mobile Phone, Text Messaging
Stockwell, Melissa S.	Columbia University Health Sciences	SINC: Synchronized Immunization Notifications	This project will create and evaluate the impact of immunization reminders using information from an electronic health record combined with an immunization information system.	Clinical Decision Support System, Registry

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Toh, Darren*	Harvard Pilgrim Health Care, Inc.	Improving Missing Data Analysis in Distributed Research Networks	This project aims to refine and develop methods to address missing electronic health record data to improve data quality and research validity.	Database, Electronic Health Record/Electronic Medical Record, Machine Learning, Architecture
Turchin, Alexander	Brigham and Women's Hospital	Identification of Patients with Low Life Expectancy	This project will use natural language processing and dynamic logic to create a high-fidelity model of risk of death to identify patients with low life expectancy.	Artificial Intelligence, Natural Language Processing System
Vest, Joshua Ryan	Indiana University-Purdue University at Indianapolis	Use of Push and Pull Health Information Exchange Technologies by Ambulatory Care Practices and the Impact on Potentially Avoidable Health Care Utilization	This project will clarify the relationship between “pull” and “push” health information exchange usage in primary care settings, and determine the impact of each approach on potentially avoidable and costly health care utilization.	Health Information Exchange, Architecture
Weiner, Saul	University of Illinois at Chicago	Integrating Contextual Factors into Clinical Decision Support to Reduce Contextual Error and Improve Outcomes in Ambulatory Care	This research will explore whether providing clinicians with contextual information at the point of care through the use of clinical decision support can reduce contextual errors, improve patient healthcare outcomes, and reduce misuse and overuse of medical services.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record
Xiong, Glen	University of California, Davis	Comparison of Asynchronous Telepsychiatry Alongside Synchronous Telepsychiatry in Skilled Nursing Facilities	This project will evaluate the comparative effectiveness of asynchronous telepsychiatry versus synchronous telepsychiatry in a skilled nursing facility population using a 12-month randomized controlled trial.	Telemedicine System

AHRQ Health Services Research Projects (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Yellowlees, Peter M.	University of California, Davis	A Clinical Trial to Validate an Automated Online Language Interpreting Tool With Hispanic Patients Who Have Limited English Proficiency	This project aims to improve access to high quality mental health services for diverse populations by implementing asynchronous telepsychiatry consultations combined with automated online interpreting.	Telemedicine System
Zhou, Li	Brigham and Women's Hospital	Encoding and Processing Patient Allergy Information in EHRs	The research team developed and evaluated a natural language processing allergy module that was used to study different types of allergies in an electronic health record.	Artificial Intelligence, Natural Language Processing System
Zhou, Li	Brigham and Women's Hospital	NLP to Improve Accuracy and Quality of Dictated Medical Documents	This project will study the impact of errors in medical documents on quality of care and develop innovative natural language processing methods to automatically detect errors so that physicians can correct the documents before finalizing them in the electronic health record.	Artificial Intelligence, Clinical Documentation, Machine Learning, Natural Language Processing System, Voice Recognition
Zhou, Li	Brigham and Women's Hospital	Improving Allergy Documentation and Clinical Decision Support in the Electronic Health Record	This project will redesign approaches for collecting and using allergy information with the goal of improving healthcare quality and safety, including completeness and accuracy of allergy data.	Artificial Intelligence, Clinical Decision Support System, Electronic Health Record/Electronic Medical Record, Natural Language Processing System, Architecture, Clinical Documentation

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Abraham, Joanna	University of Illinois at Chicago	An Etiology for Medication Ordering Errors in Computerized Provider Order Entry Systems	This project will evaluate a computerized provider order entry (CPOE)-based function—medication voiding—that can be used to prospectively identify and document medication ordering errors.	Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record, Electronic Prescribing
Adelman, Jason Stuart	Columbia University	Assess Risk of Wrong-Patient Errors in an EMR That Allows Multiple Records Open	This project compared the risk of orders placed on the wrong electronic patient record when providers were limited to having one patient record open at a time versus up to four and found no difference in errors between the two.	Computerized Provider Order Entry System, Electronic Health Record/Electronic Medical Record
Avidan, Michael	Washington University	Anesthesiology Control Tower: Feedback Alerts to Supplement Treatment (ACTFAST)	The goal of this project is to develop and evaluate an air traffic control-like command center for operating rooms.	Artificial Intelligence, Clinical Decision Support System, Dashboard, Electronic Health Record/Electronic Medical Record, Machine Learning, Mobile Device, Telemedicine System
Bardach, Naomi S.	University of California, San Francisco	Novel IT To Create Patient-Integrated Quality Improvement	This research created, piloted, and evaluated FIQS, the Family Input to Quality and Safety tool, that allows pediatric patients and their caregivers to provide safety reports regarding their inpatient care.	Dashboard, Mobile Device, Patient-Generated Health Data, Patient Portal

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Bauer, Nerissa San Luis	Indiana University-Purdue University at Indianapolis	Improving Anxiety Detection in Pediatrics Using Health Information Technology	This project integrated a validated anxiety-specific screening tool in an existing clinical decision support system and tested it with a randomized feasibility pilot that found the tool did not increase detection of anxiety in pediatric primary care.	Clinical Decision Support System
Cartmell, Kathleen Buford	Medical University of South Carolina	Reducing Hospital Readmission Rates by Implementing an Inpatient Tobacco Cessation Service Driven by Interactive Voice Recognition Technology	This study evaluated a smoking cessation program using interactive voice recognition technology and found that the intervention successfully reduced unplanned hospital readmissions and costs.	Voice Recognition, Telemedicine System, Remote Patient Monitoring
Chui, Michelle Anne*	University of Wisconsin - Madison	CancelRx: A Health IT Tool to Decrease Medication Discrepancies in the Outpatient Setting	This project will examine the impact of implementing the e-Prescribing standard CancelRx on outpatient medication discrepancies and on clinic and pharmacy workflows.	Electronic Prescribing, Pharmacy Information System
Cohen, Lindsey	Georgia State University	Relieving Anxiety in Children Undergoing Radiation Therapy Through Virtual Preparation	This research developed an interactive and engaging computer tablet-based, virtual program to prepare children with cancer for radiation therapy.	Consumer Health Informatics, Mobile Phone, Mobile Device, Virtual Reality
Dalal, Anuj K.	Brigham and Women's Hospital	Interactive Patient-Centered Discharge Toolkit To Promote Self-Management During Transitions	This project will implement and evaluate a previously developed, interactive, patient-centered discharge toolkit to improve the transition of care from the inpatient to outpatient settings.	Mobile Device, Mobile Phone, Patient Portal

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Dexheimer, Judith W.	Cincinnati Children's Hospital Medical Center	Optimal Methods for Notifying Clinicians About Epilepsy Surgery Patients	This project will integrate an existing Natural Language Processing system into neurology clinical practice and develop a decision support mechanism to alert providers about patients with epilepsy who are potential surgical candidates with the goal to shorten the time to surgical evaluation for eligible patients.	Artificial Intelligence, Clinical Decision Support System, Machine Learning, Natural Language Processing System
Dixon, Brian	Indiana University-Purdue University at Indianapolis	Exploring the Utilization of and Outcomes from Health Information Exchange in Emergency Settings	This project will examine health information exchange (HIE) usage patterns, the barriers and facilitators of HIE use, and the impact of HIE use by emergency department clinicians.	Data Warehouse, Health Information Exchange
Cartmell, Kathleen Buford	Medical University of South Carolina	A Geofencing-Based Adaptive Messaging System to Support Patient Self-Management of a Low-Sodium Diet in Hypertension	This study evaluated a smoking cessation program using interactive voice recognition technology and found that the intervention successfully reduced unplanned hospital readmissions and costs.	Voice Recognition
Dorsch, Michael	University of Michigan at Ann Arbor	Evaluation of the Impact of Telemedicine on Management of Rheumatoid Arthritis	This project will develop and test the effectiveness of a mobile application to help patients with hypertension reduce their dietary sodium intake by using mobile notifications at grocery stores and restaurants.	Consumer Health Informatics, Geographic Information System, Mobile Device, Patient Generated Health Data
Ferucci, Elizabeth D.	Alaska Native Tribal Health Consortium	StartSmart(TM): Health Information Technology to Improve Adherence to Prenatal Guidelines	This project will evaluate the impact of telemedicine rheumatology via video teleconference capability on quality of care outcomes and process measures for rheumatoid arthritis.	Telemedicine System

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Gance-Cleveland, Bonnie	University of Colorado, Denver	Exploring the Utilization of and Outcomes from Health Information Exchange in Emergency Settings	This project will develop a mobile health application to improve screening, intervention, and referrals in the care of pregnant women.	Mobile Device, Consumer Health Informatics
Goss, Foster R.	University of Colorado, Denver	Natural Language Processing To Identify and Rank Clinically Relevant Information for EHRs in the Emergency Department	This project developed a natural language processing electronic health record search tool that automatically identifies and ranks relevant clinical information based on a patient's presenting complaint within the emergency department setting.	Artificial Intelligence, Electronic Health Record/Electronic Medical Record, Machine Learning, Natural Language Processing System
Gray, Stacy W.	Beckman Research Institute - City of Hope	Empowering Cancer Patients Through Innovations in Information Technology-Based Reporting of Precision Medicine	This project will provide patients direct access to their cancer genomic sequencing results through a Web-based portal, Helping Oncology Patients Explore-Genomics (HOPE-Genomics).	Bioinformatics and Genomics, Patient Portal
Hettinger, Aaron Zachary	MedStar Health Research Institute	Context is Critical: Understanding When and Why Electronic Health Record Related Safety Hazards Happen	This project will develop a method to use video captured electronic health record interactions to analyze the context around medication errors, identify design elements that contributed to the errors, and make design recommendations to mitigate those errors.	Electronic Health Record/Electronic Medical Record, Architecture
Holden, Richard	Indiana University-Purdue University at Indianapolis	Power to the Patient: Design and Test of Closed-Loop Interactive IT for Geriatric Heart Failure Self-Care	The goal of this project is to design and test an information technology called Power to the People to support self-care management among older patients with chronic heart failure.	Consumer Health Informatics, Patient-Generated Health Data, Patient Portal

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Kazemi, Donna	University of North Carolina Charlotte	mHealth Delivery of a Motivational Intervention to Address Heavy Drinking Among College Students	This project developed and tested a smartphone application of an alcohol intervention for college freshmen and found that it worked as well as a traditional in-person approach.	Consumer Health Informatics, Mobile Phone, Text Messaging, Mobile Device
Kutney-Lee, Ann	University of Pennsylvania	Electronic Health Record Use, Work Environments, and Patient Outcomes	Focusing on the work environment of nurses, this project will study the organizational conditions under which electronic health records function best in hospitals and their potential to improve the outcomes of medical-surgical patients.	Electronic Health Record/Electronic Medical Record
Lee, Joyce	University of Michigan at Ann Arbor	Patient-Centered Data Visualizations for Diabetes	This project developed a diabetes data visualization mobile application for adolescents and found that clinical and contextual data provided greater opportunity for self-management and problem solving.	Mobile Device, Remote Patient Monitoring
Leroy, Gondy	University Of Arizona	Enabling Large-Scale Research on Autism Spectrum Disorders Through Automated Processing of EHR Using Natural Language Understanding	This project will design natural language processing algorithms to extract data from free text notes on autism spectrum disorders in electronic health records, and demonstrate the feasibility and usefulness of this approach.	Artificial Intelligence, Machine Learning, Natural Language Processing System
Leung, May May	Hunter College	Intervention INC: Interactive Nutrition Comics for Urban Minority Youth	The research team designed and developed “Invention INC,” an interactive nutrition comic for dietary self-management, focused on reducing childhood obesity risk in urban minority youth.	Mobile Device, Mobile Phone, Consumer Health Informatics

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Levin, Scott Ryan	Johns Hopkins University	HopScore: An Electronic Outcomes-Based Emergency Triage System	This project developed and pilot-tested a novel, outcomes-based emergency department triage tool and found that risk stratification and waiting times were improved for some patients.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record, Machine Learning
Lindquist, Lee A.	Northwestern University	Improving Outpatient Safety of Older Adults Through Electronic Patient Portals	This project evaluated the effects of providing caregivers of older adults proxy access to electronic patient portals and found that information exchange between caregivers and providers increased.	Patient Portal, Secure Messaging
Liss, David T.	Northwestern University	Using Location-Based Smartphone Alerts Within a System of Care Coordination	This project will design and implement a care coordination system using a smartphone application that sends location-based alerts to care managers when high-risk patients receive care at a regional hospital or emergency room.	Mobile Phone, Mobile Device, Geographic Information System
Meguid, Robert A.	University of Colorado, Denver	Surgical Risk Preoperative Assessment System	This project developed a patient-centric tool called the Surgical Risk Preoperative Assessment System to estimate the risk of adverse operative outcomes.	Clinical Decision Support System, Machine Learning, Electronic Health Record/Electronic Medical Record
Moore, Susan Louise	Denver Health and Hospital Authority	Engaging Disadvantaged Patients in Sharing Patient-Generated Health Data and Patient-Reported Outcomes through Health Information Technology	This study will test the hypothesis that low-income, disadvantaged patients can provide high-quality patient-generated health data and patient-reported outcomes through commercial technologies, and that these data can be used to improve healthcare quality and delivery.	Mobile Device, Mobile Phone, Patient-Generated Health Data

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Nahm, Eun-Shim	University of Maryland	A Theory-Based Patient Portal eLearning Program for Older Adults With Chronic Illnesses	This project will optimize and implement a vendor-agnostic eLearning program that supports older adults in using patient portals for their care.	Patient Portal
Ornstein, Steven	Medical University of South Carolina	Learning From Primary Care EHR Exemplars About Health IT Safety	The study assessed perspectives on electronic health record safety recommendations and found that physicians generally agreed with the recommendations, despite not being familiar with them.	Electronic Health Record/Electronic Medical Record
Pratap, Jayant	Cincinnati Children's Hospital Medical Center	Using the Electronic Health Record To Identify Children Likely To Suffer Last-Minute Surgery Cancellation	This project will apply machine learning against a large data set to develop a model to both understand and predict surgical cancellations on individual pediatric patients at two pediatric surgical sites.	Artificial Intelligence, Electronic Health Record/Electronic Medical Record, Machine Learning
Rangachari, Pavani	Augusta University	Using Social Knowledge Networking (SKN) Technology To Enable Meaningful Use of EHR Technology	This pilot project implemented a Social Knowledge Networking system and concluded that it supported progress toward meaningful use of medication reconciliation technology in an electronic health record.	Electronic Health Record/Electronic Medical Record, Knowledge System, Social Media
Rao, Goutham	NorthShore University HealthSystem	Improving Diagnosis of Hypertension in Children (IDHC)	This project developed, implemented, and evaluated a program that includes clinical decision support to improve diagnosis of hypertension in children.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Schnipper, Jeffrey Lawrence	Brigham and Women's Hospital	Electronic Medication Adherence Reporting and Feedback During Care Transitions	This project will implement and evaluate a "smart" pillbox given to patients in order to understand its ability to minimize discrepancies in prescribed regimens and to improve patients' medication adherence after hospital discharge.	Mobile Device, Mobile Phone, Text Messaging
Sherwin, Robert	Wayne State University	Enhancing an EMR-Based Real-Time Sepsis Alert System Performance Through Machine Learning	This project will use machine learning to enhance an existing sepsis clinical decision support tool to improve the early detection of sepsis.	Artificial Intelligence, Clinical Decision Support System, Machine Learning, Emergency Department Information System
Snyder, Margie E.	Purdue University	Enhancing Clinical Decision Support Applications for Community Pharmacist-Delivered Medication Therapy Management	This project will formulate evidence-based recommendations for clinical decision support used by community pharmacist delivering medication therapy management. The goal is to reduce medication-related problems and improve health outcomes for chronically ill patients.	Clinical Decision Support System
Turvey, Carolyn*	University of Iowa	Development of a Targeted Patient Portal Intervention to Improve Depression Treatment Adherence, Satisfaction, and Outcomes	The project will develop a patient portal intervention to increase patient activation and promote collaborative decision making for patients with depression.	Patient Portal
Valdez, Rupa Sheth	University of Virginia	Accessibility and Beyond: Designing Consumer Health IT for Disabled Individuals	This project engaged individuals with physical, sensory, and cognitive disabilities to expand upon existing consumer mobile health application design guidance for social networks.	Consumer Health Informatics, Mobile Device, Standards and Classifications

Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Wernz, Christian	Virginia Commonwealth University	Evidence-based Contingency Planning for Electronic Health Record Downtime	This project assessed the clinical and operational implications of electronic health record downtimes and developed a simulation model to support the creation of effective downtime contingency plans.	Electronic Health Record/Electronic Medical Record, Knowledge System, Clinical Information System
Xie, Anping	Johns Hopkins University	Development of a Clinical Decision Support Tool for Facilitating Naturalistic Decision-Making and Improving Blood Culture Utilization	This project will develop and evaluate an electronic health record-embedded clinical decision support tool that draws upon the strength of analytical and naturalistic decision-making to optimize the use of blood cultures in critically ill children.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record, Laboratory Information System
Ye, Lichuan	Boston College	A Sleep Promotion Toolkit for Hospitalized Patients	This research developed and pilot-tested a sleep promotion toolkit (SLEEPkit), an application designed to facilitate routine sleep assessment and inform individualized plans for sleep promotion.	Mobile Device
Yen, Po-Yin	Washington University	Development and Evaluation of Sociotechnical Metrics To Inform Health IT Adaptation	This project will study health information technology adaptation using sociotechnical theory.	Electronic Health Record/Electronic Medical Record

Mentored Clinical Scientist Research Career Development Award (K08)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Blecker, Saul B.	New York University School of Medicine	Health Information Technology in Heart Failure Care	This project will develop and test a clinical decision support tool to support the delivery of recommended care in hospitalized patients who have heart failure, regardless of the reason for hospitalization.	Artificial Intelligence, Clinical Decision Support System, Machine Learning, Natural Language Processing System, Electronic Health Record/Electronic Medical Record
Gephart, Sheila Maria	University Of Arizona	Clinical Decision Support Optimizing Necrotizing Enterocolitis Prevention Implementation in Neonatal Intensive Care Unit	This project will integrate clinical decision support into providers' workflow in neonatal intensive care units to deliver evidence-based guidelines for early recognition and prevention of necrotizing enterocolitis, a serious complication threatening the life of fragile premature infants.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Records
Melnick, Edward	Yale University	Clinical Decision Support for Mild Traumatic Brain Injury	This project developed and piloted a patient-centered clinical decision support tool that was used in emergency department management of minor head injury and found high patient and clinician satisfaction and usability.	Clinical Decision Support System, Mobile Device, Emergency Department Information System
Nanji, Karen C.	Massachusetts General Hospital	Preventing Perioperative Medication Errors and Adverse Drug Events Through the Use of Clinical Decision Support	This project will develop a clinical decision support tool for the perioperative setting.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record

Mentored Clinical Scientist Research Career Development Award (K08)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Smith, Angela B.	University of North Carolina Chapel Hill	Developing an Interactive, Patient-Centered mHealth Tool to Enhance Post-Cystectomy Care	This project will develop a mobile health tool that will prospectively collect patient-centered outcomes data on key symptoms of postoperative bladder cancer patients.	Internet, Mobile Device, Mobile Phones, Patient-Generated Health Data
Wasson, Lauren	Columbia University Health Sciences	Improving Diagnosis of Cardiovascular Disease in the Emergency Department Using Cognitive Informatics Tools	This project will develop a patient-based dashboard to improve cognitive hygiene in the emergency department, aiding in the diagnosis of acute coronary syndrome.	Dashboard, Electronic Health Record/Electronic Medical Record
Ancker, Jessica	Weill Medical College of Cornell University	Improving Healthcare Quality with User-Centric Patient Portals	This project studied patient portals, their use in primary care, and the impact of use on chronic conditions, and identified opportunities to improve adoption of patient portals.	Consumer Health Informatics, Patient-Generated Health Data, Patient Portal
Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Carayon, Pascale	University of Wisconsin - Madison	Health Information Technology-Supported Process for Preventing and Managing Venous Thromboembolism	The purpose of this project is to evaluate the cognitive and teamwork involved in venous thromboembolism prevention and management and to develop design requirements for a clinical decision support tool that supports this collaborative work.	Clinical Decision Support System, Standards and Classifications, Architecture, Clinical Information System

Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Cohen, Deborah Jill	Oregon Health and Science University	Clinical Information Needs of Community Health Centers for Health Information Technology	This project will identify the information needs required to ensure effective care coordination for complex patients through extensive ethnographic assessment and interviews, and employ user-centered design methods to rapidly develop and test tools that address these needs.	Electronic Health Record/Electronic Medical Record, Architecture
Gold, Jeffrey Allen	Oregon Health and Science University	Electronic Health Record Solutions for Accurate Reporting of Data on Interprofessional Intensive Care Unit rounds	This project will develop a series of standards for electronic health records to ensure adequate and accurate data communication for care team members in the intensive care environment.	Electronic Health Record/Electronic Medical Record
Gurses, Ayse Pinar	Johns Hopkins University	Care Transitions and Teamwork in Pediatric Trauma: Implications for Health Information Technology Design	This project seeks to develop an understanding of the cognitive work of clinician teams and family members involved in pediatric trauma care transitions in order to design usable and useful health information technologies.	Electronic Health Record/Electronic Medical Record, Architecture
Harle, Christopher Albert	Indiana University-Purdue University at Indianapolis	Designing User-Centered Decision Support Tools for Chronic Pain in Primary Care	This project will develop decision support tools that integrate with electronic health records to increase the quality and effectiveness of chronic pain care.	Clinical Decision Support System

Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Hettinger, Aaron Zachary	MedStar Health Research Institute	Cognitive Engineering for Complex Decisionmaking & Problem Solving in Acute Care	This project will apply the science of human factors and cognitive engineering to the design of clinical decision support and information technology with the goal of improving patient safety.	Architecture, Standards and Classifications, Emergency Department System, Knowledge System, Clinical Informatics
Koopman, Richelle J.	University of Missouri at Columbia	Optimizing Display of Blood Pressure Data To Support Clinical Decision	This project will determine the optimal display of blood pressure data for patients and their physicians in order to facilitate shared decision making about blood pressure control and treatment.	Clinical Decision Support System, Patient-Generated Health Data, Remote Patient Monitoring
Lavallee, Danielle	University of Washington	Developing Design Principles to Integrate Patient-Reported Outcomes (PROs) Into Clinical Practice Through Health Information Technology: Data, User Experience, and Workflow Requirements for PRO Dashboards	This project will develop design principles to enable more effective integration of patient-reported outcomes data into patient care activities through health information technology.	Dashboard
Manojlovich, Milisa	University of Michigan at Ann Arbor	The Effect of Health Information Technology on Health Care Provider Communication	The purpose of this study is to describe how communication technologies make it easier or more difficult for nurses and physicians to communicate with each other, with a goal of finding ways to support effective communication.	Clinical Documentation, Clinical Messaging, Health Information Exchange, Practice Management System

Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Melton-Meaux, Genevieve	University of Minnesota, Twin Cities	Discovery and Visualization of New Information from Clinical Reports in the Electronic Health Record	The project team developed automated methods for identifying relevant new information versus redundant information in electronic health record clinical notes.	Artificial Intelligence, Clinical Documentation, Electronic Health Record/Electronic Medical Record, Natural Language Processing System
Singh, Hardeep	Baylor College of Medicine	Decision Making and Clinical Work of Test Result Followup in Health Information Technology Settings	This project applied a human factors-based framework to understand factors associated with missed test results and found that health information technology is a key barrier to test followup.	Electronic Health Record/Electronic Medical Record
Wetterneck, Tosha Beth	University of Wisconsin - Madison	Understanding Primary Care Teamwork in Context: Implications for Health Information Technology Design	This project will inform the design of electronic health records to support the cognitive work of primary care clinicians and teams.	Dashboard, Electronic Health Record/Electronic Medical Record, Architecture
Windle, John	University of Nebraska Medical Center	Optimizing the Electronic Health Record for Cardiac Care	This project will study the usability of electronic health records (EHRs) by cardiac care physicians and nurses to develop a set of best practices in EHR design to inform vendors of the wants and needs of clinical providers.	Electronic Health Record/Electronic Medical Record
Bertoni, Alain	Wake Forest University Health Sciences	Maximizing the Impact of ePHIM in Low-Income, Multiethnic Populations	Using a community-based participatory partnership, this project will delineate the factors that facilitate or limit the use of electronic personal health information management.	Electronic Health Record/Electronic Medical Record, Patient Portal

Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Jackson, Gretchen P.	Vanderbilt University	Personal Health Information Needs and Practices for Maternal Fetal Care	Women have unique information needs during their pregnancies, ranging from medical questions about pregnancy to logistical concerns about hospital policies. This project is designed to understand these needs, the contexts in which they occur, and the resources used.	Consumer Health Informatics, Patient Portal, Personal Health Record
Matthews, Judith T.	University of Pittsburgh at Pittsburgh	Self-Management via Health Kiosk by Community-Residing Older Adults	This project will investigate older adults' perceptions of, motivations to use, and patterns of using an adaptive, community-based, multiuser health kiosk.	Kiosk, Secure Messaging
Ponto, Kevin	University of Wisconsin - Madison	vizHOME: A Context-Based Health Information Needs Assessment Strategy	The purpose of this project is to create a systematic way to understand and measure how household context—such as storage adequacy, lighting, and privacy affordance—influences personal health information management.	Artificial Intelligence, Consumer Health Informatics, Virtual Reality, Remote Patient Monitoring
Pratt, Wanda	University of Washington	Patients as Safeguards: Understanding the Information Needs of Hospitalized Patients	In an effort to reduce medical errors and adverse events, this project will determine the information needs of hospitalized patients and caregivers, and develop design requirements for a solution that supports communicating safety concerns to providers.	Consumer Health Informatics

Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Ralston, James D.	Group Health Cooperative	Understanding and Honoring Patients with Multiple Chronic Conditions	This project determined care priorities for patients with multiple chronic conditions based on patient needs, preferences, and capabilities and developed a set of recommendations for patients and providers.	Electronic Health Record/Electronic Medical Record
Safran, Charles	Beth Israel Deaconess Medical Center	InfoSage Information Sharing Across Generation and Environments	This project will examine the health care information needs and management challenges of older adults and family members involved in their care.	Consumer Health Informatics
Thompson, Hayley S.	Wayne State University	eHealth Activity Among African-American and White Cancer Survivors	This study focuses on the use of eHealth in cancer survivors and will identify determinants of eHealth activity, provide insight into the role of eHealth in survivors' overall personal health information management, and establish survivor-centered design principles for optimized eHealth tool development.	Internet, Mobile Device, Consumer Health Informatics, Patient Generated Health Data
Turner, Anne M.	University of Washington	Addressing the Personal Health Information Management Needs of Older Adults	This project will examine the health information needs of older adults to inform the design of systems to support their health and independence.	Consumer Health Informatics
Vawdrey, David Kent	Columbia University	Addressing Hospital Patient Information Needs Using a Personal Health Record Portal	This project evaluated the impact of an inpatient portal used by cardiac patients and found that patients using the portal had a lower 30-day hospital readmission rate.	Consumer Health Informatics, Mobile Device, Patient Portal, Personal Health Record

AHRQ Patient Centered Outcomes Research (PCOR) Pathway to Independence Award (K99/R00)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Lyles, Courtney	University of California, San Francisco	Engaging Diverse Patients in Using an Online Patient Portal	The goal of this project is to improve chronic illness care for ethnically and racially diverse patients using a patient portal.	Patient Portal
AHRQ Patient Centered Outcomes Research Clinical Decision Support Learning Network (U18)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Blumenfeld, Barry H.	RTI International	Patient-Centered Outcomes Research Clinical Decision Support Learning Network	The Patient-Centered Outcomes Research Clinical Decision Support Learning Network (PCOR CDS-LN) will explore the facilitators and barriers to the use of PCOR findings in CDS software and will formulate recommendations for ways to increase the uptake and use of CDS incorporating PCOR findings.	Clinical Decision Support System
Utilizing Health Information Technology to Scale and Spread Successful Practice Models Using Patient reported Outcomes (R18)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Jariwala, Sunit*	Albert Einstein College of Medicine	Adapting, Scaling, and Spreading an Algorithmic Asthma Mobile Intervention to Promote Patient-Reported Outcomes Within Primary Care Settings	This project will adapt and evaluate a mobile health application to improve patient-reported asthma outcomes in New York.	Electronic Health Record/Electronic Medical Record, Mobile Device, Patient Generated Health Data

Utilizing Health Information Technology to Scale and Spread Successful Practice Models Using Patient reported Outcomes (R18)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Lenert, Leslie A.*	Medical University of South Carolina	EHR-based Screening and Intervention for Intimate Partner Violence	This project will design, implement, and evaluate a comprehensive set of tools in an electronic health record (EHR) to support improved intimate partner violence care.	Clinical Decision Support System, Electronic Health Record/Electronic Medical Record, Public Health Informatics, Patient Generated Health Data, Telemedicine System
Penedo, Frank*	Northwestern University	Expansion, Implementation, and Evaluation of Electronic Health Record-Integrated Patient-Reported Symptom Screening in a Comprehensive Cancer Center	This project will expand, implement, and evaluate the use of a cancer screening platform, the Oncology Symptom Screening Initiative (OSSI), to improve psychosocial screening of cancer patients.	Patient Portal, Patient Generated Health Data, Health Information Exchange, Architecture, Electronic Health Record/Electronic Medical Record
Rudin, Robert Samuel*	RAND Corporation	Integrating Patient-Reported Outcomes into Routine Primary Care: Monitoring Asthma Between Visits	The project is adapting and scaling a technology-enabled practice model for asthma in a primary care setting, then evaluating its impact on patient-reported quality of life and utilization.	Dashboard, Mobile Phone, Text Messaging, Patient Generated Health Data
Yazdany, Jinoos*	University of California, San Francisco	Rheumatology Informatics System for Effectiveness Patient-Reported Outcome (RISE PRO) Dissemination Project	This project will create and evaluate a learning network to expand the use of the Rheumatology Informatics System for Effectiveness (RISE) registry for patient-reported outcomes on rheumatoid arthritis.	Artificial Intelligence, Dashboard, Natural Language Processing System, Registry, Patient Generated Health Data, Database, Patient Portal

Health Information Technology (IT) to Improve Health Care Quality and Outcomes (R21)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Friedman, Charles*	University of Michigan at Ann Arbor	Achieving Individualized Precision Prevention (IPP) through Scalable Infrastructure Employing the USPSTF Recommendations in Computable Form	This project will use Learning Health System methods to systematically apply U.S. Preventive Services Task Force's evidence-based recommendations with the goal of advancing individualized precision prevention.	Machine Learning, Mobile Device, Electronic Health Record/Electronic Medical Record, Knowledge System
Lakes, Kimberley*	University of California Riverside	The CoolCraig App: Promoting Health by Improving Self-Regulation in Adolescents with ADHD	This project will develop and evaluate CoolCraig, a wearable and connected system combining a fitness tracker, mobile phone application, and web portal that will deliver, reinforce, and sustain treatment for adolescents with attention deficit hyperactivity disorder.	Mobile Device, Patient Portal
Ruggiano, Nicole*	University of Alabama in Tuscaloosa	Examining the Clinical Workflow and Outcomes of Integrating Health Information Technology to Educate and Support Dementia Caregivers	This project will evaluate the integration into clinical care of CareHeroes, an application to support caregivers of those with Alzheimer's disease.	Mobile Device, Mobile Phone, Patient-Generated Health Data, internet, Architecture
Wallace, Andrea*	University of Utah	From Emergency to Community: Implementing a Social Needs Assessment and Referral Infrastructure Using Health Information Technology	This project will implement a social needs assessment in an emergency department and evaluate its impact on health outcomes.	Electronic Health Record/Electronic Medical Record

Developing New Clinical Decision Support to Disseminate and Implement Evidence Based Research Findings (R18)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Gong, Michelle*	Albert Einstein College of Medicine	TREAT ECARDS: Translating Evidence into Action: Electronic Clinical Decision Support in ARDS	This project will develop and evaluate an electronic clinical decision support tool for care of patients with Acute Respiratory Distress Syndrome.	Clinical Decision Support System, Dashboard, Machine Learning, Natural Language Processing System
Implementation and Evaluation of New Health Information Technology (IT) Strategies for Collecting				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Kalenderian, Elsbeth*	University of California, San Francisco	Optimizing Acute Post-Operative Dental Pain Management Using New Health Information Technology	This project will use mobile health technology to collect patient-reported outcomes after dental procedures to optimize the quality of acute post-operative dental pain management.	Mobile Device, Patient-Generated Health Data
Laiteerapong, Neda*	University of Chicago	Patient Outcomes Reporting for Timely Assessments of Life with Depression: PORTAL-Depression	This project will integrate the Computerized Adaptive Test for Mental Health into an electronic health record and evaluate the effectiveness of collecting depression symptoms with a patient portal.	Patient-Generated Health Data, Patient Portal
AHRQ Conference Grant Program (R13)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
O'Brien, Matthew James*	Northwestern University	Prevent Diabetes Mellitus (PreDM) Clinical Decision Support Intervention in Community Health Centers	This project will develop and evaluate the impact of the Prevent Diabetes Mellitus Clinical Decision Support on clinical outcomes, healthcare process measures, and associated costs.	Clinical Decision Support System, Dashboard

AHRQ Conference Grant Program (R13)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Agarwal, Ritu*	University of Maryland	Annual Conference on Health Information Technology & Analytics (CHITA)	The central goal of the annual Conference on Health IT & Analytics is to develop a health information technology and analytics (HIT+A) research agenda that supports national efforts to create a learning health system that produces evidence to make health care safer, of higher quality, more accessible, equitable, and affordable.	Bioinformatics and Genomics, Clinical Informatics, Data, Machine Learning
Contracts				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Loube, Robyn*	Sensis, Inc.	AHRQ Patient-Reported Outcome Challenge Competition Support	This contract provided the administration and management of the Agency for Healthcare Research and Quality's “Step Up App Challenge: Advancing Care Through Patient Self-Assessments.”	Consumer Health Informatics, Mobile Device
Miller, Kristen, Hettinger, Aaron Zachary*	MedStar Health Research Institute	Quantifying Efficiencies Gained through Shareable Clinical Decision Support Resources	This research will evaluate the lifecycle of clinical decision support (CDS), as currently implemented at most health systems, against a future CDS state that incorporates the use of shareable CDS resources created using the Agency for Healthcare Research and Quality’s CDS Connect tools.	Clinical Decision Support System, Knowledge System

Contracts				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Wesley, Deliya, Ratwani, Raj M.*	MedStar Health Research Institute	Advancing the Collection and Use of Patient-Reported Outcomes through Health Information Technology	This research will support development and testing of technical tools for use within electronic health records or other systems to collect patient-reported outcomes for clinical use and research.	Consumer Health Informatics, Mobile Device, Patient-Generated Health Data
Sebastian, Sharon	The MITRE Corporation*	Patient-Centered Outcomes Research Clinical Decision Support Prototype Development and Dissemination	The goal of this project is to generate a systematic and replicable process for transforming evidence-based research findings, including findings from patient-centered outcomes research, into shareable clinical decision support (CDS) standards and a publicly available CDS prototype.	Clinical Decision Support System, Standards and Classifications
Research Centers in Primary Care Practice Based Research and Learning (P30)				
Principal Investigator	**Organization**	**Project Title**	**Short Description**	**Technology**
Fiks, Alexander	American Academy of Pediatrics	National Center for Pediatric Practice Based Research and Learning	This project will establish the Center for Pediatric Practice Research and Learning (C-PRL). This Center will link existing pediatric practice-based research networks to develop evidence-based practices and improve child health outcomes.	Electronic Health Record/Electronic Medical Record, Database