AHRQ-Funded Patient Safety Project Highlights

Improving Healthcare Safety by Enhancing Medication Safety

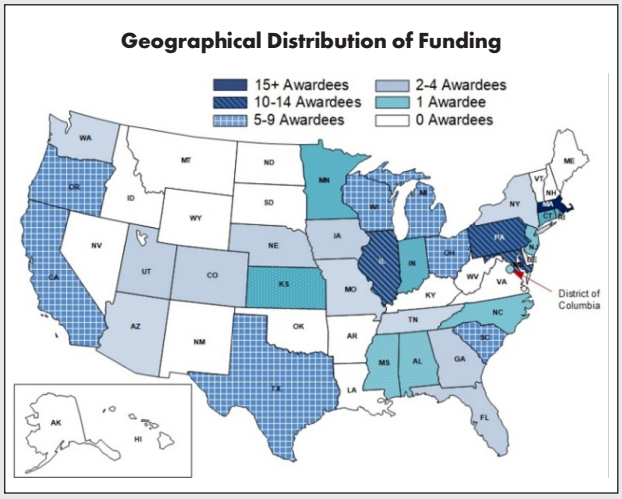
Medication safety refers to the practices and measures implemented to minimize the risk of medication errors and adverse drug events (ADEs) in various settings across the healthcare continuum. It is a critical process for protecting patients from harm and improving healthcare quality. From 2000 to 2024 AHRQ supported 137 patient safety projects related to medication safety. This publication summarizes AHRQ's investments toward safer care, including examples of project findings and products, collective outputs, and impacts of this work. Details about each AHRQ-supported project are available in the Appendix.

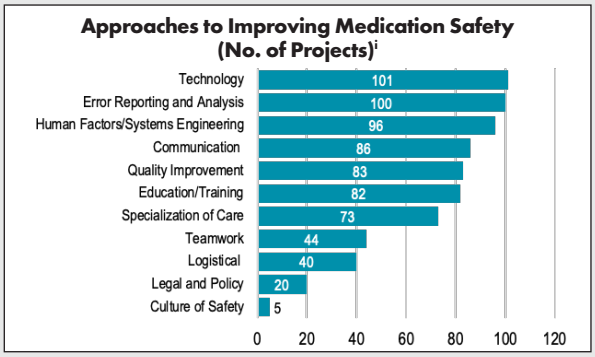
Scope of AHRQ Investments

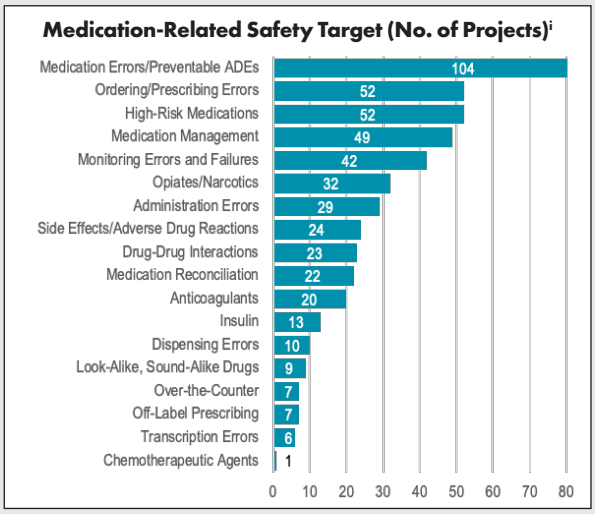
137 projects*

1,118 publications*

64,236 citations*







*as of February 19, 2025

As of February 2025, AHRQ had funded 137 medication safety projects, resulting in 1,118 publications that have collectively been cited 64,236 times. Institutions in Massachusetts were awarded the most

[i] The total number of projects is greater than 137 as some projects used more than one approach to improving safety or had more than one safety target.

projects (n=21, 15%), followed by Maryland (n=13, 9%). Among the 137 projects, the primary approach to improving patient safety was technology (n=101, 74%), followed by error reporting and analysis (n=100, 73%) and human factors and systems engineering (n=96, 70%). The top three patient safety areas targeted for improvement in these projects were medication errors and preventable adverse drug events (n=104, 76%), followed by ordering and prescribing errors, as well as high-risk medications (n=52, 38% each).

Examples of Project Findings

The projects included in this collection of work center around medication safety, which includes actions and errors that occur from the point of prescription to administration, as well as specific medications or delivery methods. These projects typically fall into one or more of the following categories:

- Epidemiology of medication errors in various settings and populations
- High-risk medication errors and approaches to improve monitoring
- Look-alike or sound-alike medications
- Off-label prescriptions
- Prescription and use of opioids
- Medication reconciliation and management during transitions of care
- Use of technological advances to mitigate medication errors

Examples of these projects and summaries of their results are described below and organized by research themes identified in this collection of work.

Understanding and Addressing the Opioid Crisis

To improve the nation's response to the opioid epidemic, AHRQ funded several projects focused on understanding this crisis and providing solutions. For example:

- One project developed and successfully tested an intervention that increased HIV primary care providers' adherence to the Centers for Disease Control and Prevention Opioid Prescribing Guideline.
- Another project developed the Resources Encouraging Safe Prescription Opioid and Naloxone Dispensing (RESPOND) Toolkit to enhance community pharmacists' use of Prescription Drug Monitoring Program data to improve opioid safety.
- To provide a roadmap for improving care for patients with chronic pain using long-term opioid therapy, one project developed and evaluated an implementation toolkit for the Six Building Blocks: A Team-Based Approach to Improving Opioid Management in Primary Care.
- Another project successfully applied a systems-level approach to improve delivery of and access to pharmacy-based naloxone and concluded that pharmacies can be optimized for broader naloxone distribution with focused training and deliberate attention to stigma reduction.

Improving Medication Safety Among AHRQ Priority Populations

Several projects focused on improving medication safety among AHRQ priority populations in various healthcare settings, most notably children and older adults. For example:

- One project successfully implemented a program that improved the quality of prescribing practices for older adults discharged from the emergency department in three health systems.

- Another project improved warfarin management among residents in 26 community nursing homes representative of nursing homes across the United States, using a standardized nurse-physician handoff communication tool.
- To reduce medication-associated acute kidney injury in nine pediatric hospitals, one project disseminated a successful screening and surveillance intervention and later aimed to disseminate it to 140 pediatric institutions in the Solutions for Patient Safety Network.
- Another project tested an electronic health record (EHR) decision-support system for deprescribing high-risk anticholinergic medications in older adults with diabetes, while separately using continuous glucose monitoring to detect hypoglycemic events in older diabetic patients, finding that 73 percent experienced undetected hypoglycemia.
- One project used learning networks supported by the Cincinnati Children's Hospital to develop and test efforts aimed at improving pediatric outcomes by optimizing the use of therapeutics. Subthemes included quality and patient safety, practice-based research and improvement networks, pharmacogenomics, and performance metrics.

Improving Medication Safety During Transitions in Care

Several projects focused on improving medication safety transitions in care settings and during clinical handoffs between healthcare professionals. For example:

- One project successfully developed and tested a process for medication reconciliation at transitions and clinical handoffs (MATCH), using a multidisciplinary team that examined its internal processes, workflow, and staff responsibilities.
- A subsequent project was funded to develop the MATCH Toolkit to support broader implementation in other acute care settings. The toolkit incorporates the experiences and lessons learned by healthcare facilities that have implemented the MATCH strategies.
- Another project improved hospital-to-home medication safety through targeted post-discharge interventions yielding a 38 percent better medication reconciliation accuracy, a 25 percent increase in timely primary care followups, and a 10–15 percent decrease in preventable readmissions.
- A subsequent implementation study observed that hospital sites that implemented this quality improvement approach saw a steady decline in their medication discrepancy rate from approximately 2.85 discrepancies/patient to 0.98 discrepancy/patient.

Applying Technological Approaches to Medication Safety

Many projects applied technological strategies for improving medication safety. For example:

- One project used barcode verification technology within an electronic medication-administration system to decrease overall rates of dispensing errors and potential ADEs and demonstrate a positive financial impact based on a cost-benefit analysis.
- Another project evaluated the impact of using a computerized provider order entry system to reduce the frequency of medication errors resulting from problems such as illegibility, use of inappropriate abbreviations, and missing information.

- One project developed an automated infusion pump system that eliminated medication errors in critical care (0% vs. 16.6% with manual systems) and integrated pumps with EHRs for real-time medication tracking.
- Another project found that a multifaceted information technology intervention combining clinical information systems, clinician alerts, and a clinical decision support tool was associated with lower hospitalization rates and lower patient medication complexity risks.

Impacts

AHRQ-funded medication safety projects have aimed to improve the quality of medication safety by better understanding and addressing related challenges such as medication error identification and management, availability of resources and training, and promotion of shared decision making. Collectively, the 137 AHRQ-funded projects have resulted in the following:

- New knowledge within the field of medication safety using qualitative and quantitative research methods, data analysis techniques, and risk models and assessments
- Development, implementation, and evaluation of tools, toolkits, quality improvement measures, policies and guidelines, education and training programs, and technological interventions
- Identification of research gaps and areas that may need further investigation within the field of medication safety
- Synthesis and dissemination of research findings via conferences and publications

The developed resources and project results of this body of AHRQ-funded work have helped to improve these areas:

- Surveillance and reporting of medication-related errors and adverse events (e.g., automated detection methods, reporting programs or systems)
- Physician adherence to clinical practice guidelines (e.g., for prescribing, dosing, monitoring)
- Patient adherence to prescribed medications (e.g., fewer missed doses, fewer side effects)
- Medication safety for various patient populations (e.g., older adults, children) and among a variety of high-risk medications (e.g., opioids, insulin, anticoagulants, antipsychotics)
- Interprofessional collaboration and communication (e.g., between physicians, nurses, pharmacists)
- Technological approaches and strategies to improving medication safety (e.g., barcode technologies, smart infusion pumps)

To learn more about each of the projects included in this synthesis, view the companion Appendix that follows.

This summary was funded under contract number GS-00F-260DA/ 75Q80120F80007 from the Agency for Healthcare Research and Quality (AHRQ), U.S. Department of Health and Human Services. The authors are solely responsible for this report's contents, findings, and conclusions, which do not necessarily represent the views of AHRQ. Readers should not interpret any statement in this summary as an official position of AHRQ or of the U.S. Department of Health and Human Services.

Appendix

Medication Safety Project Summary

This appendix briefly describes AHRQ-funded projects related to medication safety. Projects are organized alphabetically by state, then by original date of funding. Each description includes key findings as reported in available final reports and/or companion publications. In some cases, the findings are reported directly from publications (e.g., journal abstracts, journal articles). The grants listed below are linked to NIH RePORTER, an electronic tool that allows users to search a repository of federally funded research projects and access publications resulting from such funding.

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
ALABAMA		
Jacqueline Moss **University of Alabama, Birmingham** Birmingham, Alabama	U18 HS016660 [Grant] **Clinical Decision Support Simulations for Medication Administration Safety** 2009–2011 $395,462 Final Report	**Purpose:** Develop a methodology and tools for the design of clinical decision support systems to decrease the incidence of medication administration errors. **Key Findings/Impact:** Nurses' evaluation of the medication administration decision support tools as well as their actual performance revealed a tendency to underestimate their need for support. Their preferences were for decision support that was short, color coded, and easily accessed. Observations of medication administration showed that nurses exhibit a variety of work processes to prepare and administer medications to patients and access system decision support tools at a variety of points in this process. This study was performed in one hospital, and results may not generalize beyond this setting. However, this method, used to design and test decision support, could be transferred to other settings. System design should allow flexibility of multiple points and types of information delivery that can accommodate variations in workflow to minimize the tendency for system workarounds. **Publications:** 2
ARIZONA		
Daniel Malone **University of Arizona** Tucson, Arizona	R13 HS021826 [Grant] **Drug-Drug Interaction Clinical Decision Support Conference Series** 2012–2015 $287,596 Final Report	**Purpose:** Provide recommendations for evaluation of evidence for drug-drug interactions (DDIs), identify principles for including DDI alerts in clinical decision support (CDS), and establish preferred strategies for presenting DDI clinical decision support notifications. **Key Findings/Impact:** Recommendations in the final report included consistent use of terminology, visual cues, minimal text, formatting, content, and reporting standards to facilitate usability. Experts recommended (1) a transparent, systematic, and evidence-driven process with graded recommendations by a consensus panel of experts and oversight by a national organization; (2) judicious classification of DDIs as contraindicated, and (3) more research to identify methods to safely reduce repetitive and less relevant alerts. The project deliverables (i.e., workgroup white papers, recommendations, webinars, meetings/conference proceedings) can provide meaningful improvement to DDI CDS and thereby reduce alert fatigue, improve workflow, reduce medication errors, and improve patient safety. **Publications:** 7

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Neena Abraham **Mayo Clinic** Phoenix, Arizona	R01 HS025402 [Grant] **Gastrointestinal Safety of Antithrombotic Drug Regimens** 2017–2021 $1,410,985 Final Report	**Purpose:** Develop an algorithm to predict antithrombotic-related gastrointestinal bleeding (GIB) to inform the development of a clinical delivery platform. **Key Findings/Impact:** Compared with the HAS-BLED bleeding risk score, Regularized Cox (RegCox) regression, random survival forest (RSF), and extreme gradient boosting (XGBoost) demonstrated similar performance in identifying high-risk gastrointestinal bleeding (GIB) patients. The most important variables in the RegCox model were prior GIB; atrial fibrillation, ischemic heart disease, and venous thromboembolism combined; and use of gastroprotective agents. Researchers concluded that the risk of antithrombotic-related GIB is significant in older patients. They constructed a model with improved sensitivity and specificity using machine learning methods and showed the choice of method was not critical to model performance. All models were superior to the HAS-BLED model and could serve as the basis for a clinical risk assessment tool. **Publications:** 68
CALIFORNIA		
Timothy Dresselhaus **Veterans Medical Research Foundation-San Diego** San Diego, California	UC1 HS014283 [Grant] **Real-Time Assessment of Risk Factors-Medication Errors** 2003–2005 $449,536 Final Report	**Purpose:** Demonstrate the feasibility of a novel handheld instrument for real-time assessment of risk factors and error reporting; identify the types of medication errors that occur for different clinicians in different hospital settings and characterize the risks they pose to patient safety. **Key Findings/Impact:** Researchers concluded the Dynamic Handheld Survey Tool is a feasible, efficient instrument for capturing complex information in real time in the clinical work context. The significance of this research is that understanding the factors in the clinical work environment that affect frontline clinicians will better inform the design of interventions to reduce errors. Generalizable findings will contribute to patient safety efforts nationwide. Importantly, these efforts provide insights into the usefulness of the novel patient safety methods embodied in this proposal, and these insights will assist in future research. **Publications:** 6
David Magid **Kaiser Foundation Research Institute** Oakland, California	UC1 HS014249 [Grant] **Improving Drug Safety: Linking Lab and Pharmacy Data** 2003–2007 $930,778 Final Report	**Purpose:** Refine and implement a pharmacy alert system that uses linked data from the Pharmacy Information System and the Laboratory Information System to identify and warn pharmacists of possible errors. **Key Findings/Impact:** This study addressed medication errors and provided a realistic estimate of intervention effects in other settings via multiple projects. The implications of these projects for Kaiser Permanente Colorado are improved patient safety and clinical outcomes and reduced costs due to fewer adverse medication-related events. The projects have improved communication and collaboration among pharmacists, physicians, laboratory personnel, call center staff, and patients. All the interventions have become part of routine clinical practice in Colorado. **Publications:** 7

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Grace Kuo **University of California, San Diego** San Diego, California	K08 HS014552 [Grant] **Safe Use of Medications in Primary Care Practices** 2005–2010 $522,162	**Purpose:** Identify exemplary methods and exemplars for medication reconciliation (e.g., capturing and resolving discrepancies between the medications actually being taken and those recorded in patients' medical records). **Key Findings/Impact:** A final report was not available, but at least six publications were supported by this project. Three of them investigated functional health literacy and medication name recall or physician use of the electronic medical record (EMR) to print medication information. One described the results of a systematic review that confirmed the prevalence of medication discrepancy was high in ambulatory care and higher in primary care settings. Effective strategies for medication reconciliation included the use of pharmacists, letters, a standardized practice approach, and partnership between providers and patients. Future studies were recommended to investigate potential cost-savings from medication features of the EMR. Two publications described the production of a 10-step roadmap for conducting practice-based research network projects. Medication outcomes from the study included improved medication use, increased awareness of medication counseling, decreased medication errors, and identification of best practices for medication reconciliation. **Publications:** 6
Urmimala Sarkar **University of California San Francisco** San Francisco, California	P30 HS023558 [Grant] **Building an Ambulatory Patient Safety Learning Laboratory for Diverse Populations (ASCENT)** 2014–2018 $3,946,664 Final Report	**Purpose:** This Patient Safety Learning Lab (PSLL) had multiple projects, including improving patient comprehension of prescription instructions and reducing ADEs through standardized medication labeling and improved provider workflows in safety-net healthcare settings. **Key Findings/Impact:** According to the final report, this PSLL project demonstrated that implementing the Universal Medication Schedule (UMS) improved medication adherence and safety across multiple pharmacies in the San Francisco Health Network. UMS was successfully integrated into pharmacy software at Laguna Honda Hospital, Behavioral Health Services, and Jail Health. This led to increased medication adherence, with 75 percent of patients correctly following prescribed regimens compared to 72 percent in the control group. Additionally, a network-wide provider survey (n=212) revealed 97 percent support for UMS implementation, indicating strong acceptance among healthcare professionals. However, the San Francisco General Hospital outpatient pharmacy faced technical barriers in modifying its dispensing software, leading to suboptimal implementation. Pharmacists also raised concerns about patient confusion, which prompted additional provider engagement and education. Despite these challenges, the transition to Epic, the network's new EHR system, facilitated the long-term sustainability of UMS by making standardized medication labeling a default practice. The ASCENT project demonstrated that structured, technology-driven interventions can enhance medication safety, reduce ADEs, and improve adherence, particularly in safety-net healthcare systems serving vulnerable populations. **Publications:** 46

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Jinoos Yazdany **University of California San Francisco** San Francisco, California	R01 HS024412 [Grant] **ASPIRE: Advancing Safety Process Innovation in Rheumatology** 2015–2018 $1,444,344 Final Report	**Purpose:** Characterize ambulatory medication safety events related to high-risk immunosuppressive drugs and use these data to develop electronic quality measures (eMeasures) to monitor and improve care. **Key Findings/Impact:** This project generated new epidemiologic evidence of patient safety risks and adverse events for drugs that are increasingly used by those with autoimmune diseases. Two eMeasures, related to screening for latent infections and hydroxychloroquine dosing, were developed and are now part of the Centers for Medicare & Medicaid Services Quality Payment Program. In addition, these patient safety eMeasures were successfully implemented nationally in RISE, a Qualified Clinical Data Registry used for federal reporting and practice improvement by U.S. rheumatologists. **Publications:** 32
Tina Hernandez-Boussard and Catherine Mills Curtin **Stanford University** Stanford, California	R01 HS027434 [Grant] **Identifying Optimal Pain Management for Elders** 2021–2026 $393,732	**Purpose:** Validate risk-stratification tools derived from real-world evidence to identify older patients at high risk for adverse pain outcomes after surgery, which can reduce prescribed opioids circulating in the community—a key to curbing the opioid epidemic. **Key Findings/Impact:** This project is ongoing, and a final report is not available yet. In an early study, researchers conducted a systematic literature review to further identify quality measures in research publications after searching three databases: The National Quality Forum Quality (NQF) Positioning System, AHRQ Quality Indicators, and Centers for Medicare & Medicaid Services Measures Inventory Tool. Researchers identified 19 pain management quality measures from the quality measure databases, and NQF endorsed 5. The NQF measures were not specific to postoperative pain management. Three of the non-endorsed measures were specific to postoperative pain. Researchers concluded there is a great need for more rigorous evidence and widely endorsed postoperative pain quality measures to guide best practices. **Publications:** 5
Jinoos Yazdany **University of California San Francisco** San Francisco, California	R01 HS028024 [Grant] **Advancing Safety Process Innovation in Rheumatology (ASPIRE)** 2022–2027 $397,229	**Purpose:** Develop and disseminate the first implementation toolkit to improve patient safety for high-risk immunosuppressive drugs. **Key Findings/Impact:** This project is ongoing until April 30, 2027, and no final report is available yet. However, this grant has two published articles to date. One is a review of publications that assess opioid use in patients with inflammatory rheumatic disease. Researchers found high use of opioids in patients, although they found little evidence to support the efficacy of their use for pain control. In addition, evidence was found showing their use causes adverse events. The other article describes a study that assesses factors among severe COVID-19 symptoms in patients with psoriasis, psoriatic arthritis, and axial spondylarthritis. Researchers found that older age, male sex, comorbidity burden, higher disease activity, and glucocorticoid use were associated with more severe symptoms. **Publications:** 7

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
COLORADO		
Katherine Jones **University of Colorado Denver** Denver, Colorado	U18 HS011093 [Grant] **Improving Pain Management in Nursing Homes** 2000–2004 $1,583,029 Final Report	**Purpose:** Develop and test a multifaceted educational and behavioral intervention to improve nursing home (NH) pain management practices. **Key Findings/Impact:** The intervention was partially successful in improving NH pain practices. Applied nursing knowledge improved, while attitudes remained unchanged in treatment homes. Residents experienced less constant pain but reported the same pain intensity. Prescribing practices improved over time, as did documentation of pain assessments. Staff and administrative turnover and leadership style influenced intervention implementation. **Publications:** 10
Wilson Pace **University of Colorado Denver** Denver, Colorado	R18 HS017886 [Grant] **Improving Medication Management in Ambulatory Care** 2008–2011 $891,952	**Purpose:** Improve the safety culture of the ambulatory care clinics of University of Colorado Hospital using errors in medication management as the learning substrate. **Key Findings/Impact:** A final report was not available, and publications could not be found. **Publications:** 0
CONNECTICUT		
Sarwat Chaudhry **Yale University** New Haven, Connecticut	P30 HS023554 [Grant] **Yale Center for Healthcare Innovation, Redesign and Learning (CHIRAL)** 2014–2018 $3,998,061 Final Report	**Purpose:** This PSLL had multiple projects, including efforts to reduce delays, errors, and communication gaps in high-risk care transitions and ensure timely administration and appropriate management of critical medications. **Key Findings/Impact:** According to the final report, this project implemented multiple interventions to improve medication safety during interhospital transfers (IHT), intrahospital transfers, and hospital-to-skilled nursing facility (SNF) transitions. A key focus was on reducing delays in critical medication administration, particularly for patients with nontraumatic intracranial hemorrhage. The intervention led to a 44.6 percent reduction in time to anticoagulant reversal, minimizing the risk of hemorrhagic complications. Blood pressure management also improved, with effective BP treatment rates increasing from 29 to 63 percent, helping prevent further neurological deterioration. Additionally, structured handoff processes for intensive care unit-to-general medicine transfers led to a 10.1 percent reduction in adverse medication-related events within 48 hours post-transfer, indicating better medication continuity and early detection of potential issues. However, hospital-to-SNF transitions showed no significant reduction in 30-day readmissions, suggesting that further systemic improvements are needed to sustain medication safety beyond hospital discharge. Overall, the findings highlight the importance of timely medication administration, structured communication, and standardized clinical guidelines in reducing medication-related errors and improving patient outcomes. **Publications:** 34

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
DISTRICT OF COLUMBIA		
Julia Lear **George Washington University** Washington, DC	R13 HS014208 [Grant] **Improving Quality in Medication Management in Schools** 2003–2005 $45,921 Final Report	**Purpose:** Examine the health safety and quality aspects of medication management for children in school settings. **Key Findings/Impact:** Smaller workshop discussions examined the challenges to reducing risk in medication management in schools. Overall, this project had three important outcomes. First, the issues associated with medication management in schools were brought together, evaluated by a broad group of stakeholders and experts, discussed by a broader group of conferees, and refined into a document endorsed by the participants. After the conference, the proceedings and the recommendations similarly were reviewed, edited, and endorsed by the 30 participants. The proceedings were published by the Center for Health and Health Care in Schools. By spring 2005, 2,500 copies had been mailed or distributed at conferences to key leaders in child health quality and in school health. In addition, the report was posted on the Center website, where a larger number of unique visitors viewed the document. Although not anticipated in the original grant application, concerns registered by conference participants on the specific issue of psychotropic drugs at school led the Center to prepare a fact sheet, "Psychotropic Drugs and Children: Use, Trends, and Implications for Schools." This publication has been well received by state policymakers and building-based school nurses. The Center has mailed out 4,400 copies of the fact sheet, and 23,134 visitors have downloaded or viewed it from the Center website. **Publications:** 2
FLORIDA		
Earlene Lipowski **University of Florida** Gainesville, Florida	R13 HS016844 [Grant] **Embracing the PBRN Model To Improve the Medication Use Process** 2007 $47,200 Final Report	**Purpose:** Bring together faculty researchers and clinicians from multiple disciplines to consider practice-based research networks (PBRNs) in pharmacy settings as a way to improve medication use. **Key Findings/Impact:** The first round of discussion groups identified actions needed to form a PBRN for improving medication use: 1. Establish relationships with key stakeholders to further PBRN development, which involves establishing relationships with key stakeholders and together creating a working definition of the desired PBRN. 2. Develop a rigorous and robust PBRN research program of study with the aim of improving patient care. 3. Empower and educate pharmacists for participation in practice-based research that would require forming a resource center for the PBRN, acquiring tools that facilitate collaboration, identifying and sharing best practices, and conducting the education and training needed to support research. 4. Engage patients in practice-based research by building personal relationships with them and removing barriers to their participation in research. Within 6 months of the conference, PBRN development activity was reported by conference participants from the University of Colorado, Iowa, Connecticut, Wisconsin, and Texas Tech. Two institutions already affiliated with the PBRN in upstate New York, University at Buffalo and Albany College of Pharmacy, continued their efforts. The Virginia Commonwealth Pharmacy Education and Research Network officially registered as a PBRN with AHRQ. **Publications:** 10

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Nisaratana Sangasubana **Nova Southeastern University** Fort Lauderdale, Florida	R03 HS016801 [Grant] **The Elderly and Over-the-Counter (OTC) Labeling Information: A Randomized Controlled Experiment Test** 2007–2010 $61,135 Final Report	**Purpose:** Develop a questionnaire to test the effects of over the counter (OTC) medication risk labeling information on older consumers' overall risk perceptions of using OTCs and determine their likelihood of using different sources for additional information beyond the label. **Key Findings/Impact:** Participants reacted favorably to the survey topic and design. However, the questionnaire needed to be redesigned because the subjects had difficulty with (1) imagining themselves in the scenarios, (2) recalling information, (3) distinguishing between different risk manipulations, and (4) understanding labeling terminology inconsistent with words used by healthcare professionals. Researchers concluded it is critical to design questionnaires that address the needs of older subjects. The study design for questionnaire implementation should also be tailored to the needs of older subjects. Questionnaires should always be pretested in age-specific groups to evaluate subjects' understanding before actual field distribution. **Publications:** 1
Yu-Jung Wei **University of Florida** Gainesville, Florida	R03 HS027230 [Grant] **Prescription Opioid Use Trajectories and Risk Factors Associated With Opioid-Related Hospitalizations in Older Adults** 2019–2021 $99,999 Final Report	**Purpose:** Assess high-risk prescription opioid use patterns and risk factors associated with opioid-related adverse events (ORAEs), including opioid misuse, opioid use disorder, and opioid overdose among older adults. **Key Findings/Impact:** The risk of ORAEs increased with increasing prescribed opioid dose and was associated with receipt of duplicated opioids, chronic opioid use, and co-use of opioids with other central nervous system medications. Significant predisposing factors of ORAEs included mental health conditions, cardiovascular diseases, and kidney disease. Significant prognostic factors associated with subsequent increased risk of ORAEs among older adults included newly diagnosed injury, respiratory infection, and infection due to nonsterile opioid injection after opioid initiation. Regular monitoring of these events after initiating prescription opioids may help identify older opioid users at risk for ORAEs. **Publications:** 6
GEORGIA		
Mark Williams **Emory University** Atlanta, Georgia	U18 HS015882 [Grant] **Hospital Patient Safe-D(ischarge): Discharge Bundle for Patients** 2005–2007 $466,664	**Purpose:** Implement a "discharge bundle" of patient safety interventions advocated by the Joint Commission on Accreditation of Healthcare Organizations, the National Quality Forum, and AHRQ. Interventions included medication reconciliation, discharge education, and a post-discharge continuity check by a clinician. **Key Findings/Impact:** A final report was not available. One publication is a commentary that describes several salient but dysfunctional moments in the discharge process and provides suggestions for improvement. **Publications:** 1

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Elizabeth Vaughan **Emory University** Atlanta, Georgia	R18 HS024499 [Grant] **EQUIPPED (Enhancing Quality of Prescribing Practices for Older Adults Discharged From the Emergency Department)** 2016–2019 $1,527,584 Final Report	**Purpose:** Evaluate adaptation in non-Veterans Affairs health systems of the EQUIPPED program, an innovative quality improvement initiative developed within the Veterans Health Administration to reduce potentially inappropriate medication (PIM) prescribing to adults age 65 years and older discharged from the emergency department. **Key Findings/Impact:** The EQUIPPED program was successfully implemented in three health systems (Grady Health System in Atlanta, GA; Mount Sinai Health System in New York, NY; and Duke Health System in Durham, NC). Assessment of the sequential approach yielded an implementation package that can be vetted, piloted, evaluated, and finalized for large-scale dissemination in community-based settings. Evaluation of monthly PIM prescribing rates at each implementation site showed a sustained trend toward improved prescribing, approaching the monthly target of 5 percent PIMs or less. Evaluation of site and provider-level factors impacting EQUIPPED implementation was to be combined with a second AHRQ-funded spread/scale project. **Publications:** 3
ILLINOIS		
Bruce Lambert **University of Illinois Chicago** Chicago, Illinois	R01 HS011609 [Grant] **Auditory Perception of Drug Names: Neighborhood Effects** 2003–2008 $1,700,525 Final Report	**Purpose:** Minimize the incidence of name confusion errors by developing an empirically validated, user-friendly software tool that healthcare providers and patients can use to screen proposed drug names against databases of existing drug names. **Key Findings/Impact:** Overall, researchers found that high-quality drug name retrieval systems can be designed using techniques from computer science and computational linguistics. This project's experiments validated some of these measures against human performance in an auditory perception task. Findings suggest that no single ranking method will perform as well as a method that intelligently combines multiple ranking methods. Systems such as the one designed in this study are used by the Food and Drug Administration (Phonetic and Orthographic Computer Analysis program) to analyze proposed new drug names. These systems need continual updating and refinement. By the end of 2008, researchers had planned to release a test collection of drug names and relevance judgments that could be used to evaluate current and future retrieval systems. Researchers believe the output of computerized drug name searches should be used as input to a panel of human experts when drugs are being evaluated for confusability. **Publications:** 6
Gary Noskin **Northwestern University at Chicago** Chicago, Illinois	U18 HS015886 [Grant] **Medications at Transitions and Clinical Handoffs (MATCH)** 2005–2007 $575,480 Final Report	**Purpose:** Implement a process for medication reconciliation at Northwestern Memorial Hospital and evaluate the intervention's effectiveness. **Key Findings/Impact:** Researchers found that medication discrepancies upon admission were common. Preliminary data suggest that patients on an increased number of medications are at risk for medication reconciliation failures. The presence of a medication list may help prevent discrepancies in patients' medication histories. Also, early identification and correction of medication reconciliation failures may mitigate or prevent patient harm. The results are consistent with the findings of other researchers and support the patient safety benefits of reconfirming medication histories and performing reconciliation. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Bruce Lambert **University of Illinois at Chicago** Chicago, Illinois	U18 HS016973 [Grant] **Tools for Optimizing Prescribing, Monitoring, and Education** 2007–2012 $3,937,671 Final Report	**Purpose:** Improve patient safety by developing and refining tools for safer medication use. **Key Findings/Impact:** Researchers had varying levels of success and productivity across the five project areas. They were most successful and productive in the work on formulary decision making, drug utilization review, and lab-pharmacy linkages and less so in pharmacoeconomics and N-of-1 clinical trials. **Publications:** 27
Northwestern Memorial Hospital Chicago, Illinois **Island Peer Review Organization** Lake Success, New York	HHSA290200900013C [Contract] **Medications at Transitions and Clinical Handoffs (MATCH) Toolkit for Medication Reconciliation** 2009–2013	**Purpose:** Develop a toolkit based on the Medications at Transitions and Clinical Handoffs (MATCH) web site. **Key Findings/Impact:** A final report was not available; however, the MATCH Toolkit for Medication Reconciliation is on the AHRQ website. The toolkit provides a step-by-step guide to improving the medication reconciliation process and is divided into seven components to assist with improvement: • Building the Project Foundation: Gaining Leadership Support Within the Organization • Building the Project Foundation: Project Teams and Scope • Developing Change: Designing the Medication Reconciliation Process • Developing and Pilot Testing Change: Implementing the Medication Reconciliation Process • Education and Training • Assessment and Process Evaluation • High-Risk Situations for Medication Reconciliation The appendix functions as a work plan for facilities to implement medication reconciliation according to the MATCH principles. **Publications:** 1
Bruce Lambert **University of Illinois Urbana-Champaign** Urbana-Champaign, Illinois	U19 HS021093 [Grant] **Tools for Optimizing Medication Safety (TOP-MEDS)** 2011–2017 $4,325,152 Final Report	**Purpose:** Develop and test tools in four areas: statistical methods for studies of drug safety and effectiveness, opioid prescribing for acute pain, prevention and detection of drug name confusion, and patient-centered drug information. **Key Findings/Impact:** Researchers had varying success across the projects. They were most successful in their statistical methods and drug name confusion projects. They built and tested an opioid simulator and demonstrated its effects as a teaching tool. Similarly, data from the health literacy randomized trial was still being analyzed at the project's end, but preliminary results suggested a small or null patient benefit. **Publications:** 23

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Danielle McCarthy **Northwestern University** Chicago, Illinois	R18 HS023459 [Grant] **EHR Based Medication Complete Communication Strategy To Promote Safe Opioid Use** 2014–2017 $1,466,127 Final Report	**Purpose:** Evaluate the effect of an Electronic Medication Complete Communication (EMC^2) Opioid Strategy on patients' safe use of and knowledge about opioids. **Key Findings/Impact:** Researchers found that the intervention improved the safety of opioid dosing and increased patient knowledge. It also showed low cost with minimal workflow interruption; however, researchers could not show a significant impact of the intervention on patients' actual safe use of their medications. This lack of impact may have been partly due to the low frequency of "maximal dosing" of the medications at home or related to the fidelity with which the Take-Wait-Stop bottles were filled in the community pharmacies. Researchers also found that the SMS text message portion of the intervention was possibly the most powerful for imparting knowledge. Patients who received the messages were more likely to plan to dispose of their pills. In addition, they had greater awareness of use precautions related to Tylenol and benzodiazepines. **Publications:** 10
Amisha Wallia **Northwestern University** Chicago, Illinois	R18 HS026143 [Grant] **Implementation and Testing of a Diabetes Discharge Intervention To Improve Safety During Transitions of Care** 2019–2024 $1,495,907	**Purpose:** Integrate and implement the Diabetes Discharge Toolkit to improve the quality and safety of the transition of type 2 diabetes mellitus (DM) care from hospital to home for patients newly prescribed insulin. **Key Findings/Impact:** According to the final report, researchers created a culturally competent diabetes knowledge assessment tool and adapted the toolkit for both in-person and remote delivery during the COVID-19 pandemic. The pilot randomized controlled trial achieved high participation (60%, N=62) despite patients experiencing significant stress and social needs. Key findings included strong patient acceptance of the toolkit and continuous glucose monitoring technology, with toolkit usage maintained throughout follow-up periods and website engagement actually increasing at 3 months. The study revealed high rates of hyperglycemia but less frequent severe hypoglycemia, demonstrating the toolkit's potential effectiveness in supporting safe transitions from hospital to home for insulin-dependent patients. **Publications:** 5
Jonah Stulberg **Northwestern University** Chicago, Illinois	R18 HS027331 [Grant] **Preventing Opioid Misuse Through Safe Opioid Use Agreements Between Patients and Surgical Providers (PROMISE ME)** 2020–2024 $448,522 Final Report	**Purpose:** To test whether the use of contractual agreements between patients and surgical providers can improve safe opioid use to prevent misuse and opioid-related harm. **Key Findings/Impact:** According to the final report, this project evaluated the effectiveness of a safe opioid use agreement in surgical care on patients' opioid disposal, use, and storage behaviors. A randomized controlled trial (RCT) was implemented across three surgical clinics affiliated with UTHealth Houston, enrolling 450 patients between December 2022 and October 2023. Of these, 359 underwent surgery and completed post-operative follow-up, and 254 were prescribed opioids. However, only 143 patients (32%)—who had leftover opioids at follow-up—were included in the final analysis. The primary outcome, opioid disposal rate within 25-40 days post-surgery, was 9.1 percent overall. Secondary outcomes, including safe storage and disposal methods, showed no significant difference between groups. Despite the intervention's structured implementation, the opioid use agreement was found to be ineffective in improving opioid disposal or safe use behaviors. Factors such as a high dropout rate, differences in patient populations between study sites, and a general reduction in opioid prescribing during the study period may have influenced results. Although the agreement did not yield the expected outcomes, this study represents the first randomized clinical trial integrating an opioid use agreement into surgical care, contributing valuable insights for future implementation research. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Howard Kim **Northwestern University** Chicago, Illinois	R01 HS027426 [Grant] **A Cluster-Randomized Trial of the Northwestern Embedded Emergency Department Physical Therapy (NEED-PT) Protocol for Acute Low Back Pain** 2020–2025 $1,844,032	**Purpose:** Offer emergency department (ED) patients with back pain ED-initiated physical therapy to improve functioning and reduce the use of opioids and diagnostic imaging. **Key Findings/Impact:** This project is ongoing, and no final report is available yet. However, in a study published in 2023, the researchers conducted focus group discussions and individual interviews among patients visiting an urban academic ED for acute low back pain. They recruited participants from an ongoing prospective study of 101 patients receiving either ED-initiated physical therapy or usual care. The researchers conducted four focus group discussions among 18 participants (median age 46.5 years, 66.7% women, 61.1% Black) and individual interviews with 27 participants (median age 45 years, 55.6% women, 44.4% White). Five summary themes emerged: (1) participants decided to seek emergency care for low back pain due to severe pain, resulting disability, and fears about a catastrophic diagnosis; (2) participants had various goals from their ED visit but emphasized pain control; (3) participants were reluctant to use pain medications but acknowledged their benefit; (4) participants saw a number of benefits from direct access to a physical therapist in the ED; and (5) participation in physical therapy helped recovery, but pain was a barrier to performing exercises. These themes may be used to inform a more patient-centered emergency care experience and contextualize quantitative research findings on ED care for low back pain. **Publications:** 6
Carolyn Foster and Nicole Werner **Lurie Children's Hospital of Chicago** Chicago, Illinois	R18 HS029638 [Grant] **The SafeCare@ Home4Kids Learning Lab: Designing Safer Healthcare at Home for Children** 2023–2027 $490,128	**Purpose:** Bring together experts, including diverse families, for a long-term, equity-focused collaborative PSLL that codesigns ways to identify, communicate, and prevent safety events at home in children with complex medical conditions. **Key Findings/Impact:** This PSLL project is ongoing until July 31, 2027. According to annual progress reports, the project successfully established a multidisciplinary PSLL that includes researchers, healthcare professionals, and diverse family advocates. The team conducted its first major event, "Designing Safer Healthcare at Home for Children," where stakeholders identified key patient safety priorities. In Aim 2, researchers developed and refined interview guides, launched qualitative data collection, and interviewed parents about device-related safety concerns. Additionally, the Lab team conducted data analysis on over 700 de-identified home healthcare safety incidents across 12 states, with ongoing coding to categorize errors and adverse events. Despite initial delays due to a 2-month cybersecurity disruption at Lurie Children's Hospital, the project remains on track. Recruitment for Aim 2 is progressing, and findings from these early efforts will inform the codesign of a safety toolkit in Aim 3. **Publications:** 0

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INDIANA		
Christopher Callahan **Indiana University** Indianapolis, Indiana	P30 HS024384 [Grant] **Brain Health Patient Safety Learning Laboratory (Brain Safety Lab)** 2015–2019 $3,998,100	**Purpose:** This PSLL had multiple projects, including efforts to reduce medication-related harm in older adults by implementing interventions to deprescribe high-risk medications and enhance medication management in primary care settings. **Key Findings/Impact:** According to the final report, this PSLL project evaluated two medication safety interventions with mixed results. A cluster-randomized trial of an EHR decision-support system for deprescribing anticholinergic medications in older adults showed limited effectiveness, with providers opening the order set in only 15% of alerts and completing medication changes in just 1.2% of cases, resulting in no significant reduction in target medication use. Meanwhile, a pilot study using continuous glucose monitoring (CGM) in older adults with diabetes revealed that 73% of participants experienced at least one hypoglycemic event over two weeks, with 42% recording clinically significant low glucose values below 54 mg/dL. However, implementation challenges included premature sensor dislodgement (24%) and low adherence to self-reporting prompts. While real-time monitoring successfully identified previously undetected hypoglycemia, findings from both interventions highlight the need for improved technology usability, better patient adherence strategies, workflow integration, and potentially stronger behavioral nudges or policy-driven initiatives to meaningfully impact medication safety in clinical practice. **Publications:** 29
IOWA		
James Levett **Kirkwood Community College** Cedar Rapids, Iowa	U18 HS015830 [Grant] **Improving Warfarin Management in Competitive Healthcare*** 2005–2008 $607,031 Final Report	**Purpose:** Create a community model of care delivery and patient safety using International Organization for Standardization (ISO) 9001 principles as a framework of cooperation at a community anticoagulation (CAT) clinic. **Key Findings/Impact:** Eight ISO executive and four staff training sessions were held. The CAT clinic developed an electronic medical record/database, enrolled 250 patients, collected data on numerous metrics, and showed improved patient care. The percentage of International Normalized Ratios (INRs) in range improved from 49 to 65 percent. Nurse contacts with a physician decreased from a high of 20 percent to 1 percent; and percentage of INRs above 5 decreased from 3 to 1 percent. The CAT clinic developed a "compliance assessment" tool measuring warfarin compliance. The clinic's compliance score increased from 97 to 99 percent. The CAT clinic tracks complications such as bleeding or clotting and whether these require emergency room treatment/hospital admission. Bleeding/clotting events requiring hospital admission remain below 0.02 percent of all patient visits. Cedar Rapids Healthcare Alliance (CRHA) was created to oversee the CAT clinic and other community projects. The CRHA became 501 I(3) certified in July 2007. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Amany Farag **University of Iowa** Iowa City, Iowa	R18 HS029292 [Grant] **Assuring Medication Safety in K-12 Schools: Implementing and Evaluating the Electronic School Medication Administration Record (E-SMAR) System** 2023–2026 $330,229	**Purpose:** Implement eSMAR in a real-world setting (grade schools) and evaluate the usability and effectiveness of eSMAR on medication administration and documentation in schools. **Key Findings/Impact:** This project is ongoing until March 31, 2026, and no final report or publications are available yet. **Publications:** 0
KANSAS		
Paul Sharek **Child Health Corporation of America** Shawnee Mission	U18 HS013698 [Grant] **Implementing Pediatric Patient Safety Practices** 2002–2006 $1,144,950	**Purpose:** Develop, evaluate, and implement national quality and safety measures for pediatric healthcare, focusing on medication safety, pain management, and patient safety improvements through evidence-based practices and technological integration. **Key Findings/Impact:** A final report was unavailable. This project, the Child Health Accountability Initiative (CHAI), was a collaboration of approximately two dozen prominent children's hospitals in the United States. To date, there is limited publicly available information about CHAI's activities or existence beyond that period. **Publications:** 0
MARYLAND		
Diane Cousins **U.S. Pharmacopeia** Rockville, Maryland	R13 HS016515 [Grant] **Medication Error Reporting Systems: Challenges, Lessons, Future Direction** 2006–2007 $49,000	**Purpose:** Explore how hospitals experienced in medication error reporting have used medication error reports to improve patient safety through a better understanding of how such reported information is used, which in turn encourages patient safety interventions at the health facility level. **Key Findings/Impact:** This conference resulted in important information regarding how to enhance the value obtained from patient safety reporting systems. Most efforts focused on encouraging caregivers to submit reports, with less attention given to how best to analyze these data, how to prioritize improvement efforts based on the data, or how best to evaluate whether adverse event reporting systems are associated with improved patient safety. The conference participants also offered insights that will prove valuable in the creation of the proposed national patient safety database and for improving local reporting systems that will submit information to the national system. Conclusions from discussions of the conference are directly applicable to AHRQ's mission to improve the quality and safety of healthcare for all Americans and are relevant to AHRQ's efforts to develop strategies for reducing errors and improving patient safety. Results from this conference should be especially useful as AHRQ administers the activities mandated by the Patient Safety and Quality Improvement Act of 2005, including the network of patient safety databases. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
David Bundy **Johns Hopkins University** Baltimore, Maryland	R03 HS016774 [Grant] **Pediatric Medication Safety** 2007–2009 $100,000 Final Report	**Purpose:** Identify medications and situational and patient characteristics associated with high-harm medication errors in selected pediatric conditions that pose a high healthcare burden and systematically explore the causes of these errors. **Key Findings/Impact:** Researchers concluded that harmful pediatric medication errors were infrequently reported in the MEDMARX data. Nonetheless, the data generally supported the hypothesis that nonharmful medication errors would have characteristics similar to harmful errors. This finding suggests that, similar to the aviation industry's examination of "near-miss" events, the medical and pharmaceutical industries should consider studying nonharmful medication errors, of which many more are reported, to better understand and prevent harmful medication errors. The researchers also found that the same types of system failures that plague inpatient medical settings (e.g., failure to discriminate between two look-alike/sound-alike medications) are present in outpatient settings. Remedying these system failures in outpatient settings is likely more complex than inpatient failures, since there is no single overlying structure across which to implement system changes as there might be within an inpatient setting. **Publications:** 6
Mae Thamer **Medical Technology and Practice Patterns** Bethesda, Maryland	R03 HS020572 [Grant] **Do Safety Warnings Change Prescribing Among the U.S. Dialysis Population?** 2011–2013 $99,869 Final Report	**Purpose:** In March 2007, the Food and Drug Administration (FDA) issued a black box warning to use the lowest possible erythropoiesis-stimulating agent (ESA) doses for treatment of anemia associated with renal disease. The goal of this study was to determine if a change in ESA use was observed among U.S. dialysis patients after the warning. **Key Findings/Impact:** Researchers concluded ESA therapy had been both profitable for providers and controversial regarding benefits for nearly two decades. The extent to which an FDA black box warning highlighting important safety concerns influenced use of ESA therapy among nephrologists and dialysis providers was unknown. This study found no evidence of changes in ESA prescribing for the overall dialysis population resulting from an FDA black box warning. **Publications:** 2
Adam Sapirstein **Johns Hopkins University** Baltimore, Maryland	P30 HS023553 [Grant] **Transdisciplinary Learning Lab to Eliminate Patient Harm and Reduce Waste** 2014–2018 $3,968,056 Final Report	**Purpose:** This PSLL had multiple projects, including efforts to integrate automation, interoperability, and predictive analytics to reduce medication errors and improve administration accuracy in ICU settings. **Key Findings/Impact:** According to the final report, this PSLL's Smart Agent system, an automated bidirectional infusion pump, significantly improved medication administration by reducing manual dosing of insulin. In a controlled study with 20 critical care nurses performing 120 simulated scenarios, the Smart Agent system resulted in zero medication errors, whereas the manual system had a 16.6% error rate (20 errors). Additionally, nurses completed insulin adjustments 33.08 seconds faster per trial when using the Smart Agent, reducing delays in critical medication administration. The system also lowered clinician workload scores (NASA-TLX scale) from 10.23 to 6.33, improving efficiency without compromising safety. Another key intervention was interoperability, which integrated infusion pumps with EHRs, allowing real-time medication tracking and reducing documentation errors. The project's Susceptibility Index further predicted high-risk patients prone to adverse drug events, using machine learning models that achieved over 80% accuracy in identifying patients at risk for ICU-related medication complications. These findings underscore the importance of automation, interoperability, and predictive analytics in reducing medication errors, improving efficiency, and enhancing overall patient safety in ICU settings. **Publications:** 8

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Stephen Berry **Johns Hopkins University** Baltimore, Maryland	R01 HS024079 [Grant] **Hospital HIV/HCV Support Team To Improve Medication Safety and Engagement in Care** 2015–2021 $1,210,121 Final Report	**Purpose:** Assess whether an HIV/hepatitis C virus (HIV/HCV) Support Team (HST) could reduce inpatient medication errors and improve engagement in outpatient HIV care for people living with HIV (PLWH). **Key Findings/Impact:** The results reflect a national shift to simpler, safer HIV regimens and indicate the HST was not effective at increasing postdischarge care engagement. The project results help show major changes in the field of HIV medicine. These include a dramatic shift toward single-tablet regimens with extremely low rates of side effects and drug interactions and a progressive (and highly desirable) shift toward more PLWH coming into care and achieving viral suppression on these regimens. Therefore, the project team discontinued plans for an online HST toolkit and for a cost-effectiveness analysis. Despite the shifts in care, the study's electronic medical record (EMR) alert for PLWH was 100 percent sensitive (82–100%) with a positive predictive value of 83 percent (81–85%). The EMR alert that facilitated the interventional study was novel and successful, and researchers have submitted results of an analysis of its accuracy as well as a description of lessons learned in the process of creating it. The project team has also implemented and started to evaluate a similar alert for HCV. **Publications:** 2
Angela Smith **American Urological Association** Linthicum, Maryland	R13 HS026679 [Grant] **American Urological Association's Quality Improvement Summit: Opioid Stewardship in Urology** 2018–2019 $35,100 Final Report	**Purpose:** Convene a multidisciplinary panel of speakers to take part in a collaborative effort dedicated to reducing the impact of urologic surgery and subsequent pain management strategies on the current opioid epidemic. **Key Findings/Impact:** Presentations facilitated information exchange between a broad range of clinicians and educated urology practitioners about the latest research and practices that can reduce opioid prescribing and effectively manage patient postoperative pain. This type of exchange gave attendees the knowledge needed to take first steps toward accelerating adoption of evidence-based practice. In addition, the open format and multidisciplinary approach promoted partnerships that could facilitate physician-led opioid stewardship programs and research, thereby enhancing the quality and safety of medical care and improving the lives of patients, their families, and their communities. **Publications:** 1
Sadaf Kazi **MedStar Health Research Institute** Hyattsville, Maryland	R03 HS027510 [Grant] **A Memory-Based Approach to Reducing Medication Errors** 2020–2023 $71,223 Final Report	**Purpose:** Use a cognitive psychology-based approach, with a focus on prospective memory (PM), to identify PM demands during medication administration. **Key Findings/Impact:** Researchers found 2 percent of total warfarin orders placed had nonoptimal International Normalized Ratio (INR) values with a gap of more than 24 hours from previous INR measure, indicating potential error. These potential errors were located on different units and facilities, demonstrating the need for systematic solutions and spreading best practices across the healthcare organization. Researchers concluded that PM tasks could be anticipated during medication planning; however, several PM tasks also arise dynamically depending on changes to the patient's condition or because of changing nurse or unit workflow priorities. PM tasks that arise during planning are amenable to being encoded as reminders on the electronic health record and nursing paper tools ("nurse brains"). Still, there is a need to develop tools to improve support for PM tasks that arise dynamically. The medication administration workflow in inpatient settings is complex and encompasses a variety of PM tasks. PM failure is likely to have adverse patient safety implications because of heightened risk of medication administration errors. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Brandyn Lau **Johns Hopkins University** Baltimore, Maryland	R18 HS027415 [Grant] **Disseminating a Patient Centered Venous Thromboembolism Prevention Bundle** 2020–2026 $400,000	**Purpose:** Empower patients to make informed decisions about their venous thromboembolism (VTE) preventive care, increase VTE prophylaxis medication adherence, and improve delivery of patient-centered, defect-free VTE prevention to hospitalized patients. **Key Findings/Impact:** This project is ongoing until February 28, 2026, and no final report is available yet. However, one systematic review has been published reporting on evidence for ambulation as a prophylaxis for VTE in hospitals. Researchers concluded that ambulation should not be considered an adequate prophylaxis for VTE, nor an adequate reason to discontinue pharmacologic prophylaxis for VTE during a patient's hospital admission. **Publications:** 3
Raj Ratwani **MedStar Health Research Institute** Hyattsville, Maryland	R18 HS029117 [Grant] **Safe and Equitable Telehealth for Chronic Conditions (SafE-T C2) Learning Laboratory** 2022–2026 $1,483,993	**Purpose:** Identify and mitigate medication safety risks in telehealth by analyzing patient safety event data, optimizing EHR usability, and implementing interventions to improve medication reconciliation, adherence, and chronic disease management. **Key Findings/Impact:** This PSLL project is ongoing until September 29, 2026. According to annual progress reports to date, it has analyzed over 2,000 patient safety events, identifying critical medication-related risks in virtual care, including prescribing errors and medication reconciliation challenges. A JAMA Network Open publication from the project's EHR audit log analysis revealed how physician time spent in electronic health records during telehealth impacts medication safety. The team has developed and is currently testing a nurse practitioner-led telehealth intervention to improve post-discharge medication reconciliation and reduce readmissions among high-risk patients. The project has also identified potential EHR workflow optimizations to reduce cognitive overload and medication errors in virtual settings. Future work will expand intervention testing and integrate AI-based decision support tools to enhance medication safety in telehealth environments. **Publications:** 2
Vinciya Pandian **Johns Hopkins University** Baltimore, Maryland	R18 HS029124 [Grant] **Center for Immersive Learning and Digital Innovation: A Patient Safety Learning Lab Advancing Patient Safety Through Design, Systems Engineering, and Health Services Research** 2022–2026 $1,428,927	**Purpose:** Enhance infection control and medication safety by leveraging advanced technologies—virtual and augmented reality, robotics, and human factors engineering—to improve provider training, procedural accuracy, and the safe administration of intravenous therapies, ultimately reducing central line-associated bloodstream infection (CLABSI) rates and related mortality. **Key Findings/Impact:** This PSLL project is ongoing until September 29, 2026. According to annual progress reports to date, general findings indicate significant advancements in leveraging immersive learning technologies and systems engineering approaches to improve patient safety, particularly in preventing and managing CLABSI. An option is to develop a robot-controlled intravenous administration system to facilitate remote management of IV therapies and blood withdrawals, reducing the risk of medication errors, contamination, and healthcare worker exposure while improving adherence to infection control protocols. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Sadaf Kazi and Naveen Muthu **MedStar Health Research Institute** Hyattsville, Maryland	R18 HS029291 [Grant] **A Systems Engineering Approach to Optimize Pediatric Medication Safety** 2023–2026 $500,000	**Purpose:** Improve pediatric medication safety in the electronic health record through optimization, deployment, and testing of an assessment tool designed to identify pediatric weight-based dosing errors. **Key Findings/Impact:** This project is ongoing until March 31, 2026, and no final report or publications are available yet. **Publications:** 0
MASSACHUSETTS		
David Bates **Brigham and Women's Hospital** Boston, Massachusetts	U18 HS011169 [Grant] **Improving Safety by Computerizing Outpatient Prescribing** 2000–2003 $1,700,187	**Purpose:** Study the impact of electronic medical records and computerized prescribing in a diverse array of clinic settings associated with Partners HealthCare System and the Regenstrief Institute/Indiana University. **Key Findings/Impact:** A final report was not available. However, resulting publications pertained to the steps involved in ADE monitoring development and rule validation at large outpatient practices in Boston and Indianapolis, as well as the cost efficiency of newly developed methods for identifying ADEs and medication errors. Publications also addressed development of a computerized ADE measurement process and computerized prescribing in the ambulatory setting. **Publications:** 10
David Bates **Brigham and Women's Hospital** Boston, Massachusetts	P01 HS011534 [Grant] **Improving Medication Safety Across Clinical Settings** 2001–2007 $5,600,165 Final Report	**Purpose:** Broaden scientific knowledge about medication safety and create models of error reduction that may be generalized to other safety domains. **Key Findings/Impact:** The final report summarizes results from six studies focusing on patient safety and medication errors in various healthcare settings. Study 1 evaluated a web-based reporting system, showing promise in improving incident reporting efficiency. Study 2 revealed that medication errors and ADEs are common in pediatric ambulatory care. Study 3 examined medication errors and ADEs in psychiatric inpatient settings, providing valuable information on prevention strategies. Study 4 investigated the use of smart pumps for intravenous infusions, leading to design improvements despite not reducing serious error rates. Study 5 highlighted the prevalence and preventability of warfarin-related adverse events in nursing homes. Lastly, Study 6 assessed safety culture in hospitals, identifying problematic areas and emphasizing the importance of hospital management support for safety. Together, these studies provide crucial insights into patient safety issues and potential improvement strategies across different healthcare environments. **Publications:** 22

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Stephen Soumerai **Harvard Pilgrim Health Care, Inc.** Wellesley, Massachusetts	U18 HS012019 [Grant] **Randomized Control Trial To Reduce Prescribing Errors in Hypertension** 2001–2005 $566,695 Final Report	**Purpose:** Compare two educational interventions, group versus individual academic detailing, to reduce prescribing errors in hypertension. **Key Findings/Impact:** Researchers reported that in the first year following the intervention, the rates of diuretic or beta blocker use increased by 13.2 percent in the group detailing practices, 12.5 percent in the individual detailing practices, and 6.2 percent in the usual care practices. Compared with usual care practices, diuretic or beta blocker use was more likely in both group detailing practices and individual detailing practices. Neither intervention affected blood pressure control. Two years after this single-visit intervention, there was still a trend suggesting a persistent effect of individual, but not group, detailing, compared with usual care. Researchers also found that both individual and group academic detailing can increase the use of guideline-based treatments for hypertension. Further study is needed to understand the economic ramifications of expanding this kind of intervention to improve the care of hypertension and other chronic diseases. **Publications:** 4
Tejal Gandhi **Brigham and Women's Hospital (BWH)** Boston, Massachusetts	R01 HS014053 [Grant] **Using Barcode Technology To Improve Medication Safety** 2003–2006 $1,341,802 Final Report	**Purpose:** Conduct a randomized controlled trial to examine the impact of barcode/eMAR technology on medication transcribing and administration errors. **Key Findings/Impact:** Researchers found evidence that barcode technology improves medication safety at the level of pharmacy dispensing. The overall rates of dispensing errors and potential adverse drug events substantially decreased after bar code technology was implemented. Baseline time-motion studies showed nurses spend about 25 percent of their time on medication administration and approximately 25 percent of their time on communication, emphasizing the importance of these two processes. A pre-post time-motion workflow assessment revealed no statistically significant increase in the percentage of time spent on medication administration. Results of a nursing satisfaction survey showed meaningful and statistically significant improved satisfaction scores after the implementation of barcode technology. A cost-benefit analysis revealed that implementation of a hospital-based pharmacy barcode system for medications can result in a positive financial return on investment for the healthcare organization, as well as for society overall. **Publications:** 9

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Tejal Gandhi **Brigham and Women's Hospital** Boston, Massachusetts	R01 HS015226 [Grant] **Improving Safety and Quality With Outpatient Order Entry** 2004–2008 $1,499,401 Final Report	**Purpose:** Study the impact of integrating ambulatory computerized physician order entry (ACPOE) with an advanced clinical decision support system (CDSS) on important safety and quality domains in the ambulatory setting using randomized controlled trials. Evaluate the impact on organizational efficiency, physician workflow, and satisfaction, and perform a cost-benefit analysis. **Key Findings/Impact:** For Aim 1, the authors implemented four enhanced actionable reminders targeting performance of annual mammography, one-time bone-density screening, and diabetic testing. They found that actionable reminders did not improve receipt of overdue tests, potentially due to limitations of workflow integration. For Aim 2, the average adjusted overall time spent per scheduled patient increased but was not statistically significant. Surveys revealed that while many physicians agreed that the ACPOE improves the quality of patient care, a significant portion also found the system difficult to use and a hindrance to their personal efficiency. Another survey found an increase in the percentage of clinicians agreeing that the EHR improved quality of care, reduced medication-related errors, improved test result followup, and improved communication among clinicians. Over time, a decreasing percentage agreed that the EHR reduced the quality of patient interactions, resulted in longer patient visits, and increased time spent on medical documentation. For Aim 3, results for the cost-benefit analysis required data and analysis from Aims 1 and 2 that were not available in the final report or literature. **Publications:** 2
Jerry Gurwitz **University of Massachusetts Medical School, Worcester** Worcester, Massachusetts	R01 HS016463 [Grant] **Enhancing the Safety of Warfarin in the Nursing Home** 2006–2010 $899,931 Final Report	**Purpose:** Improve warfarin management among nursing home residents through the use of a standardized nurse-physician communication tool. **Key Findings/Impact:** Researchers concluded the use of a communication protocol based on the SBAR handoff tool modestly improved the quality of warfarin management in nursing homes, as reflected by increased time in therapeutic range. This low-technology approach may also serve as a model for improving the safety of other medications associated with high rates of preventable adverse drug events and safety for vulnerable nursing home residents at special risk for medication-related problems. The significance of this study is that it was set among 26 community-based nursing homes similar to nursing homes across the United States, making its results generalizable. Researchers also worked closely with the Clinician-Consumer Health Advisory Information Network (CHAIN) to disseminate the Warfarin Communication Toolkit. CHAIN is an online educational, informational, and resource dissemination program operated as a collaborative effort of the Centers for Education and Research on Therapeutics Educational Consortium. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Terry Field **University of Massachusetts Medical School** Worcester, Massachusetts	P20 HS017109 [Grant] **Proactive Risk Reduction in Medication Prescribing in the Ambulatory Setting** 2007–2008 $199,975 Final Report	**Purpose:** Use probabilistic risk assessment (PRA) to characterize systemic and behavioral elements that increase the risk of serious errors in prescribing and monitoring medications in the ambulatory care setting. Identify potentially high-yield and likely-to-be-successful interventions for lowering rates of preventable adverse drug events. **Key Findings/Impact:** Several interventions were spontaneously undertaken in a bottom-up fashion as teams highlighted two areas of system failure—lack of up-to-date patient contact information and high rate of patient "no shows" for laboratory tests. A system for updating patient contact information was in full flow and consistently carried out by the end of the grant. Researchers identified several themes that emerged for the PRA process: (1) lack of redundancy in the ambulatory care setting and the potential impact it may have on patient safety; (2) a need for better and more systematized communication within the clinic and between the clinic and patients; (3) ease of engaging clinicians in a probabilistic risk assessment endeavor; and (4) in an organization structured with open opportunities for bottom-up system changes, the possibility of staff participation in risk assessment activities leading directly to spontaneously generated system improvements. **Publications:** 1
Saul Weingart **Dana-Farber Cancer Institute** Boston, Massachusetts	P20 HS017123 [Grant] **Oral Chemotherapy Safety in Ambulatory Oncology: A Proactive Risk Assessment** 2007–2009 $193,952 Final Report	**Purpose:** Assess the risks associated with the oral chemotherapy medication use process in adult and pediatric ambulatory oncology and develop improvement strategies. **Key Findings/Impact:** Each stage of the medication use process poses risks to oral chemotherapy safety. Key vulnerabilities include patient education about drug handling and adverse effects; safe prescription writing; patient administration and adherence difficulties; and failure to monitor and manage toxicities. This study also demonstrated the use of failure modes and effects analysis to analyze risks across drugs within a single cancer center. Although researchers found more similarities than differences in the failure modes, effects, and mitigation strategies, the differences were meaningful and could lead to targeted interventions for certain populations. Understanding the internal process involved in prescribing, dispensing, administering, and monitoring oral chemotherapy—as well as the interfaces between them—provided a new perspective on the process and made the vulnerabilities more transparent and actionable. **Publications:** 3
Sarah Shoemaker **Abt Associates** Cambridge, Massachusetts	290-06-00011-5 [Contract] **Assessing Organizational Responses to AHRQ's Health Literacy Pharmacy Tools** 2008–2011 $400,000	**Purpose:** Understand the facilitators and barriers to the adoption and implementation of AHRQ's health literacy tools, particularly a tool to assess a pharmacy's health literacy practices. **Key Findings/Impact:** Curricular modules about health literacy can be used or adapted for lectures, seminars, laboratory classes, and other courses deemed appropriate by faculty. The modules can also be used in pharmacy experiential education, including both Introductory Pharmacy Practice Experiences and Advanced Pharmacy Practice Experiences. Finally, the curricular modules offer valuable activities and content for Pharm.D. students and pharmacy residents' projects. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Terry Field **University of Massachusetts Medical School** Worcester, Massachusetts	R18 HS017906 [Grant] **Risk Informed Intervention To Improve Ambulatory Drug Monitoring and Safety** 2008–2012 $878,632 Final Report	**Purpose:** Improve patient safety by implementing interventions to improve the rate of ordering and completion of therapeutic laboratory monitoring of high-risk medications in the ambulatory setting. **Key Findings/Impact:** Analyses of baseline ordering and completion of laboratory monitoring and interviews with patients about missed lab tests provided a basis for intervention design. However, the impacts of the interventions were small, and most were not statistically significant. Automated alerts generated to prescribers at the time of medication renewals did increase test ordering. Cost estimates for development of the interventions found extensive time required from a physician/informaticist. **Publications:** 7
Aaron Kesselheim **Brigham and Women's Hospital** Boston, Massachusetts	K08 HS018465 [Grant] **Off-Label Prescribing: Comparative Evidence, Regulation, and Utilization** 2009–2011 $798,371 Final Report	**Purpose:** Study the characteristics of off-label drug use in three select classes: cancer drugs, neuropsychiatry drugs, and drugs for other rare diseases. **Key Findings/Impact:** Researchers found varying effects of the interventions they studied on off-label drug use. For example, initiation of government investigations into illegal off-label marketing had little impact on off-label prescribing, while aspects of the drug/disease being studied, heightened consent requirements, and local restrictions on pharmaceutical/physician interactions had statistically significant effects. Several resulting articles were published in premiere journals. Within the most cited, researchers found (1) there is no available evidence that brand-name antiepileptic drugs are more effective than generic in maintaining seizure control; (2) patients are more likely to suffer from serious adverse events compared with patients in studies of nonorphan products; and (3) the government should limit liability of designers and vendors who fear modifying alert systems that indicate potentially dangerous drug interactions. The efforts of this project have contributed to an ongoing understanding of the proper role of off-label prescribing and promotion in the United States, for the benefit of physicians and patients. **Publications:** 63
David Bates **Brigham and Women's Hospital** Boston, Massachusetts	P30 HS023535 [Grant] **Making Acute Care More Patient-Centered** 2014–2018 $3,911,230 Final Report	**Purpose:** This PSLL had multiple projects, one of which was to enhance real-time clinical decision support (CDS) by integrating electronic safety tools within the EHR to reduce medication-related adverse events and improve high-risk prescribing practices in acute care settings. **Key Findings/Impact:** According to the final report, the Patient Safety Dashboard improved medication safety monitoring, leading to a reduction in hypoglycemia rates, though with a mild increase in mean glucose levels, indicating a trade-off in glycemic control. The intervention increased venous thromboembolism prophylaxis adherence, ensuring timely anticoagulation for at-risk patients, and improved opioid prescribing practices by refining clinical alerts to reduce provider cognitive burden. The dashboard was accessed 70% of intervention days, with 8,302 logins from 413 providers, demonstrating its integration into clinical workflows. However, urinary catheter and central line management interventions showed neutral or mixed effects, highlighting areas for further refinement in real-time medication safety decision support. **Publications:** 33

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Jeffrey Schnipper **Brigham and Women's Hospital** Boston Massachusetts	R18 HS023757 [Grant] **Implementation of a Medication Reconciliation Toolkit To Improve Patient Safety** 2015–2018 $1,452,672 Final Report	**Purpose:** Determine the effects of mentored implementation of a refined medication reconciliation best practices toolkit on medication discrepancies across multiple hospitals. **Key Findings/Impact:** During the intervention, sites saw a steady decline in their medication discrepancy rate from approximately 2.85 discrepancies/patient to 0.98 discrepancy/patient. In interrupted time-series analysis, the intervention was associated with a 5 percent relative decrease in discrepancies per month over baseline temporal trends. The results showed that a multicenter medication reconciliation quality improvement initiative using mentored implementation of a refined best practices toolkit was associated with a significant reduction in unintentional medication discrepancies over time. Researchers recommended that future efforts focus on ensuring as many patients as possible receive effective interventions to minimize medication discrepancies. **Publications:** 12
Traci Green **Boston Medical Center** Boston, Massachusetts	R18 HS024021 [Grant] **Advancing Patient Safety Implementation Through Pharmacy-Based Opioid Medication Use Research** 2015–2018 $1,326,127 Final Report	**Purpose:** Apply a systems-level approach to improve delivery of and access to pharmacy-based naloxone (PBN). **Key Findings/Impact:** PBN access flourished during the study period. Focus groups helped finalize PBN materials and design approaches to reducing stigma in the pharmacy. Using academic detailing, pharmacies increased naloxone dispensing, and multiple detailing visits expanded access for places less ready to implement PBN. Store- and community-level factors independently associated with dispensing underscore how PBN complements community naloxone programs and extends naloxone availability to exurban areas. The demonstration project's effects were bolstered by strong pharmacy leadership and corporate culture change, as well as shifts in the environment: new naloxone product availability, the Surgeon General's public advisory, and the prominence of illicitly manufactured fentanyl. To facilitate dissemination, the website prevent-protect.org houses all study materials. **Publications:** 21

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Jerry Gurwitz **University of Massachusetts Medical School** Worcester, Massachusetts	R18 HS023774 [Grant] **Improving Safety After Hospitalization in Older Persons on High-Risk Medications** 2015–2018 $1,352,940 Final Report	**Purpose:** Evaluate the effectiveness of a clinical trial focused on older patients who were recently discharged from a hospital with prescribed medications within one of three high-priority, high-risk drug classes (anticoagulants, diabetes agents, and opioids) to reduce the risk of clinically important medication errors. **Key Findings/Impact:** Researchers developed a multifaceted intervention for older adults recently discharged from the hospital who were prescribed at discharge one or more of three high-priority, high-risk drug classes (anticoagulants, diabetes agents, and opioids). Clinical pharmacists thought the most critical components of the intervention were medication reconciliation and the ability to see firsthand all the patient's medications (prescription and over the counter). Medication discrepancies were the most common issues identified by the clinical pharmacists carrying out the intervention. Researchers found that clinically important medication errors were common during the immediate posthospitalization period among study subjects. More than three-quarters of the events led to multiple symptomatic days, adding to the problems involved in recovering from hospitalization. However, the intervention did not lower the incidence rate of events. The frequency of such events and their impact on patients during a critical period suggests a need for further research and the development, testing, and adoption of more effective approaches to preventing these important events. **Publications:** 2
Sara Singer **Harvard University** Cambridge, Massachusetts	P30 HS024453 [Grant] **Engineering Highly Reliable Learning Lab (EHRLL)** 2015–2019 $3,998,180 Final Report	**Purpose:** This PSLL had multiple projects, including efforts to improve medication reconciliation, opioid management, and prescribing practices to prevent ADEs and patient deterioration during care transitions. **Key Findings/Impact:** According to the final report, this PSLL project significantly improved medication safety through targeted interventions, particularly in postdischarge medication reconciliation and opioid prescribing management. Project 4, which focused on hospital-to-home transitions, resulted in a 38 percent improvement in medication reconciliation accuracy, reducing medication discrepancies that could lead to ADEs. The intervention also led to a 25 percent increase in timely primary care followups, ensuring that medication issues were addressed before they contributed to hospital readmissions. As a result, preventable readmissions decreased by 10–15 percent, highlighting the effectiveness of improved medication tracking and patient education. Additionally, Project 3 targeted opioid medication safety, implementing a urine toxicology screening protocol that led to a 50 percent increase in compliance, helping providers identify high-risk patients earlier. The project also standardized Naloxone prescribing for at-risk opioid users, reducing opioid-related emergency department visits. These findings demonstrate that structured medication reconciliation and prescribing safety interventions can lead to measurable improvements in patient outcomes, reducing adverse events and enhancing overall medication management in high-risk populations. **Publications:** 20

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Yuri Quintana (Formerly, Charles Safran) **Beth Israel Deaconess Medical Center** Boston, Massachusetts	R18 HS024869 [Grant] **Leveraging a Social Network of Elders and Families To Improve Medication Safety at Transitions of Care** 2016–2019 $1,491,436 Final Report	**Purpose:** Expand the functionality of the Information Sharing Across Generations (InfoSAGE) platform to include a mobile-first/point-of-care medication manager. The platform helps older people and their families keep an accurate medication list, coordinate the list with prescribing clinicians, track the impact of medications on symptoms, view medication precautions and drug-drug interactions, and become more engaged as partners in their care. **Key Findings/Impact:** Researchers identified facilitators and barriers to the use of a shared online medication list and assessed the usability and e-health literacy needs for platform adoption and use. This research has shown that it is possible to recruit adults over 75 and their families to use online and mobile technologies for information sharing and care coordination. **Publications:** 3
Shoshana Herzig **Beth Israel Deaconess Medical Center** Boston, Massachusetts	R01 HS026215 [Grant] **Characterizing Opioid-Related Adverse Events in Older Adults After Hospital Discharge** 2018–2024 $1,977,682	**Purpose:** Determine the incidence and patient- and prescribing-related risk factors for postdischarge adverse events among older adults discharged on opioids. **Key Findings/Impact:** According to the final report, researchers used both national Medicare claims data and prospective clinical data from two Massachusetts healthcare systems, the research revealed significant findings: opioid-related adverse events occurred in 7.0% of medical hospitalizations and 2.5% of orthopedic surgical hospitalizations among Medicare beneficiaries discharged on opioids. When compared to patients prescribed NSAIDs, those prescribed opioids demonstrated higher risks of death, healthcare utilization, falls/fractures, nausea/vomiting, and slowed colonic motility. Key risk factors across cohorts included advanced age, kidney disease, dementia/delirium, anxiety disorder, and musculoskeletal injuries. The study also uncovered concerning medication management practices, with over 75% of participants reporting leftover opioids (approximately 70% of prescribed doses unused) and less than 5% storing medications securely in locked locations, highlighting critical opportunities for improved prescribing practices and patient education to enhance safety after hospital discharge. **Publications:** 24
Abt Associates Cambridge, Massachusetts	HHSP233201300257P [Contract] **Evaluating and Implementing the Six Building Blocks Team Approach To Improve Opioid Management in Primary Care** 2018–2021 $1,039,225	**Purpose:** Develop a Six Building Blocks (6BBs) How-To-Implement Guide for primary care practices to assist them in managing patients with chronic pain on long-term opioid therapy (LTOT) and evaluate use of the Guide and implementation of opioid management practices. **Key Findings/Impact:** The 6BBs program is an evidence-based quality improvement roadmap that aids primary care teams in implementing effective, guideline-driven care for patients on LTOT by: • Providing leadership support • Revising and aligning clinic policies, patient agreements, and workflows • Tracking and monitoring the population of patients using LTOT • Engaging in planned, patient-centered visits • Identifying resources for complex patients • Measuring success Overall, participating healthcare organizations found the Guide to be an acceptable, flexible, and useful tool to implement the 6BBs program. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Alok Kapoor **University of Massachusetts Medical School** Worcester, Massachusetts	R18 HS026859 [Grant] **Leveraging Evidence-Based Practices for Ambulatory VTE Patients To Be Safe With Direct Oral Anticoagulants: LEAVE Safe with DOACs** 2019–2023 $1,494,927	**Purpose:** Operationalize items on the direct oral anticoagulants (DOACs) Checklist to create a comprehensive intervention delivered by clinical pharmacists and a pharmacy technician. The goal is to prevent DOAC-related clinically important medication errors. These include preventable ADEs, ameliorable ADEs (i.e., ADEs in which the severity or duration could have been reduced), and potential ADEs (i.e., medication errors with the potential to cause harm). **Key Findings/Impact:** No final report or publications are available yet. **Publications:** 0
Anupam Jena **Harvard Medical School** Boston, Massachusetts	R01 HS026753 [Grant] **Prescribing of Opioids at Hospital Discharge and Associated Adverse Patient Outcomes** 2019–2025 $1,948,891	**Purpose:** Build a data infrastructure that allows up-to-date data access on opioid prescribing patterns, ensuring that the project's findings are relevant to current clinical practice and opioid policy. **Key Findings/Impact:** This project was ongoing until July 31, 2025, and no final report is available yet. However, several articles funded by this work have been published. One found that one-click integration of a state's prescription drug monitoring program (PDMP) markedly increased the number of searches but was associated with modest decreases in opioids prescribed and patients receiving a prescription. Single-click electronic health record integration of the PDMP, if implemented broadly, may be a way for states to significantly increase PDMP use. Another study had results suggesting that differences in care provided in pediatric versus adult care settings may be important to understanding prescribers' roles in the opioid epidemic. **Publications:** 10
Joshua Gagne **Brigham and Women's Hospital** Boston, Massachusetts	R01 HS027623 [Grant] **Drug Interactions and Opioid-Related Emergency Room Visits and Hospitalizations Among Older Adults** 2020–2025 $1,599,996	**Purpose:** Study whether interactions between medications prescribed for depression, hypertension, and acute coronary syndromes affect the rates of opioid-related emergency room visits and hospitalizations among older adults who use tramadol. **Key Findings/Impact:** This project was ongoing until July 31, 2025, and no final report is available yet. However, one study conducted thus far compares opioid overdose rates in patients initiating oxycodone while taking selective serotonin reuptake inhibitors (SSRIs) that are potent inhibitors of the cytochrome-P450 2D6 enzyme (CYP2D6) with SSRIs that are not. Researchers found a small increased risk of opioid overdose in patients taking paroxetine or fluoxetine. **Publications:** 5
Kathleen Walsh **Boston Children's Hospital** Boston, Massachusetts	R18 HS027401 [Grant] **Spread of Safety Interventions: Planning for Context** 2020–2025 $1,598,910	**Purpose:** Reduce nephrotoxic medication-related acute kidney injury, assess acceptability of intervention, and test a scalable approach to overcome contextual and implementation barriers to spread patient safety interventions nationally and internationally more effectively and efficiently. **Key Findings/Impact:** This project is ongoing until July 31, 2025, and no final report or publications are available yet. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
MICHIGAN		
Christopher R. Friese **University of Michigan** Ann Arbor, Michigan	R01 HS024914 [Grant] **Communication Processes, Technology, and Patient Safety in Ambulatory Oncology** 2016–2020 $1,430,301 Final Report	**Purpose:** Understand variation in clinician communication processes, technology use, and patient outcomes, and assess barriers and facilitators to safe chemotherapy delivery. **Key Findings/Impact:** Higher satisfaction with technology and higher quality clinician communication were associated with increased patient safety actions (e.g., communication with other physicians, electronic health record capabilities, communication through technology) whereas increased reliance on all-digital records was associated with lower safety actions. Treatment delays were attributed to care plan discrepancies and missing orders, uncommunicated day-of-treatment order changes, orders not signed in advance by physicians, and laboratory testing processes. Patient toxicity rates varied across practices. Toxicity severity and service use incidence exceeded previously published trial data, particularly for pain, fatigue, and gastrointestinal issues. Researchers noted that to their knowledge, this study is among the first multisite, mixed-methods studies to examine the impact of communication processes and communication technologies on patient safety actions in ambulatory oncology practices—care settings that deliver high-risk and high-cost cancer treatments. The collection, analysis, and integration of quantitative and qualitative data permitted rich exploration of key patient safety and quality issues in ambulatory oncology care. **Publications:** 8
Mark Becker and Laura Lee Bix **Michigan State University** East Lansing, Michigan	R01 HS025386 [Grant] **Optimizing OTC Labels for Older Adults: Empirical Evaluation of Labels Designed To Provide Older Users the Information They Need To Minimize Adverse Drug Events** 2018–2024 $1,760,931 Final Report	**Purpose:** Apply empirical methods from basic research on attention and visual cognition (e.g., eye-tracking, change detection, and visual search tasks) to investigate how well different over-the-counter (OTC) label designs attract attention to critical information, promote decision making, and facilitate rapid, cross-product comparisons. **Key Findings/Impact:** According to the final report, this project found that traditional Drug Facts Labels (DFLs) failed to communicate critical warnings effectively, with participants frequently misjudging inappropriate OTCs as safe. A survey of 318 pharmacists identified drug-drug and drug-diagnosis warnings as essential for preventing ADEs, leading to the development of a novel front-of-pack (FOP) warning label. Across six experiments, the FOP label increased attention to warnings, improved decision accuracy, and reduced incorrect medication choices, particularly when users did not inspect side panels. Despite improving cautious decision making, the FOP label did not enhance users' ability to distinguish safe from unsafe medications. These findings informed discussions with regulatory agencies and suggested the need for additional tools, such as augmented reality systems, to support medication safety. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Geoffrey Barnes **University of Michigan** Ann Arbor, Michigan	R18 HS026874 [Grant] **Improving Safe Use of Direct Oral Anticoagulants: A Population Health Approach** 2020–2024 $1,486,943 Final Report	**Purpose:** Evaluate the implementation of a population health approach to ensuring appropriate anticoagulant prescribing in a diverse collection of health systems. **Key Findings/Impact:** According to the final report, this project demonstrated that implementing a clinical decision support Dashboard significantly improved direct oral anticoagulant (DOAC) prescribing safety across healthcare systems. With high adoption rates at VHA sites and increasing clinician usage, the Dashboard effectively reduced off-label DOAC prescribing and lowered rates of thromboembolism and stroke events. In MAQI2 health systems, pharmacists successfully addressed nearly 1,800 medication alerts with a high clinical intervention acceptance rate from prescribers. The project identified five essential implementation factors: clinician autonomy, professional satisfaction, documentation needs, workflow integration, and technology compatibility. These findings highlight the importance of pharmacist involvement and seamless workflow integration in improving anticoagulation safety in clinical practice. **Publications:** 15
Corey Lester **University of Michigan** Ann Arbor, Michigan	R18 HS028786 [Grant] **Preventing Medication Errors Due to Unsafe Electronic Prescription Transactions With Just-in-Time Feedback** 2022–2026 $954,684	**Purpose:** Test a tool that can actively monitor and communicate useful feedback to healthcare organizations about unsafe e-prescription transactions on the more than 2 billion new e-prescriptions transmitted each year in the United States. **Key Findings/Impact:** This project is ongoing until September 29, 2026, but it has already resulted in two publications. One study highlighted the potential of digital health tools and patient-centered strategies to improve adherence and outcomes in heart failure care, while identifying barriers such as medication complexity and care coordination. The second study examined pharmacy staff experiences with electronic prescription data, revealing issues like data inconsistencies and workflow disruptions that compromise prescription accuracy. Together, these findings underscore the need for improved digital systems, communication, and patient engagement to enhance medication safety and healthcare delivery. **Publications:** 2
John Hoyle **Western Michigan University School of Medicine** Kalamazoo, Michigan	R18 HS029283 [Grant] **Augmenting the On-scene Medic (ATOM): Development of a Head-Mounted Display Application To Reduce Prehospital Pediatric Medication Errors** 2023–2026 $500,000	**Purpose:** Develop and test a highly dynamic cognitive aid application for use through a head-mounted display to dramatically decrease pediatric medication errors in emergency medical services. **Key Findings/Impact:** This project is ongoing until March 31, 2026, but one publication has been produced to date. The investigators explored factors affecting the reliability of biometric identification in on-scene smart healthcare applications. Their paper, presented at the IEEE 3rd International Conference on Computing and Machine Intelligence, examined challenges such as environmental conditions, sensor accuracy, and variations in biometric data due to patient movement or physiological changes. The authors emphasize the need for robust biometric systems that account for these variables to ensure accurate identification in emergency and mobile healthcare settings. The study highlights potential improvements in sensor technology and machine learning algorithms to enhance biometric reliability and support efficient patient identification in critical healthcare scenarios. **Publications:** 1

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
MINNESOTA		
Joel Farley **University of Minnesota** Minneapolis, Minnesota	R18 HS027754 [Grant] **Integrating Pharmacists Into an Automated Discharge Process To Promote Comprehensive Medication Management** 2021–2025 $1,417,221	**Purpose:** Use an adapted Consolidated Framework for Implementation Research and the Reach, Effectiveness, Economics, Adoption, Implementation and Maintenance model to evaluate the implementation of pharmacist-led comprehensive medication management in transitions of care. **Key Findings/Impact:** This project is ongoing until June 30, 2025, but two publications have been produced to date. One explored the potential benefits of social determinants of health (SDOH) screening on CMM effectiveness but identified no specific outputs. The other conducted a qualitative study on integrating clinical pharmacists into transitions of care at federally qualified health centers, highlighting key barriers and facilitators. Their findings underscore the need for structural support and interdisciplinary collaboration to optimize pharmacist-led interventions. These insights contribute to ongoing efforts to improve medication safety and care coordination in vulnerable populations. **Publications:** 2
MISSISSIPPI		
Andrew Brown **University of Mississippi Medical Center** Jackson, Mississippi	U18 HS011923 [Grant] **Addressing Preventable Medication Use Variance in Mississippi** 2001–2005 $4,422,011 Final Report	**Purpose:** Establish a large-scale demonstration project to assess the effectiveness of Mississippi's methods of collecting and using information to reduce medical errors and their impact. **Key Findings/Impact:** The project results were disseminated to different audiences via 7 refereed publications and 19 presentations at the state and national level. Specific projects were completed, including: (1) website development; (2) patient safety hotline; (3) Focus One focus groups; (4) medication error reporting system; (5) pharmacy survey; (6) ambulatory clinic patient survey; and (7) establishment of private industry partnerships (SoftMed and DecisionQ). **Publications:** 8
MISSOURI		
Jill Scott-Cawiezell **University of Missouri** Columbia, Missouri	UC1 HS014281 [Grant] **Technology To Improve Medication Safety in Nursing Homes** 2003–2007 $929,351 Final Report	**Purpose:** Evaluate the use of bedside technology (One Touch eMAR System) and the Quality Improvement Program for Missouri's Long-Term Care Facilities to improve medication safety practices within the nursing home setting as a companion study to a technology study funded by the Centers for Medicare & Medicaid Services. **Key Findings/Impact:** Nearly 16,000 administered medications were observed over 2 years. Technology and related process improvements increased the efficiency of medication administration across all nursing homes. In addition, four of five nursing homes showed statistically significant improvement at some point during the study. The pattern of improvement varied, suggesting many factors influenced the impact of technology and focused quality improvement activities on medication error. Organizational factors, such as nursing leadership and effective teamwork, appeared to be closely linked to the pattern of improvement. Nurse leaders were critical to improvement and varied in their skills, suggesting that nurse leader development is essential. **Publications:** 11

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Thomas Bailey **Washington University** Saint Louis, Missouri	R18 HS017010 [Grant] **Surveillance for Adverse Drug Events in Ambulatory Pediatrics** 2007–2011 $992,614 Final Report	**Purpose:** Evaluate automated detection methods for ADEs in pediatric patients with sickle cell anemia, cystic fibrosis, and cancer in the ambulatory setting. **Key Findings/Impact:** Researchers found a high rate of ADEs in pediatric patients with sickle cell disease, cystic fibrosis, or cancer. In this study, these ADEs resulted in harm to patients and were associated with a high degree of causality with the associated drugs. Nearly 50 percent of these ADEs originated in the outpatient setting. The researchers also believed that automated detection of ADEs represented an efficient and feasible way to detect ADEs in high-risk pediatric populations in both the inpatient and outpatient settings that would otherwise go undetected in the absence of labor-intensive chart review. **Publications:** 5
Grant Savage **University of Missouri** Columbia, Missouri	R03 HS016789 [Grant] **Workarounds: Developing Definitions, Measurement Strategies, and Links to Medication Safety** 2007–2009 $100,000 Final Report	**Purpose:** Study the impact of employee-devised workarounds within intensive care units on medication errors. **Key Findings/Impact:** Researchers concluded that analysis of work processes revealed common themes, such as the idiosyncratic nature of workarounds, common locations in the process where workarounds and rework occur, the number of barriers faced, and the downstream impact on work processes. Most important, the findings build on a growing body of literature that suggests that barriers in workflow and workarounds can lead to negative patient outcomes. This study is among the first, to the researchers' knowledge, to document examples of rework in healthcare settings, such as where it occurs, why it occurs, and how it is associated with workarounds and patient safety concerns. The findings also reinforce the potential application of Lean manufacturing principles to healthcare work processes. If rework and workarounds are indeed the result of perceived barriers and inefficiencies, it suggests a need for continuous quality improvement initiatives that can address those inefficiencies, such as Lean practices. Involving staff in "leaning out" the process should also likely lead to positive outcomes. **Publications:** 1
NEBRASKA		
Keith Mueller **University of Nebraska Medical Center** Omaha, Nebraska	U18 HS015822 [Grant] **Implementing a Program of Patient Safety in Small Rural Hospitals** 2005–2007 $528,730 Final Report	**Purpose:** Implement the patient safety practices of voluntary medication error reporting and organizational learning to improve the safety of medication use in small rural hospitals. **Key Findings/Impact:** The Hospital Survey on Patient Safety Culture was used to identify components of culture in need of improvement, raise awareness of safety culture, evaluate the effectiveness of patient safety interventions, and create benchmarks. Researchers found that a safe, informed culture requires a foundation of reporting, using standardized taxonomies and systematic analysis. They recommended that critical access hospitals (CAHs) collaborate with rural advocacy organizations to obtain the educational and technical resources needed to understand and execute the practices that support reporting, just, flexible, and learning cultures. The significance of this research is that it can inform policymakers, network hospitals, quality improvement organizations, and other organizations that advocate for rural hospitals about resources and practices that 1,283 CAHs in the nation can use to improve medication safety and quality improvement efforts. **Publications:** 5

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Karsten Bartels **University of Nebraska Medical Center** Omaha, Nebraska	R01 HS027795 [Grant] **Efficiency and Quality in Post-Surgical Pain Therapy After Discharge – EQUIPPED** 2021–2026 $1,185,291	**Purpose:** Demonstrate that the amounts of opioids prescribed and opioids taken after discharge following surgery can be reduced while ensuring effective treatment of pain. **Key Findings/Impact:** This project is ongoing until July 31, 2026, but has already produced several publications. Researchers found that personalizing pain management after surgery significantly improves patient outcomes while reducing unnecessary opioid exposure. Their research demonstrated that a shared decision-making tool for orthopedic surgery patients resulted in fewer prescribed opioids (6.4 versus 10 pills) without compromising pain control. Another study identified that the 24-hour pre-discharge period provides the most reliable prediction of a patient's post-discharge pain medication needs, offering clinicians a practical timeframe for assessment. For cardiac surgery patients, it was found that while most use opioids initially, only about 6 percent continue beyond 3 months, highlighting opportunities for earlier transition to alternative pain management strategies. This project has also published articles related to the STRoke After Surgery (STRAS) screening tool, corticosteroid administration among COVID-19 patients, and personal protective equipment shortages. **Publications:** 20
NEW HAMPSHIRE		
George Blike **Dartmouth College** Lebanon, New Hampshire	P30 HS024403 [Grant] **Failure to Rescue-Patient Safety Learning Lab (FTR-PSLL)** 2015–2019 $3,956,659 Final Report	**Purpose:** This PSLL had multiple projects, including efforts to integrate continuous surveillance monitoring and real-time alert systems to detect and respond to medication-induced respiratory depression and other adverse drug events in hospitalized patients. **Key Findings/Impact:** According to the final report, the interventions significantly improved early detection and response to opioid-induced respiratory depression in hospitalized patients. The implementation of continuous surveillance monitoring, using wireless pulse oximetry and automated alert systems, resulted in a 19-fold reduction in mortality from pharmacological respiratory arrest. The study found no permanent harm in patients receiving sedative and analgesic medications when monitoring was available. Data collection time was reduced by 30%, improving efficiency, while total patient monitoring time increased by 18%, leading to enhanced detection of early warning signs of respiratory decline. Surveys and clinical feedback indicated high provider acceptance of the surveillance system, with improved clinician workflow and reduced alarm fatigue. These findings underscore the critical role of continuous monitoring and structured escalation protocols in preventing medication-related patient harm in hospital settings. **Publications:** 53

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
NEW JERSEY		
Stephen Crystal **Rutgers University** New Brunswick, New Jersey	R18 HS023464 [Grant] **Improving Medication Safety in Nursing Home Dementia Care** 2014–2017 $1,291,034 Final Report	**Purpose:** Examine the effectiveness of national, state, and facility initiatives to reduce antipsychotic prescribing in nursing homes. **Key Findings/Impact:** Antipsychotic prescribing declined nationally by 29 percent from 2011 to 2016. Reduction was particularly substantial for Black (from 21.0% to 13.4%) and Hispanic (from 25.9% to 17.2%) residents compared with non-Hispanic White residents (from 23.2% to 16.8%). Sedative/hypnotic prescribing decreased from 2011 to 2016 by an even greater amount, declining by nearly 43%. In terms of implications for patient safety improvement initiatives in other clinical situations, particularly those related to safe medication use, results of this study suggest elements likely to lead to successful large-scale quality and patient safety initiatives. Broadly, they suggest that these elements include a balance between voluntary and mandatory features that require some level of provider engagement, integrating educational and regulatory components; strategies that achieve provider buy-in; use of public reporting as a motivator; and "normalization" of preferred provider behaviors as accepted best practices within the provider community. **Publications:** 15
NEW YORK		
Rollin Fairbanks **University of Rochester** Rochester, New York	U18 HS015818 [Grant] **The Emergency Department Pharmacist as a Safety Measure in Emergency Medicine** 2005–2008 $601,304 Final Report	**Purpose:** The purpose of this Partnerships in Implementing Patient Safety project was to optimize the role of emergency pharmacists (EPhs), assess acceptance, evaluate impact, and create a comprehensive toolkit for EDs creating new programs. **Key Findings/Impact:** Researchers reported seven emerging themes identified for the optimization phase. During chart review, they examined 10,224 cases and found no difference in adverse drug events with an EPh in the ED, but a trend toward improvement was seen in certain quality measures. Nearly all (99%) responding staff felt the EPh improved quality of care. Eight percent of academic EDs surveyed reported EPh services were available 24 hours a day, but 70 percent reported no coverage. The EPh spent the highest percentage of time with communication events, roaming, and resuscitation efforts. Resources developed were available on a website that is no longer accessible. **Publications:** 15
Penny Feldman **Visiting Nurse Service of New York** New York, New York	R18 HS017837 [Grant] **Improving Medication Management Practices and Care Transitions Through Technology** 2008–2012 $1,191,412 Final Report	**Purpose:** Conduct a randomized trial to examine the effectiveness of a multifaceted information technology (IT) intervention to improve management for patients at risk due to the complexity of their medication regimen. **Key Findings/Impact:** No positive intervention impact was found. However, nurses' use of clinical decision support (CDS) (compared with non-use) within the intervention group was associated with more patients moving below the medication complexity risk threshold and lower patient hospitalization rates. CDS use was affected by both nurse and patient characteristics. Outcomes could be improved by increasing knowledge, comfort, and motivation to use IT of nurses paid on a per visit basis; improving continuity of care; and avoiding short lengths of stay. This research has shown that polypharmacy and medication regimen complexity are associated with worse adherence and higher risk of adverse events. Reducing the frequency that a patient needs to remember to take a medication each day and simplifying administration instructions are strategies that can lower the risk. **Publications:** 2

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Jessica Robinson-Papp **Icahn School of Medicine at Mount Sinai** New York, New York	R18 HS025641 [Grant] **Toward Safer Opioid Prescribing for Chronic Pain in High-Risk Populations: Implementing the Centers for Disease Control (CDC) Guideline in the Primary Care HIV Clinic** 2017–2021 $1,483,542 Final Report	**Purpose:** Develop and pilot test an intervention to increase HIV primary care providers' (PCPs) adherence to the Centers for Disease Control Opioid Prescribing Guideline (CDCOPG). **Key Findings/Impact:** PCPs randomized to the TOWard SafER Opioid Prescribing (TOWER) intervention were 48 percent more CDCOPG adherent. They showed significant improvement in use of nonpharmacologic treatments, functional treatment goals, opioid agreements, prescription drug monitoring programs, opioid benefit/harm assessment, and naloxone prescribing. The main findings from the developmental stages of the work (Aim 1, Steps 1-4) were qualitative and were used to inform the development of the TOWER intervention. The TOWER pilot study demonstrated that a relatively simple and sustainable intervention (involving direct data collection from patients using a mobile health technology, a PCP decision support tool, and a PCP training) can assist HIV PCPs to deliver more guideline-adherent care to people with HIV and chronic pain-long-term opioid therapy. Moreover, doing so does not appear to compromise the patient-PCP relationship or lead to worsening of other patient-centered outcomes. **Publications:** 5
Ranjit Singh, Heui-Yen Chen, and David Jacobs **State University of New York at Buffalo** Amherst, New York	R18 HS029122 [Grant] **Patient-Driven Medication Safety Learning Laboratory in Care Transitions** 2023–2027 $500,000	**Purpose:** Develop a cross-system learning laboratory that brings together older adults, caregivers, researchers, and healthcare teams in innovative ways to protect them from medication harm. **Key Findings/Impact:** This PSLL project is ongoing until June 30, 2027, and no final report or publications are available yet. According to annual progress reports, the project has made significant progress in understanding the challenges and needs related to medication safety during care transitions for older adults. Key findings indicate that medication errors and adverse events are closely linked to gaps in communication, cognitive work challenges, and the social determinants of health. Initial surveys and interviews have highlighted patient and caregiver struggles with medication changes and symptom management post-hospitalization. Observational and cognitive analyses have identified workflow inconsistencies and safety risks within hospital and primary care settings. The use of health information exchange data has provided insights into system- and patient-level risk factors, facilitating the development of predictive models for unplanned hospitalizations and medication harm. The project has also successfully established a Community Advisory Board to guide intervention design and foster stakeholder engagement. These findings collectively inform the iterative development of patient-driven interventions aimed at reducing medication harm and improving care transitions. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
NORTH CAROLINA		
Delesha Carpenter **University of North Carolina** Chapel Hill, North Carolina	R13 HS024471 [Grant] **Addressing Methodological and Ethical Issues in Pediatric Medication Safety Research** 2015–2016 $33,151 Final Report	**Purpose:** Present a forum for discussing state-of-the-art methods and issues in pediatric medication safety research. **Key Findings/Impact:** According to the final report, the PharmSci2016 conference had 68 attendees, including faculty, clinicians, industry representatives, and trainees, to discuss state-of-the-art research methods. Conference evaluations were highly positive, with 100% of attendees agreeing the objectives were met, and 62.5% reporting increased likelihood of engaging in pediatric medication safety research. At 6-month follow-up, 11 attendees had formed new collaborations, including partnerships with Duke University and the International Society of Pharmacoepidemiology. Key conference takeaways were used in grant applications, publications, and research initiatives, while 14 speaker summaries were published on YouTube for broader dissemination. The conference filled a critical gap in pediatric medication safety research, fostering interdisciplinary networking and advancing future research effort. **Publications:** 1
OHIO		
Carole Lannon **Cincinnati Children's Hospital Medical Center** Cincinnati, Ohio	U19 HS021114 [Grant] **Pursuing Perfection in Pediatric Therapeutics** 2007–2011 and 2011–2016 $4,235,825 Final Report	**Purpose:** The 2007–2017 Cincinnati Children's pediatric Center for Education and Research in Therapeutics (CERTs) Research Center (RC) aimed to improve outcomes for children by optimizing the use of therapeutics. Subthemes included quality and patient safety, practice-based research and improvement networks, pharmacogenomics, and performance metrics. **Key Findings/Impact:** A final report for U18 HS16957 (2007–2011) showed the RC created a research core that supported clinicians and scientists in developing and testing innovative therapeutics and education projects. The RC also created new knowledge about how to use therapeutics effectively and how to translate that knowledge more rapidly into practice, resulting in safer and more effective clinical practice and improved patient outcomes. This project has implications for (1) emphasizing the importance of testing measures prior to adoption; and (2) understanding how quality measures developed for accountability can be used to support improvements in care that will lead to effective use of pediatric therapeutics. In a final report for U19 HS21114 (2011–2017), researchers reported that CERTs supported multiple successful projects in several learning networks (LNs). The CERTs further developed the infrastructure to support LNs and worked with multiple partners capable of disseminating research and education programs to a large majority of the nation's pediatric practitioners and tertiary care settings. The LNs achieved improved pediatric health outcomes. **Publications:** 48

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michael Rothberg **Cleveland Clinic Foundation** Cleveland, Ohio	R01 HS022883 [Grant] **Patient-Centered Approach to Reducing Harm from VTE** 2014–2019 $993,115 Final Report	**Purpose:** Develop, validate, and implement a risk assessment model for venous thromboembolism (VTE) in hospitalized medical patients to optimize prophylaxis decisions and improve patient safety while minimizing unnecessary anticoagulation and bleeding risks. **Key Findings/Impact:** According to the final report, this project developed and validated a risk assessment model (RAM) for venous thromboembolism (VTE) in hospitalized medical patients, which outperformed the widely used Padua model. The model was embedded into the EHR as a smart order set to assist physicians in making informed prophylaxis decisions. The randomized controlled trial (RCT) enrolled approximately 100,000 patients across nine Cleveland Clinic hospitals. The decision analytic model identified 0.8% as the threshold risk at which VTE prophylaxis was cost-effective, with an incremental cost of $44,091 per quality-adjusted life year (QALY). The model classified 25% of patients as high risk and 75% as low risk, helping to reduce unnecessary anticoagulation. However, physician adoption varied significantly across hospitals (ranging from 5% to 75%), highlighting the need for further integration strategies. The study demonstrated that targeted VTE prophylaxis could improve patient safety while reducing complications and costs, with final outcome data pending further analysis. **Publications:** 2
Stuart Goldstein **Cincinnati Children's Hospital Medical Center** Cincinnati, Ohio	R18 HS023763 [Grant] **Reduction of Nephrotoxic Medication-Associated Acute Kidney Injury in Children** 2015–2018 $1,494,548 Final Report	**Purpose:** Reduce acute kidney injury caused by nephrotoxic medication in non-critically ill children across the collaborative. **Key Findings/Impact:** Researchers found the intervention reduced nephrotoxic medication exposure and associated acute kidney exposure. Participating in a learning network that required all participants to implement Nephrotoxic Injury Negated by Just in time Action (NINJA), a daily monitoring tool, was associated with achieving targeted outcomes. This project demonstrated successful dissemination and implementation of a program to decrease nephrotoxic medication-associated acute kidney injury in children at nine pediatric institutions. As a result of this work, nephrotoxic acute kidney injury has been selected as a hospital-acquired condition to be addressed by Solutions for Patient Safety. Researchers planned to disseminate NINJA to the 140 pediatric institutions in the Solutions for Patient Safety Network by 2020. **Publications:** 12
Lawrence Kleinman **Case Western Reserve University** Cleveland, Ohio	R01 HS024433 [Grant] **Epidemiology, Exploration, and Evaluation: Addressing Potentially Dangerous Medications in Medicaid Children With a Mental Health Diagnosis** 2015–2018 $1,500,001 Final Report	**Purpose:** (1) Describe the epidemiology of potentially dangerous (PD) behavioral and mental health medication (BMHRx) use in children; (2) analyze impact of specified policies on PD BMHRx practices; and (3) survey clinical practices regarding Med Rec practices. **Key Findings/Impact:** Behavioral health diagnoses and BMHRx were associated with increased emergency department use and hospitalization, not explained fully by visits primarily for behavioral health diagnoses. Likely off-label use (LOLU) of BMHRx is common. It was seen in 36 percent of children in 2008 and decreased to 24 percent in 2014, when LOLU was most common in adults ages 18–20 (33%) and least common in children ages 6–11 years (20%). Patient-centered-medical-home was not protective for drug-drug interactions or LOLU. Moving to a prescription carve-out was associated with reduction of PD BMHRx use. Despite nearly universal e-prescribing, Med Rec practices varied greatly and were not highly sophisticated. **Publications:** 9

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Kathleen Walsh and Eric Kirkendall **Cincinnati Children's Hospital Medical Center** Cincinnati, Ohio	R18 HS026644 [Grant] **Ambulatory Pediatric Safety Learning Lab** 2018–2023 $2,484,256 Final Report	**Purpose:** Redesign systems of care and coordination between the clinic and home to eliminate harm due to health care in these settings. **Key Findings/Impact:** According to the final report, this PSLL project identified medication safety challenges for children with Type 1 diabetes (T1D) and autism spectrum disorder (ASD). Most patients in both groups experienced medication-related errors, including missed doses, incorrect administration techniques, and inadequate monitoring. Some T1D errors led to emergency department visits. Simulation training showed that caregivers made insulin dosing errors and had gaps in ketone management knowledge. The project implemented interventions including a ketone calculator, visual management tools, simulation training, and an eVisit template to improve monitoring. These interventions improved the followup rate for ASD patients on antipsychotic medications. The findings highlight the need for better medication education, decision support tools, and communication between families and healthcare providers to reduce medication errors in these pediatric populations. **Publications:** 6
OREGON		
HMO Research Network [Unknown], Oregon	290-00-0015-10 [Contract] **Prevalence and Strategies for Appropriate Prescription Medication Dosing for Children** 2002–2003 $184,578	**Purpose:** Assess the prevalence of inappropriate prescribing of medication in the ambulatory pediatric setting and the scope and breadth of current strategies to avoid inappropriate prescribing. Assess appropriate medication safety monitoring by recommended laboratory tests (e.g., liver function tests for carbamazepine). **Key Findings/Impact:** A final report was not available, but an article supported by this project noted that potential medication dosing errors occurred frequently in outpatient pediatric care. Approximately 15 percent of children in the study population (N=1,933) were dispensed a medication with a potential dosing error. Eight percent were potential overdoses, and 7 percent were potential underdoses. For children less than 35 kg, only 67 percent were given medication within the recommended dosing range, and more than 1 percent were given double the recommended maximum dose. Analgesics were most likely to be potentially overdosed (15%) while antiepileptics were potentially underdosed (20%). In addition, use of electronic prescription writers was not associated with fewer potential errors. **Publications:** 2

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Grant Higginson **Oregon State Department of Human Services** Salem, Oregon	UC1 HS014259 [Grant] **Risk Models To Improve Long-Term Care Medication Safety** 2003–2004 $165,205 Final Report	**Purpose:** Determine if sociotechnical probabilistic risk assessment (ST-PRA) can create statewide risk models to identify combinations of medication delivery system and behavioral elements that produce wrong drug, wrong dose, wrong resident, and omission medication errors in nursing and community-based care facilities. **Key Findings/Impact:** Researchers concluded that ST-PRA models offer four advantages over current risk management methodologies: 1. They provide a structure and process that allows gathering sometimes highly charged information about policy, procedure, and behavioral deviations not otherwise available. 2. They provide contextual maps of errors and behaviors leading to system failures so that policymakers, regulators, and managers can use ST-PRA to identify, prioritize, and prospectively model risk reduction interventions. 3. The models are dynamic; they are designed to evolve as fresh data from new studies, patient safety reporting systems, or facility incident reporting systems are used to refine probability estimates for different elements in the models. 4. Policymakers and regulators can appreciate the unanticipated consequences of particular enforcement actions (e.g., increased borrowing behavior to avoid citations for "drug not available," time pressures introduced by interpretations of the federal "2-hour rule" governing the time a drug is administered to a patient). This research complements earlier studies of medication errors conducted by researchers over the course of more than 20 years. **Publications:** 3
Melinda Muller **Emanuel Hospital and Health Center** Portland, Oregon	U18 HS015904 [Grant] **Medication Reconciliation: Bridging Communications/ Care** 2005–2007 $585,941 Final Report	**Purpose:** Develop and test an interdisciplinary medication reconciliation process to improve documentation and transfer of medication lists across the continuum of care. **Key Findings/Impact:** This project created a standard process and location for the medication information accessible to everyone involved with patient care at all points of contact in the Legacy Health System. Researchers concluded that medication reconciliation requires input and cooperation from an interdisciplinary team to succeed. To accomplish the process effectively, increased nursing and pharmacy resources are needed and physician buy-in is crucial. Involving the medical staff and senior leadership early in the process increases the chances of success. Current electronic medical records often require significant upgrades and modifications to successfully implement the process. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Mary Minniti **Sacred Heart Medical Center** Eugene, Oregon	P20 HS017143 [Grant] **Medication Management at Home: Patient Identified Processes and Risk Assessment** 2007–2009 $199,977 Final Report	**Purpose:** Understand the patient experience and risks of managing medications at home. **Key Findings/Impact:** Understanding the medication management process from the patient perspective yielded a rich picture of what behaviors and practices patients use every day. A common framework and process maps provided a picture of steps that create a method to manage medications. This finding is significant because it promotes medication safety from the patient perspective. While they had a common framework—the high-level processes of getting, organizing, taking, and refilling medications for every patient interview—researchers learned their methods were diverse and very individual. A common theme was the use of visual cues for taking medications. **Publications:** 1
Daniel Hartung **Oregon State University** Corvallis, Oregon	R18 HS024227 [Grant] **Prescription Drug Monitoring Program (PDMP) Toolkit** 2015–2018 $1,486,713 Final Report	**Purpose:** Develop the Resources Encouraging Safe Prescription Opioid and Naloxone Dispensing (RESPOND) Toolkit to enhance community pharmacists' use of PDMP data to improve opioid safety. **Key Findings/Impact:** The RESPOND Toolkit included a patient screening and communication algorithm, a provider communication checklist, and three online asynchronous educational modules. The final pilot demonstrated that the toolkit was effective at significantly improving perceived behavioral control and changing attitudes toward opioid use disorder, perceived barriers to address prescription opioid misuse, and PDMP attitudes. A moderate effect was observed for objective knowledge gains across the modules. Researchers concluded that the toolkit was an effective and scalable training resource for community pharmacists, with the potential to promote behavioral shifts that support opioid safety for patients. Future work on the RESPOND Toolkit should focus on the measurement of objective behavior outcomes, including pharmacists' dispensing behaviors and the frequency and quality of pharmacist-patient engagement around opioid safety. **Publications:** 9
PENNSYLVANIA		
Joel Portnoy **Children's Hospital of Philadelphia** Philadelphia, Pennsylvania	K08 HS011636 [Grant] **The Effect of Medication Errors in the Pediatric ICU** 2001–2005 $520,776	**Purpose:** Advance knowledge on the effect of medication errors on the morbidity, mortality, and costs of care of the population of patients in the pediatric intensive care unit. **Key Findings/Impact:** A final report and supporting literature for this project were not available. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Brian Strom **University of Pennsylvania** Philadelphia, Pennsylvania	P01 HS011530 [Grant] **Improving Patient Safety by Reducing Medication Errors** 2001–2007 $6,758,053 Final Report	**Purpose:** Improve patient safety by identifying the factors that predispose to medication errors and create a research base for the design of interventions to reduce the frequency of medication errors. **Key Findings/Impact:** Researchers found that participants were six times more likely to take too few pills than to take extra pills. Adherence changed over time, initially worsening over the first 6 months of monitoring, followed by improvement beyond 6 months. Although clinicians were statistically better than chance at correctly labeling a participant's adherence, their estimates were often inaccurate. Researchers also found that a widely used computerized physician order entry (CPOE) system contributed to 24 types of medication errors (e.g., pharmacy inventory displays mistaken for dosage guidelines). As CPOE systems are implemented, clinicians and hospitals must attend to errors they cause, in addition to errors they prevent. It is also critical to incorporate plans for continuous revisions and quality improvement. Researchers also concluded that improved patient education and delivery of medication organization systems are immediate opportunities to potentially reduce the risk of medication errors among older adults. **Publications:** 19
Jane Barnsteiner **University of Pennsylvania** Philadelphia, Pennsylvania	R13 HS014836 [Grant] **State of the Science on Safe Medication** 2004–2005 $50,000 Final Report	**Purpose:** Develop research priorities and clinical care and policy recommendations addressing the state of the science of safe medication administration. **Key Findings/Impact:** Symposium participants identified specific barriers to safe medication administration in the areas of research, education, practice, policy, and administration. In addition to barriers, participants identified strategies to address them and priorities to research. Dissemination of the proceedings and recommendations were published in a supplement to the March 2005 American Journal of Nursing (AJN), the official journal of the American Nurses Association, and copublished in a supplement to the Journal of Infusion Nursing, the official publication of the Infusion Nurses Society. The supplement was mailed to 90,000 AJN subscribers and all members of the Infusion Nurses Society. The supplement continues to be available at here. The executive summary of the report was published within the March 2005 issue of AJN, which went to 344,000 registered nurse subscribers. Other dissemination included internet, mass media, professional publication, and presentations to regional and national audiences. **Publications:** 9
Carl Sirio **University of Pittsburgh** Pittsburgh, Pennsylvania	U18 HS015851 [Grant] **Enhanced Patient Safety Intervention To Optimize Medication Education** 2005–2008 $598,565 Final Report	**Purpose:** Evaluate the hospital-wide implementation of a multimodal patient medication education system hereafter referred to as EPITOME (i.e., Enhanced Patient Safety Intervention to Optimize Medication Education.) **Key Findings/Impact:** Patients responded positively to the intervention with a greater awareness of their medication regimens and sense of satisfaction regarding the indications and side effects associated with their medications. Pharmacy and respiratory therapy consultations were the easiest to deploy. Significant work is required to sustain nursing engagement given workflow. An important unanticipated benefit was identification of medication errors. Improving the intervention requires in-depth workflow assessment and full administrative support. Researchers found that 30-day hospital readmission was affected, likely a result of inconsistent implementation. **Publications:** 2

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michael Cohen **Institute for Safe Medication Practices** Horsham, Pennsylvania	P20 HS017107 [Grant] **Using Risk Models To Identify and Prioritize Outpatient 'High-Alert' Medications** 2007–2008 $199,050 Final Report	**Purpose:** Determine if sociotechnical probabilistic risk assessment (ST-PRA) can create detailed risk models that predict the incidence of preventable adverse drug events (PADEs) with high-alert medications dispensed in community pharmacies. **Key Findings/Impact:** PADEs with the highest incidence include dispensing the wrong dose/strength of warfarin due to a data entry error; dispensing warfarin to the wrong patient; and dispensing an inappropriate fentanyl patch dose due to a prescribing error. PADEs with the lowest incidence include dispensing the wrong drug when filling a warfarin prescription. Increased patient counseling, conducting a second data entry verification process during product verification, bar-coding technology, and hard computer alerts that are not bypassed easily provided the largest quantifiable reductions in risk. These findings quantify, for the first time, human error probabilities and at-risk behavior frequencies that combine and contribute to dispensing system failures and the overall incidence of PADEs with four high-alert medications. Researchers concluded that ST-PRA demonstrated important and largely correctable community pharmacy dispensing system vulnerabilities, identified by the people who work within those systems. **Publications:** 1
Jeffrey Greenwald **Society of Hospital Medicine** Philadelphia, Pennsylvania	R13 HS017520 [Grant] **Medication Reconciliation: A Team Approach** 2008–2009 $50,000 Final Report	**Purpose:** Identify key action items and stakeholder organization roles needed to address opportunities and challenges in medication reconciliation. **Key Findings/Impact:** The principal findings from the conference were these: • A consensus among key stakeholders is essential in elucidating and addressing the opportunities and challenges in medication reconciliation. • A standardized definition of "medication" and "reconciliation," with guiding principles and clearly defined processes, is a prerequisite to addressing specific medication reconciliation issues. • Electronic health records (personal and provider based) must be standardized and implemented to transfer medication information effectively and efficiently across transitions of care. • Developing a public health agenda around medication safety as the community-based concept of medication reconciliation is important for patient understanding and engagement in the medication reconciliation process. • It is important to build on existing community-based initiatives and infrastructures in many national organizations to foster collaboration. • Partnerships are an important implementation concept. • Public health systems must partner with community-based organizations to encourage and promote the established standards for medication reconciliation. **Publications:** 3

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Brian Strom **University of Pennsylvania** Philadelphia, Pennsylvania	R03 HS017358 [Grant] **Clinical Importance of the Drug Interaction Between Statins and CYP3A Inhibitors** 2008–2011 $100,000 Final Report	**Purpose:** Compare the relative hazard of muscle toxicity, renal dysfunction, and hepatic dysfunction associated with the drug interaction between statins and concomitant medications that inhibit the cytochrome P450 3A4 (CYP3A4) isoenzyme. **Key Findings/Impact:** Overall, this study found no difference in the relative hazard of muscle toxicity, renal dysfunction, or hepatic dysfunction for patients prescribed a statin-3A4 substrate versus a statin non-3A4 substrate with CYP3A4 inhibitor concomitancy. Additional research could further evaluate the nonsignificant yet increased muscle toxicity interaction ratio observed for highly potent statin dosages and within 6 months after statin initiation. However, the overall results show no evidence of increased hazard of statin-related adverse events based on statin metabolism. **Publications:** 0
Michael Cohen **Institute for Safe Medication Practices** Horsham, Pennsylvania	R18 HS017910 [Grant] **Risk-Informed Interventions in Community Pharmacy: Implementation and Evaluation** 2008–2012 $708,616 Final Report	**Purpose:** Develop and test three risk-informed interventions in community pharmacies intended to identify, quantify, eliminate, reduce, or mitigate the risks associated with dispensing high-alert medications. **Key Findings/Impact:** Researchers concluded for intervention 1 that mandatory scripted patient counseling was an effective and well-accepted model for patient education that should be considered in all community pharmacies. For intervention 2, a barcode verification system readiness assessment demonstrated the overall value of a readiness assessment. Results showed its ability to predict and thereby prevent technology problems when implementing the technology in community pharmacies. For intervention 3, High-Alert Medication Modeling and Error-Reduction Scorecards (HAMMERS™) was a robust tool that helped community pharmacies uncover important and largely correctable dispensing system vulnerabilities identified by people who work within those systems. **Publications:** 1
Steven Handler **University of Pittsburgh** Pittsburgh, Pennsylvania	R01 HS018721 [Grant] **Enhancing the Detection and Management of Adverse Drug Events in the Nursing Home** 2010–2014 $1,992,614 Final Report	**Purpose:** Improve patient safety with respect to medications in nursing homes. **Key Findings/Impact:** According to the final report, this project demonstrated that an active medication monitoring system significantly improved the detection and management of ADEs in nursing homes. Physicians who received real-time alerts detected more ADEs and responded faster than those providing usual care. The study identified common ADEs including hypoglycemia, acute kidney injury, hypokalemia, and elevated INR, with many being potentially preventable, often due to prescribing errors. When alerted, physicians took action in most cases by ordering lab tests, stopping medications, or adjusting dosages. The intervention also enhanced the perceived value and performance of consultant pharmacists within nursing homes. These findings have informed new ADE detection strategies and clinical decision-support tools, advancing medication safety practices in long-term care settings. **Publications:** 50

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Vincent Lo Re **University of Pennsylvania** Philadelphia, Pennsylvania	R01 HS018372 [Grant] **Clinical Prediction of Hepatotoxicity & Comparative Hepatic Safety of Medications** 2010–2015 $2,495,705 Final Report	**Purpose:** (1) Evaluate the incidence and outcomes of drug-induced acute liver failure (ALF) in an integrated healthcare system; (2) develop and validate a highly sensitive model to identify drug-induced liver injury patients at increased risk of ALF; and (3) compare the risk of severe acute liver injury and ALF associated with different medications to provide additional evidence on comparative hepatic safety. **Key Findings/Impact:** Drug-induced ALF is uncommon, but over-the-counter products and dietary/herbal supplements are its most common causes. A new risk prediction model with platelet count and total bilirubin identified patients with drug-induced liver injury at increased risk of ALF with high sensitivity and reasonable specificity. Acute liver injury occurred rarely within the first year of modern antiretroviral initiation, but protease inhibitor use was associated with a higher risk of aminotransferase elevations among hepatitis-coinfected patients. Researchers reported improved understanding of the incidence, etiology, and outcomes of ALF in a community-based population. These data highlight the rarity of this outcome and provide estimates of the true risk of ALF resulting from medications, herbals, and dietary supplements. Furthermore, such events are rarely due to prescription medications. These data suggest that closer attention to the hepatotoxicity of over-the-counter medications, particularly dietary and herbal supplements, is needed. **Publications:** 21
Jeffrey Schnipper **Society of Hospital Medicine** Philadelphia, Pennsylvania	R18 HS019598 [Grant] **Multicenter Medication Reconciliation Quality Improvement Study (MARQUIS)** 2010–2013 $1,480,620 Final Report	**Purpose:** The goals of MARQUIS were to operationalize best practices for inpatient medication reconciliation, test their effect on potentially harmful unintentional medication discrepancies, and understand barriers and facilitators of successful implementation. **Key Findings/Impact:** Researchers concluded that adoption of a multifaceted quality improvement (QI) initiative for medication reconciliation using a mentored implementation model was associated with a reduction in potentially harmful medication discrepancies over time. They found that hiring additional pharmacy staff to assist with discharge reconciliation and patient counseling was the most effective component of a medication reconciliation QI program. They also identified several barriers to implementation. Next steps included a larger round of mentored implementation, using an enhanced version of the toolkit, with rigorous recruitment of sites committed and able to improve their medication reconciliation process, and incorporating lessons learned regarding the most effective ways to implement this intervention and improve medication safety during transitions of care. A subsequent project to this one is included in this appendix (R18 HS023757). **Publications:** 9

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Sandra Kane-Gill **University of Pittsburgh** Pittsburgh, Pennsylvania	R18 HS024208 [Grant] **Transforming the Medication Regimen Review Process of High-Risk Drugs Using a Patient-Centered Telemedicine-Based Approach To Prevent Adverse Drug Events in the Nursing Home** 2015–2018 $1,496,302 Final Report	**Purpose:** Develop clinical decision support alerts to inform pharmacists of inappropriate prescribing and monitoring of high-risk drugs for the prevention of ADEs. **Key Findings/Impact:** Results led researchers to question the current model of practice for consultant pharmacists. The data provided evidence to support the use of telemedicine for patient-centered communication when performing medication reconciliation and regimen reviews at care transition on admission to the nursing home and during the resident's stay for residents receiving high-risk medications. The product of this research is a generalizable electronic health record-agnostic medication management model including decision support rules, as well as structured communication tools to optimally execute the consultant pharmacist's role in ADE prevention in the nursing home. **Publications:** 4
RHODE ISLAND		
Kate Lapane **Brown Medical School** Providence, Rhode Island	R18 HS011835 [Grant] **Pharmacist Technology for Nursing Home Resident Safety** 2001–2005 $1,049,839 Final Report	**Purpose:** Evaluate the effectiveness of the clinical software program Geriatric Risk Assessment Med Guide™ (GRAM™) in nursing facilities to improve medication safety. **Key Findings/Impact:** Researchers concluded GRAM would not be used effectively unless completely integrated in the real-time operations of the long-term care pharmacy. Another option was to import the drug into the software without reentering detailed, complicated drug regimens**.** The rigorous validation protocol and enhancements to the algorithms underlying the software may have made the triggering much more selective. The significance of this study is that GRAM was developed as a clinical decision-making tool for geriatric patients on medication therapy to treat chronic disease and conditions. It has applicability in all settings where older adults reside, and widespread implementation of the tool is likely to occur in nursing facilities. Anyone can use the GRAM software, which is relatively inexpensive, but only health professionals with expertise in geriatric pharmacotherapy can use it as a clinical decision-making tool. **Publications:** 6
SOUTH CAROLINA		
William Basco **Medical University of South Carolina** Charleston, South Carolina	K08 HS015679 [Grant] **Prescribing Errors in Ambulatory Pediatric Care** 2006–2010 $645,676 Final Report	**Purpose:** Evaluate the frequencies of prescribing errors in ambulatory pediatric care. **Key Findings/Impact:** Out of 395 screening alerts, researchers identified 43 true errors. The implication of this research is that identifying either look-alike, sound-alike (LASA) substitution errors or dosing errors may be akin to "finding a needle in a haystack" and possibly not workable without automation. Use of health information technology, including automated screening of prescriptions for either LASA or dosing errors, would be a potential approach to decreasing the risk of pediatric medication errors. In 2009, principal investigator William Basco secured an R03 grant (HS18841) to develop and evaluate a list of more than 200 pediatric LASA pairs used in outpatient pediatric care and thought to be problematic for patients should a substitution occur at the time of drug dispensing. **Publications:** 11

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Steven Ornstein **Medical University of South Carolina** Charleston, South Carolina	R18 HS017037 [Grant] **Medication Safety in Primary Care Practice: Translating Research Into Practice (MS-TRIP)** 2007–2010 $1,183,549 Final Report	**Purpose:** Develop medication safety measures for primary care practice and assess the impact of a validated quality improvement (QI) intervention on performance on these measures among practices in an EHR-based practice-based research network. **Key Findings/Impact:** Medication safety measures of the following categories were produced: avoiding potentially inappropriate therapy, inappropriate dosages, drug-drug interactions, and drug-disease interactions and monitoring or preventing adverse drug events. Strategies adopted to improve medication safety included developing procedures to ensure accurate patient medication lists, increasing use of EHR decision support, adopting medication refill protocols, and using performance reports to identify patients with potential prescribing errors. During the intervention, practice performance improved significantly on avoidance of potentially inappropriate therapy, drug-disease interactions, and appropriate monitoring. This project was the first of its kind in independent practices, which still constitute most primary care settings in the United States. The QI interventions incorporating audit and feedback and practice implementation and adaptation of safety strategies are relevant to the growing number of U.S. practices that will adopt EHRs in this era of physician incentives for meaningful use of EHRs. **Publications:** 4
Andrea Wessell **Medical University of South Carolina** Charleston, South Carolina	R18 HS019593 [Grant] **Dissemination of the PPRNet Model for Improving Medication Safety** 2010–2012 $595,860 Final Report	**Purpose:** Decrease preventable prescribing and monitoring medication errors in primary care practices across the United States through dissemination of a quality improvement model focused on medication safety (MS). **Key Findings/Impact:** Only modest quantitative changes were observed, but lessons from this dissemination project on use of a broad MS indicator set and MS improvement strategies are relevant to the growing number of U.S. primary care practices that will adopt and "meaningfully" use EHRs. MS indicators from this project have been supplemented with MS-related EHR Meaningful Use Clinical Quality Measures and added to PPRNet Reports. These reports are regularly disseminated to more than 150 member practices in 40 states. The MS toolkit and findings from this project will continue to be integrated into PPRNet learning network activities as an AHRQ Center for Primary Care Practice-Based Research and Learning. **Publications:** 3
Andrea Wessell **Medical University of South Carolina** Charleston, South Carolina	R18 HS023454 [Grant] **Reducing ADEs From Anticoagulants, Diabetes Agents and Opioids in Primary Care** 2014–2017 $1,410,985 Final Report	**Purpose:** Develop ADE clinical quality measures (CQMs) for high-priority medications and test the impact of a community-engaged action research approach on practice performance on ADE CQMs. **Key Findings/Impact:** The measure development process resulted in nine CQMs. Intervention practices improved on two anticoagulant CQMs compared with control practices; control group practices improved on Avoiding Potential Overtreatment of Diabetes and Proportion of Adult Patients With an Opioid Prescription. Control and intervention practices improved on Avoiding CNS Depressants in Patients on Long-Term Opioids. There was no difference in the adjusted change between groups in the three other CQMs. Future work should focus on reducing variability across opioid CQMs and examine alternative roles for patient advisors in primary care. Selected ADE CQMs from this project were incorporated into the PPRNet 2017 Qualified Clinical Data Registry measure set recognized by the Centers for Medicare & Medicaid Services. **Publications:** 0

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
David Taber **Medical University of South Carolina** Charleston, South Carolina	R18 HS023754 [Grant] **Improving Transplant Medication Safety Through a Pharmacist-Led, mHealth-Based Program** 2017–2021 $1,492,135 Final Report	**Purpose:** Examine the efficacy of improving medication safety through a pharmacist-led, mobile health–based intervention. **Key Findings/Impact:** Researchers concluded that a pharmacist-led, mobile health–based intervention improved medication safety in kidney transplant recipients. During the 12-month study, the intervention produced a significant reduction in medication errors, lower rates of grade 3 or higher adverse events (AEs), and reduced hospitalization rates compared with controls. In terms of AEs, this study demonstrated a significant difference in severity, but was not powered, and did not demonstrate any difference in type of AEs between the treatment arms. **Publications:** 15
Ken Catchpole **Medical University of South Carolina** Charleston, South Carolina	R18 HS026625 [Grant] **Identifying and Reducing Errors in Perioperative Anesthesia Medication Delivery** 2018–2023 $2,466,217 Final Report	**Purpose:** Engineer reductions in anesthesia medication errors in operating rooms that address three sources of failure: failures of execution, failures of intention, and complexities of the working environment. **Key Findings/Impact:** According to the final report, this PSLL project improved perioperative medication safety through systems-based interventions. It identified high variability in medication handling, decision making, and workspace design, which contributed to anesthesia medication errors. The implementation of medication icon labels led to high compliance in practice, with increased confidence in drug selection and faster identification of medications. The syringe organization hub reduced syringe movements per hour from 16.7 to 11.5 and significantly decreased the variability of medication delivery locations, reducing the risk of errors. An academic detailing intervention aimed at improving incident reporting resulted in a 144% increase in reported perioperative complications, from 55 in 2021 to 134 in 2022, reflecting an enhanced safety culture. Additionally, a virtual reality evaluation of optimized operating room configurations found statistically significant improvements in situational awareness, visual monitoring, and workspace availability. These findings highlight the effectiveness of human factors engineering and systems safety approaches in reducing medication errors, enhancing provider workflow, and strengthening safety reporting mechanisms in perioperative care. **Publications:** 12

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Anjali Joseph **Clemson University** Clemson, South Carolina	R18 HS029109 [Grant] **Realizing Improved Patient Care through Human-Centered Design for Pediatric Mental and Behavioral Health in the Emergency Department (RIPCHD.PED)** 2022–2026 $1,439,719	**Purpose:** Develop and implement human-centered systems engineering-based work systems in emergency departments (EDs) to improve the safety, efficiency, and effectiveness of care for pediatric mental and behavioral health patients. This includes improving prescribing and administration workflows, integrating decision support technologies, and optimizing medication storage and accessibility to reduce errors and ADEs. **Key Findings/Impact:** This project is ongoing until September 29, 2026. According to annual progress reports to date, the RIPCHD.PED project has conducted staff interviews, retrospective ED data analysis, and workflow assessments to uncover barriers to safe prescribing, administration, and medication tracking. Findings have informed the refinement of EMRs to improve medication documentation and accessibility, as well as the integration of clinical decision support tools to enhance prescribing accuracy and reduce medication errors. The project has also developed structured workflows and standardized psychiatric medication protocols to ensure timely and appropriate treatment. Additionally, the team has designed and tested simulation-based interventions to evaluate medication workflows in real-world ED settings, allowing for the identification of potential risks and refinement of best practices. Efforts to optimize medication storage and accessibility have been incorporated into ED redesign plans to reduce the risk of medication diversion, delays, and administration errors. Moving forward, the project will continue refining and implementing these strategies to further enhance medication safety, reduce ADEs, and improve overall care efficiency for pediatric patients in crisis. **Publications:** 3
TENNESSEE		
Jerry Shenep **St. Jude Children's Research Hospital** Memphis, Tennessee	UC1 HS014295 [Grant] **Risk Analysis of Pediatric Chemotherapy Processes** 2003–2005 $200,000 Final Report	**Purpose:** Formally evaluate the risks associated with each step of a complex chemotherapy process for possible failure points before and after use of a commercially available integrated computerized provider order entry (CPOE) system at a leading children's cancer center. **Key Findings/Impact:** Researchers examined a commercially available software system designed for CPOE, automated safety checks, pharmacy dispensing, and electronic documentation of medication administration in a pediatric oncology setting. They sought to determine if the system's available series of integrated applications were as safe as a long-established paper-based process with multiple redundant checks. Based on initial assessment of the individual components of the system, an integrated system, once available, appeared promising. **Publications:** 1
Kevin Johnson **Vanderbilt University Medical Center** Nashville, Tennessee	R03 HS016261 [Grant] **Show Your Work: Do Prescription Annotations Impact Near-Miss Medication Errors?** 2006–2007 $100,000 Final Report	**Purpose:** Assess the impact of electronic prescription writing with Show Your Work on pharmacy callbacks to prescribers. **Key Findings/Impact:** This study was the first of its kind to examine the incorporation of a prescription annotations tool in an e-prescribing system. Results suggested that a relatively low-cost, easy-to-implement intervention could impact the pharmacist's perceived effectiveness and foster more effective partnering with prescribers. **Publications:** 1

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
TEXAS		
Grace Kuo **Baylor College of Medicine** Houston, Texas	R03 HS014406 [Grant] **The Effect of EMR on Medication Safety: A SPUR-Net Study** 2003–2005 $99,849 Final Report	**Purpose:** Provide an understanding of medication errors in a diverse primary care population. Assess the effectiveness of an electronic medical record (EMR) with computerized provider order entry (CPOE) that had clinical decision support system (CDSS) features in decreasing medication errors compared with paper medical records (PMRs). **Key Findings/Impact:** Preliminary data analyses showed that EMRs helped prevent certain medication errors (e.g., documentation or monitoring errors) while creating other types of medication errors (e.g., prescribing errors due to missing information or errors in spelling). EMRs were associated with increased medication counseling in primary care clinics. This study extended understanding of medication errors in a diverse primary care population and highlighted the effects of CPOE with CDSS in increasing or reducing errors. These findings were used by clinicians and clinic administrators affiliated with the Southern Primary Care Urban Research Network to design EMRs in clinics using PMRs and starting to use EMRs. The findings also helped EMR clinics find ways to improve CPOE features to further decrease medication errors. **Publications:** 2
Rajender Aparasu **University of Houston** Houston, Texas	R01 HS021264 [Grant] **Anticholinergics and Cognitive Decline in the Elderly With Depression** 2012–2016 $872,568 Final Report	**Purpose:** Evaluate the central adverse effects profile of medications with significant anticholinergic activity in older residents with depression. **Key Findings/Impact:** According to the final report, anticholinergic use was linked to increased risks of dementia, hip/femur fractures, and all-cause mortality. Additionally, a cumulative Anticholinergic Drug Scale (ADS) score of 3 or more at 60 days before the event date was associated with a 16% higher risk of mild-to-moderate cognitive impairment. Further subgroup analyses found that the antidepressant paroxetine, an anticholinergic-level 2 drug, exhibited similar clinical and cognitive safety profiles as other selective serotonin reuptake inhibitors, with no significant differences in dementia, cognitive impairment, fractures, or all-cause mortality. The study underscores the need for caution in prescribing anticholinergic medications to elderly patients with depression, as high anticholinergic burden is a modifiable risk factor for adverse outcomes. Providers should consider nonanticholinergic alternatives or nonpharmacological treatments to reduce risks associated with these medications. **Publications:** 8
Ayse Gurses (Formerly, Yan Xiao) **Baylor Research Institute** Dallas, Texas	R01 HS024436 [Grant] **Patient-Centric Risk Model for Medication Safety During Care Transitions** 2015–2019 $1,396,509 Final Report	**Purpose:** Develop a patient-centric risk model of medication-related harms during transitions by (1) identifying hazards to medication safety using a patient work system framework; (2) developing a risk assessment tool; and (3) evaluating the risk assessment tool in a multisite prospective longitudinal study. **Key Findings/Impact:** Top sources of hazards for medication-related harms identified by professionals were defects in patient education and inadequate homework system, challenging medications, cost, and information inaccuracies. Medications most frequently cited were anticoagulants, insulins, diuretics, opioids, and antiplatelets. Researchers concluded that risks to medication safety during transitions of care may be understood as a mismatch between medication management tasks and capabilities in an ambulatory environment. The significance of this project is that a risk assessment tool was developed that may be implemented to reduce risks of patient harms due to medication use, misuse, or non-use. The project refined a framework for developing patient partnerships, which may be used for research and for practical solutions and technology development. **Publications:** 6

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Eric Thomas **The University of Texas Health Science Center at Houston** Houston, Texas	P30 HS024459 [Grant] **Caregiver Innovations to Reduce Harm in Neonatal Intensive Care** 2015–2019 $3,997,797 Final Report	**Purpose:** This PSLL had multiple projects, including efforts to enhance EHR tools in the neonatal intensive care unit, optimize drug-drug interaction (DDI) alerts, and refine weight-based dosing practices to reduce preventable adverse drug events in neonates. **Key Findings/Impact:** According to the final report, this project refined EHR-based medication alerts, improving clinician adherence to best practices and reducing preventable medication errors. The study identified 177 unique override reasons for drug-drug interaction alerts across 10 clinical sites, highlighting the variability in alert use and the potential for missed critical warnings. By optimizing alert systems, the project helped reduce alert fatigue, ensuring that high-risk medication alerts were more effective in catching prescribing errors. Additionally, Safer Dx Trigger Tools enabled real-time electronic monitoring of medication-related safety risks, allowing for earlier detection of prescribing errors and missed doses. As a result, hospitals using these tools reported fewer medication errors and improved compliance with weight-based dosing protocols. The project's work also contributed to CMS implementing a national requirement in 2022 for hospitals to complete annual EHR safety self-assessments, reinforcing the importance of medication safety improvements. These collective efforts enhanced medication accuracy, minimized preventable drug-related harm, and promoted a safer neonatal care environment. **Publications:** 11
Hua Chen **University of Houston** Houston, Texas	R03 HS026790 [Grant] **Risk of Acute Asthma Associated With the Pediatric Use of Opioids** 2019–2021 $100,000 Final Report	**Purpose:** Assess whether exposing children and adolescents to prescription opioid analgesics is associated with increased risk of asthma attacks. **Key Findings/Impact:** The use of opioid analgesics was most common among children with outpatient procedures, dental procedures, traumatic injuries, or respiratory infections. Researchers concluded that opioid analgesics were commonly prescribed to children with asthma. The utilization rate was higher among non-Hispanic White children and children with prior asthma-related emergency department visits and short-acting beta agonist overuse. Other than procedures and diagnoses associated with frequent opioid use, such as surgical and dental procedures, a considerable number of children with asthma also received opioids for relatively minor conditions, including respiratory infections, abdominal pain, and general infections. In addition, the findings indicated that asthma exacerbation was uncommon after the dispensing of either opioid or nonopioid analgesic medication in children with current asthma. There was no significant difference in the odds of asthma exacerbation following the dispensing of opioid versus nonopioid analgesics. **Publications:** 3
Yan Xiao **The University of Texas at Arlington** Arlington, Texas	R18 HS027277 [Grant] **PROMIS Learning Lab: Partnership in Resilience for Medication Safety** 2019–2025 $2,493,137	**Purpose:** Improve the value of primary care services using work system design strategies, such as informational tools, task redesign, and space layout, to enable and build capacity. **Key Findings/Impact:** This PSLL project was ongoing until March 31, 2025, and no final report is available yet. However, publications produced thus far pertain to past, current, and future work concerning human-centered design and research in deprescribing medications, as well as difficulties and obstacles faced by older adults during the COVID-19 pandemic. **Publications:** 8

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
UTAH		
Ginette Pepper **The University of Utah** Salt Lake City, Utah	R01 HS011966 [Grant] **Nurses' Working Conditions: Effects on Medication Safety** 2001–2006 $1,008,919	**Purpose:** Describe the relationships between working conditions that affect nurses and the safety and quality of care they provide, with a focus on medication safety. This study focused on organizational variables that could be affected administratively, rather than individual nurse characteristics. **Key Findings/Impact:** A final report was not available for this project; however, a resulting review discussed potential theories or conceptual frameworks that combine clinical, organizational, financial, and outcome variables from the unique perspective of nursing. Theories not only suggest ideas for research, but also provide order and logic to an investigation and limit the number and type of variables to be considered to a reasonable few. Although relatively little health services research is done within nursing, there is a growing appreciation of the need for knowledge related to the use, costs, quality, delivery, organization, financing, and outcomes of health care and how nursing practice influences these variables. Conceptual frameworks used by investigators in AHRQ-funded grants show that workforce-related health services research of nursing phenomena is based on a wide variety of conceptual models, many of the investigator's own inventions. Researchers believe that such conceptualizations will guide future researchers and add coherence to the body of health services research into nursing issues. **Publications:** 1
Jordan King **The University of Utah** Salt Lake City, Utah	R18 HS026156 [Grant] **Management of Direct Oral Anticoagulants To Lower Adverse Events in Atrial Fibrillation (MODL-AF)** 2018–2022 $1,378,518 Final Report	**Purpose:** Determine the comparative safety, effectiveness, and cost-effectiveness of different models of direct oral anticoagulants (DOACs). **Key Findings/Impact:** Analysis included a robust comparison of baseline patient characteristics between DOACs and warfarin initiators in each Kaiser Permanente region. The study included 44,746 patients who met the inclusion criteria. Among all regions, DOAC-treated patients were modestly more likely to be younger, male, non-Hispanic White, former or never smokers, >60 kg in weight with hypertension. Among DOAC initiators, researchers analyzed 1-year medication adherence (the proportion of days covered [PDC]—that is how many pills "covered" the observed followup period—and medication persistence [how long a patient took their initiated treatment]). There was no significant difference in the average PDC between the three DOAC care models. Between 65.5 percent and 72.4 percent of patients had a 1-year PDC ≥80 percent depending on the underlying assumptions and DOAC care model. No significant difference in medication persistence was found across the three DOAC care models. **Publications:** 5
Daniel Witt **The University of Utah** Salt Lake City, Utah	R18 HS027960 [Grant] **Overcoming Barriers to Warfarin Patient Self-Management Implementation in the U.S. Healthcare System** 2021–2025 $1,347,674	**Purpose:** Improve the safety of ambulatory warfarin therapy by increasing implementation of patient self-management. **Key Findings/Impact:** This project was ongoing until April 30, 2025, and no final report is available yet. However, several articles have been published to date, one of which describes a single-center study that displayed the tremendous potential to improve patient safety and reduce bleeding harm. Based on recent guidelines limiting indications and duration of antiplatelet therapy (APT) added to anticoagulation, results showed that more than 95 percent of patients warranted reassessment of APT indication. Stable atherosclerotic cardiovascular disease and primary prevention were the prime targets for APT deprescribing. **Publications:** 10

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
WASHINGTON		
Emily Devine **University of Washington** Seattle, Washington	K08 HS014739 [Grant] **Evaluating e-Prescribing in a Community-Based, Integrated Health System** 2006–2011 $509,881 Final Report	**Purpose:** Provide protected time for the primary investigator to (1) obtain advanced training in health services research methods; and (2) use these newly acquired skills to design, conduct, analyze, and disseminate the findings of a sequence of research projects centered on evaluating the impact of the use of an electronic prescribing (or computerized provider order entry [CPOE]) system on outcomes. **Key Findings/Impact:** This Mentored Clinical Scientist Training Award grant enabled the investigator to obtain skills in advanced health services research methods that she is now applying to launch her career at the intersection of comparative effectiveness research and clinical research informatics. For example, her work has led her to make the following conclusions: (1) a basic CPOE system in a community setting was associated with a significant reduction in medication errors of most types and severity levels; and (2) e-prescribing takes longer than handwriting, and e-prescribing at the point of care takes longer than e-prescribing in offices/workstations. **Publications:** 14
Cindy Corbett **Washington State University** Pullman, Washington	R21 HS019552 [Grant] **Transitional Care Medication Safety and Medical Liability: Closing the Chasm** 2010–2011 $298,810 Final Report	**Purpose:** Improve medication safety and quality of care during the hospital to community transition, thereby improving patient outcomes and reducing adverse events and costs, including medical liability. **Key Findings/Impact:** Findings from aim 1 included: • Discrepancies occur across all medicine classes and are surprisingly common in those considered at high risk of causing patient harm. • The risk of harm from identified medication discrepancies is generally minimal but occasionally serious. • Five types of medicines were found to pose a high risk for medical liability. • Patient and system-level structure and process variables offer minimal to modest contributions to identifying the risk of medication discrepancies. Findings from aim 2 included: • Stakeholder groups could identify factors that impact antecedent, structure, process, and outcomes related to medication discrepancies during the transition from home to hospital and hospital to home. Different stakeholder groups often identify similar factors. • Emerging themes were identified as contributing to medication discrepancies during hospital community care transitions. • Strategies were identified by the Patient Safety Advisory Council for improving hospital community care transitions following the failure modes and effects analysis. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michael Parchman **Kaiser Foundation Health Plan of Washington** Seattle, Washington	R18 HS023750 [Grant] **Team-Based Safe Opioid Prescribing** 2015–2018 $1,471,862 Final Report	**Purpose:** Improve safe prescribing of chronic opioid medication for patients with noncancer pain in rural primary care clinics across Washington and Idaho. **Key Findings/Impact:** System redesign guided by the Six Building Blocks resulted in significant declines in the percentage of patients on high-dose opioids and the total number of patients receiving opioids in rural clinics compared with controls. Structural changes implemented as part of the intervention improved workplace organizational and emotional aspects for clinicians and staff. Increased confidence, comfort, collaboration, and teamwork improved clinician and staff practice environment perceptions and overall professional satisfaction. With adequate implementation support, the Six Building Blocks program provides an incidence-based roadmap or guide for primary care clinics to provide guideline-concordant long-term prescribing of opioids for chronic pain in a manner that improves patient safety and the work life of primary care clinicians and staff. **Publications:** 8
WISCONSIN		
Pascale Carayon **University of Wisconsin–Madison** Madison, Wisconsin	UC1 HS014253 [Grant] **Medication Error Reduction, Technologies, and Human Factors** 2003–2006 $460,531 Final Report	**Purpose:** Examine the impact of the implementation of medication administration technology, namely Smart infusion pumps and barcode medication administration technology, using human factors techniques. **Key Findings/Impact:** This project identified many medication-use practice issues, including unlabeled infusion bags from the operating room, missing medication orders for infusing medications, and protocols not being followed by the user. Researchers concluded that prospective risk analysis and usability testing greatly improved the implementation of the Smart infusion pump technology. Perceptions related to pump functioning, interface, improved patient safety, and ease of use predicted pump acceptance. Medication administration errors decreased, and pump-related errors were few. **Publications:** 20
Korey Kennelty **University of Wisconsin–Madison** Madison, Wisconsin	R36 HS021984 [Grant] **Medication List Consistency When Patients Transition From Hospital to Community** 2012–2013 $39,458 Final Report	**Purpose:** (1) Examine the agreement of medication lists for patients recently discharged from a hospital, focusing primarily on community pharmacy lists after the patient's first prescription fill. (2) Describe barriers and facilitators community pharmacists face when reconciling medications for recently discharged patients. **Key Findings/Impact:** Researchers concluded that information should facilitate future research to better understand the mechanisms for medication discrepancies. In addition, specific facilitators and barriers community pharmacists perceive when reconciling medications for recently discharged patients suggest promising avenues for future research interventions to decrease medication discrepancies (e.g., publications, conference presentations). A website, patient safety hotline, focus groups, and surveys offered participants additional portals for accessing information and updates pertaining to the project. Another mechanism for dissemination of project information and educational activities was Blackboard 5™, a comprehensive e-learning system that allows educators to enhance their learning product using the internet. **Publications:** 4

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michelle Chui **University of Wisconsin–Madison** Madison, Wisconsin	R18 HS024490 [Grant] **Improving Over-the-Counter Medication Safety for Older Adults** 2016–2020 $1,447,284 Final Report	**Purpose:** Examine the effectiveness of a structural pharmacy design change on over-the-counter (OTC) medication misuse in older adults, called the Senior Section™. **Key Findings/Impact:** Researchers identified statistically significant reductions in drug/disease misuse and drug/label misuse subtypes, with reduced daily-dosage and single-dosage misuse. The Senior Section slightly reduced drug/drug misuse and improved the quality of pharmacist–older adult encounters. After implementation, pharmacy staff were more likely to initiate patient encounters, address more topics, provide details about OTC products, discuss appropriateness of OTC use, and discuss medication classes highlighted in the Senior Section. Based on the proven effectiveness of the intervention and the minimal impact to pharmacist workload, the Senior Section can be scaled up to most community pharmacies in the United States. The Senior Section reduced the purchase of these products by 37 percent, which could potentially shield close to 6 million older adults from significant harms. **Publications:** 17
Maureen Smith **University of Wisconsin–Madison** Madison, Wisconsin	R18 HS026624 [Grant] **Engineering Safe Care Journeys for Vulnerable Older Adults** 2018–2023 $1,874,801 Final Report	**Purpose:** Develop and evaluate a Patient Safety Passport to support the safe transition of vulnerable older adults from the emergency department (ED) to subsequent care settings, ensuring continuity of care and reducing medication-related errors. **Key Findings/Impact:** According to the final report, this project identified key medication safety challenges in emergency care, particularly with antibiotic prescribing for suspected urinary tract infections (UTI) and medication reconciliation at discharge. Many women diagnosed with UTI in the ED didn't receive proper urine cultures, leading to unnecessary antibiotic use. The team implemented EHR alerts to notify skilled nursing facility practitioners about pending cultures, improving prescribing accuracy. The project also expanded pharmacist involvement in medication reviews at discharge, especially for patients on medications that increase fall risk. These interventions led to a reduction in ED revisits, showing improved medication safety and adherence to discharge plans. While most patients reported satisfaction with discharge instructions, some still experienced confusion about their medications. A redesigned After Visit Summary with patient-friendly formatting helped improve comprehension. The findings highlight how system redesign and EHR integration can enhance medication safety and improve care transitions for older adults. **Publications:** 16

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michelle Chui **University of Wisconsin–Madison** Madison, Wisconsin	R18 HS027737 [Grant] **Effectiveness and Sustainment of a Tailored Over-the-Counter Medication Safety Intervention in Community Pharmacies** 2020–2024 $1,467,146	**Purpose:** Adapt, adopt, and provide long-term evaluation of a system redesign intervention (the Senior Section) to decrease over-the-counter (OTC) medication misuse for patients in 63 Advocate Aurora Health pharmacies. **Key Findings/Impact:** According to the final report, researchers successfully developed, implemented, and evaluated a pharmacy-based intervention to reduce potentially dangerous OTC medication misuse among older adults. Through a three-phase study involving adaptation, randomized controlled trial, and sustainment evaluation across 67 Aurora Pharmacy sites in Wisconsin, the intervention redesigned pharmacy OTC aisles by color-coding medications based on safety profiles and relocating high-risk products behind the counter. Key findings demonstrated that Senior Safe effectively reduced OTC medication misuse—particularly drug-age and drug-drug interactions—without increasing pharmacy staff workload. The intervention showed both immediate and sustained effectiveness, with pharmacy patients more likely to initiate medication consultations in Senior Safe sites and pharmacists providing safer OTC recommendations. Eye-tracking research confirmed that older adults spent significantly more time examining safer "green" products in intervention sites. This evidence-based intervention provides health systems with a practical, sustainable approach to enhance medication safety for vulnerable older adults. **Publications:** *7*
Ryan Coller **University of Wisconsin–Madison** Madison, Wisconsin	R18 HS028409 [Grant] **Improving Medication Safety for Medically Complex Children With mHealth Across Caregiving Networks** 2022–2025 $999,999	**Purpose:** Create a scalable mobile health (mHealth) intervention that improves medication safety for children with medical complexity across the caregiving network, which includes primary (physicians) and secondary (e.g., family, in-home care professionals, schools) caregivers. **Key Findings/Impact:** This project was ongoing until April 30, 2025, and it has generated five publications. The investigators highlighted significant gaps in home healthcare safety, caregiver burden, and system coordination. Researchers explored the design and implementation of mHealth tools, including the development of the Meds@HOME app, aimed at reducing medication errors and improving adherence. Studies emphasized the importance of user-friendly, caregiver-centered technology and identified best practices and challenges in engaging families through remote and codesign methods. Overall, the project contributed to digital health innovation, caregiver engagement strategies, and patient-centered safety research in pediatric complex care. **Publications:** *5*

Principal Investigator Organization City, State	Project Number [Type] Project Title Project Period Total Investment to Date	Purpose, Key Findings/Impact, and Number of Publications
Michelle Chui **University of Wisconsin–Madison** Madison, Wisconsin	R18 HS029608 [Grant] **Engineering Resilient Community Pharmacies (ENRICH)** 2023–2027 $499,979	**Purpose:** Conceptualize, design, implement, and test a Medication Safety Map (MedSafeMap) for the community pharmacy setting to enhance pharmacists' and technicians' abilities to avoid, or to quickly identify and recover from, medication errors before patient safety is endangered. MedSafeMap is an innovative approach that pharmacists and pharmacy technicians will use to better navigate complex tasks in the pharmacy and to facilitate communication with both patients and clinicians, while safely providing medications to complex patients with chronic health conditions. **Key Findings/Impact:** This PSLL project is ongoing until August 31, 2027. According to annual progress reports, researchers have conducted foundational work to ensure high-quality data collection and analysis, including refining data collection tools, reviewing key literature on Safety-I/Safety-II principles and Functional Resonance Analysis Method (FRAM) modeling, and completing pharmacy familiarity exercises. Observations and interviews were conducted at six participating community pharmacy sites. The Lab team has also held regular meetings with principal investigators, advisory board members, and site liaisons to discuss logistics, address barriers, and refine implementation strategies. Additionally, a research specialist was hired to support ongoing project activities, and a protocol paper was submitted for publication. The next phase of the project will focus on developing and testing MedSafeMap through simulation-based evaluations, ensuring its feasibility and effectiveness in real-world pharmacy settings. **Publications:** 1

AHRQ Pub. No. 24-0017-1-EF
August 2025
www.ahrq.gov