Regional Autonomous Patient Safety (RAPS) Initiative

Today, health care is at a tipping point. The industry is facing a "triple crisis" of workforce shortages and burnout, a rise in safety issues, and a growing lack of trust. The ongoing public health crises have highlighted the fragility of our health systems and the undue burden we place on our frontline workers.

A report by the Office of the Inspector General found that 25% of hospitalized Medicare patients experienced harm prior to COVID-19 in October 2018. During COVID-19, the CDC and CMS observed a substantial deterioration in patient safety measures, including a 28% increase in central lines infection, a 17.4% increase in falls in skilled nursing facilities, and a 41.8% increase in pressure ulcers. The increase in medical errors is compounded by COVID-19's impact on workforce shortages, burnout, and turnover. In the American Nurses Foundation's 2022 Workplace Survey, 55% of nurses in acute care hospitals indicated that less than half the time their unit does not have the necessary number of staff to provide quality care, and 27% of nurses responded that ancillary staff is seldom or never available to adequately support safety.

In the midst of this triple crisis, we can't ask our frontline clinical teams to do more. Instead, we need to create **autonomous solutions** for providers and use a human-factors engineering lens to build our care teams a better work environment to achieve safe, optimal care. The Pittsburgh region is primed to become a leader in creating these solutions by deploying its **regional assets** in robotics, AI/ML, Big Data Analytics, and integrated delivery systems.

To establish Pittsburgh as a global tech hub for developing autonomous patient safety technologies, the Jewish Healthcare Foundation (JHF) and Pittsburgh Regional Health Initiative (PRHI) created the **Regional Autonomous Patient Safety (RAPS) initiative** in 2022. To plant a flag in Pittsburgh, JHF funded:
- the AI/ML in Healthcare Symposium in Pittsburgh in May 2022 with the University of Pittsburgh's Center for Military Medicine Research;
- the CMU Initiative for Patient Safety Research (IPSR);
- the University of Pittsburgh Department of Biomedical Informatics' (DBMI) "Medication Error Avoidance at Region Scale" (MEARS) study team, which is collaborating with the CMU IPSR team; and
- the RAPS Launch Event to generate further excitement about the region's potential to become a tech hub for autonomous patient safety solutions.

CMU Initiative for Patient Safety Research (IPSR)

CMU's Center for Digital Health Innovation (CDHI) received a grant from the Jewish Healthcare Foundation to launch the **CMU Initiative for Patient Safety Research (IPSR)**. The IPSR is co-managed by Tepper and CDHI, which builds on and broadens the significant experience and success of CMU's Center for Machine Learning and Health (CMLH).

With an initial focus on medication errors, the IPSR aims to:
1) Build and educate a community of patient safety researchers across CMU's schools and centers to work on specific problem definitions related to medication errors.
2) Create a benchmark data set with external data partners.

3) Analyze the benchmark data set to refine problem definitions, identify outliers, conduct root-cause analyses, and generate hypotheses and proofs-of-concept methods to detect and prevent medication errors.

The first major milestone is to create the benchmark data set with data partners by the end of summer 2023. This dataset will enable rapid exploration, insight, and innovation, catalyzing research to identify positive or negative deviations related to medication errors. A multi-disciplinary team with expertise in statistics, operations, human and organizational behavior, system design, psychology, and information theory will conduct comprehensive root-cause analyses on a selected number of the deviations.

The IPSR will result in diverse teams of faculty and PhD students, producing proof-of-concept innovations based on the benchmark data for anticipating, identifying, and preventing medication errors by the end summer 2024. These insights and discoveries have the potential to alert providers to anomalous situations, recommend actions, and predict changes in patients' conditions.

University of Pittsburgh Department of Biomedical Informatics' Medication Error Avoidance at Region Scale (MEARS)

The Jewish Healthcare Foundation is also funding the **Medication Error Avoidance at Region Scale (MEARS)** study at the **University of Pittsburgh School of Medicine's Department of Biomedical Informatics.**

MEARS aims to reduce preventable adverse drug events among skilled nursing facility (SNF) patients who transition between the hospital and SNF facilities by developing and pilot testing a clinical decision support (CDS) intervention. This will be accomplished by:
- Developing and validating computable rules that identify medication errors occurring during patient care transitions from the hospital to skilled nursing facilities
- Piloting a novel medication monitoring CDS intervention that uses medication error rules, computable phenotypes, and data from multiple settings and patient-owned devices to help clinicians improve the care of individual patients and set quality improvement goals for their entire patient population

The key functionality of the novel Risk Sentinel CDS system will be to support patient-specific medication risk assessment by a pharmacist and enable population-level monitoring of important medication safety concerns for both transitions to and from the hospital setting.

The MEARS study team will also collaborate with the CMU IPSR team to allow CMU researchers to develop and test predictive and analytic models focused on patient safety and medication error avoidance.

This study will result in validated and sharable decision support rules that use data from multiple care settings and devices owned by the patients. It will clarify the most important data elements for accurately discriminating a patient's risk of the four important undesirable health outcomes as they transition between care settings. It will also estimate the rate of alerts that involve actionable treatment recommendations. Preliminary data will inform the design of a randomized trial to determine the effectiveness of the new intervention model.

RAPS Launch Event

To generate further excitement about RAPS' vision and spark connections among technology and healthcare stakeholders, PRHI co-hosted the **RAPS Launch Event** with the Pittsburgh Technology Council on February 24, 2023 at CMU's Cohon University Center. Over 110 people attended the event, representing healthcare leaders, researchers, funders, legislators, and tech companies across the region.

During the event, Joe Kiani, President & CEO of Masimo and Co-Chair of the Patient Safety Workgroup for the President's Council of Advisors on Science and Technology (PCAST), underlined the promise of technology in preventing medical errors and the market opportunity.

Following the keynote, breakout session leaders discussed success factors of innovations and identified opportunities to work across silos to develop autonomous solutions for patient safety.

Richard Boyce, PhD, MEARS Study PI and Associate Professor at the University of Pittsburgh's DBMI, and Ari Lightman, MBA, MSc, CMU IPSR Co-PI and Professor of Digital Media and Marketing at Carnegie Mellon University Heinz College, led the **Regional R&D and Collaboration Breakout**. The participants suggested to focus on medication errors during transitions of care and discussed the importance of designing technologies to support frontline providers in the midst of the workforce crisis. They identified a need to develop a regional ecosystem for patient safety R&D that would provide access to funding, donors, and data.

Lindsey Ronnenberg, Senior Director of Global Quality, Products and Services at Omnicell, and Sean McDonald, president and CEO of Ocugenix and CMU Entrepreneur in Residence, led the **Commercialized Solutions Breakout**. The participants discussed how tech innovators often get squeezed out of the healthcare market by large IT vendors, such as EPIC, due to interoperability issues and healthcare systems working with large vendors that offer a suite of products. The participants suggested to organize meet-and-greets to bring healthcare providers and tech companies together to solve problems. They identified an additional need to create financial incentives to support R&D and the adoption of tech innovations for patient safety. They also noted that it would be helpful to develop a "playbook" for tech companies on how to design and implement predictive AI algorithms and other technologies in health care.

Jeanne Iasella, Chief Solutions Officer at TeleTracking, and Paul Phrampus, MD, Director of WISER and Medical Director of Patient Safety at UPMC Health System, led the **Federal Patient Safety Priorities Breakout**. The breakout participants suggested that we organize monthly *salons* for multi-disciplinary research teams to:
- learn about the federal patient safety priorities,
- monitor funding opportunity announcements,
- hear from local providers about what they need and want,
- catalogue the existing patient safety innovations in Pittsburgh,
- establish connections across silos,
- network with national and local donors,
- identify opportunities to share datasets for AI learning,
- jointly apply for federal grants, and
- troubleshoot implementation issues with providers, payers, government, and tech groups.

This type of collaboration could bring additional funding for patient safety R&D to the region, leading to an innovation tech hub for patient safety.

Jose-Alain Sahel, MD, Chairman and Distinguished Professor of the Department of Ophthalmology at the University of Pittsburgh School of Medicine, and Lee Harrison, MD, Associate Chief of Epidemiology and Education at the University of Pittsburgh School of Medicine, led the **Opportunities for Breakthroughs in Medical Specialties Breakout**. The participants stressed the need for intuitive, autonomous tech solutions that solve problems at the frontline for different specialties. They identified examples and discussed the importance of pilot testing the solutions and demonstrating cost-savings in health care.

RAPS Next Steps

As a follow-up from the Launch Event, PRHI is planning to:
- form a Regional Advisory of academics, policy leaders, health system leaders, and tech innovators;
- create a Concept Note, backed by the Advisory, to pitch to funders, bringing additional funding the region to establish tech hubs for autonomous patient safety R&D;
- commission an economic analysis;
- create a seed grant program for early-stage autonomous patient safety tech start-ups and R&D; and
- organize a series of "Patient Safety R&D Salons" with multi-disciplinary research teams, providers, payers, and tech companies in the region in response to the ideas raised during breakout sessions at the RAPS Launch Event.

The **RAPS Regional Advisory** will:
1. Advise on the design of the Patient Safety R&D Salons
2. Identify regional assets for invitations to the Patient Safety R&D Salons (e.g., start-ups, tech companies, providers, and multi-disciplinary researchers)
3. Review and offer feedback on the submissions for the R&D Seed Grant Program
4. Inform and approve a RAPS Concept Note
5. Identify federal grant opportunities (e.g., ARPA-H, Department of Commerce's Tech Hub, DOD, AHRQ, National Science Foundation, NIH, and PCORI)

The report of the **economic analysis** will describe the regional assets, the existing grants that have been secured for patient safety tech R&D, the current opportunities and threats, and recommendations for becoming a global tech hub for patient safety R&D. It would also estimate the amount of future funding that could be secured by multi-disciplinary R&D teams in the region, the number of jobs this would create, and the number of healthcare workers that could be retained in the region if the autonomous solutions were adopted. This strategy is informed by how the Southwestern Pennsylvania New Economy Collaborative was able to secure federal Build Back Better Regional Challenge grant.

PRHI is also planning to facilitate the **Patient Safety R&D Salons** for interested multi-disciplinary research teams, providers, payers, tech companies, and tech start-ups. The Salons will be designed to:
- learn about the federal and local patient safety priorities (e.g., patient boarding the ER, misdiagnoses, the inseparable connection to the workforce crisis, etc.)
- monitor funding opportunity announcements
- understand the business case for safety from a provider, payer, and purchaser perspective
- hear from local providers about what they need and want (meet-and-greets),
- identify tactics for improving the adoption and dissemination of tech in health care (Machine-Human Interface and Human Factors Engineering)
- review and expand an inventory of regional assets (i.e., existing patient safety innovations in Pittsburgh)
- shape the playbook for developing tech in health care (e.g., FDA approval, HIPAA, testing, ROI)
- establish inter- and intra-institutional connections across silos for research and discover
- build networks with national and local donors
- identify opportunities to share datasets for AI learning and tracking pre-conditions of injury/harm
- jointly apply for federal grants
- troubleshoot implementation issues with providers, payers, government, and tech groups

These Salons—recommended by the breakout groups during the RAPS Launch Event—would stimulate a pipeline of new research and development activity in the region. They would create a structure for the researchers, providers, start-ups, and tech groups to begin the conversations that would lead to collaborations and advance early-stage processes (possibly with support from the Seed Grants). These early collaborations should yield applications for federal grants or larger investments.

PRHI is also administering a **Seed Grant Program** to provide early-stage grants to start-ups, multi-disciplinary R&D teams, and tech companies in the Pittsburgh region that are in the *earliest stages* of developing, testing, and promoting autonomous solutions to prevent medical errors. It responds to a critical need identified during the RAPS launch event.

The seed grant program would include different levels of seed grants, totaling up to $200,000 of available funds:
- for start-ups and young innovators who are developing ideas for patient safety technologies;
- to incentivize health systems to test and implement autonomous solutions from a tech start-up or company in the region; and
- for the early stages of multi-disciplinary R&D teams that form across more than one university, center, or organization in the region.

The Seed Grants would be awarded based on the extent to which the team's idea for the autonomous solution is aligned with what healthcare providers need to work in a safe environment and the extent to which it is aligned with federal funding opportunities. The submissions will also be reviewed to determine whether the proposed scope of the early-stage work will put in place the structures and processes to position the innovators to further develop a start-up idea, apply for federal grants, or pilot test a new technology solution in a healthcare setting.