Unpacking the challenges of conducting embedded, learning health system research: The winning entries of a Challenge Contest sponsored by AcademyHealth

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Learning health system (LHS) science is anchored in research that spans the spectrum from systematic quality improvement to more rigorous research designs, including randomized controlled trials. While there is a growing number of investigators conducting embedded research, not all identify as LHS scientists. A general anchoring of LHS science in health services research among members of AcademyHealth was leveraged by the LHS Interest Group to create a Challenge Contest. Our aim was to expand the community of embedded researchers across the field (including its membership) experiencing similar issues in their work.

The Challenge Contest was launched via a webinar in December 2021 and entries were due in January 2022. A panel of LHS Interest Group Steering Committee members reviewed and selected 10 winners from a pool of 19 entries. Each entry was reviewed and scored by two reviewers in a highly competitive contest. Selected entries received a $1000 stipend to be applied to travel expenses to attend the Annual Research Meeting and/or AcademyHealth membership.

At the 2022 Annual Research Meeting, the LHS Interest Group used its time together in an open session to hear about recent developments in the broader LHS community and to discuss the results of the Interest Group sponsored Challenge Contest. The overarching aim of incorporating the Contest into the Interest Group meeting was to increase our collective capacity to engage in health services research embedded within healthcare organizations. Organizers envisioned that discussion of real-world problems in dynamic settings would lead to a rich experience for workshop participants. Meeting attendees had the opportunity to share insights and wisdom harvested from the challenges we face as LHS researchers.

Selected Challenge Contest winners gave rapid-fire talks that were thematically linked to critical aspects of working in an LHS: patient factors, data, engagement, and system factors. These presentations were chosen from a competitive pool of 10 winners and featured four talented researchers and timely topics:

- Mark Kowalkowski, Atrium Health: A Learning Health Sciences Strategy to Reduce Morbidity and Mortality after Sepsis (patient factors)
- Samuel Savitz, The Mayo Clinic: Challenges in the Evaluation of a Virtual Nursing Program (data)
- Paula Lozano (presenting for Claire Allen), Kaiser Permanente Washington: Adaptation and Implementation of An Evidence-Based Program To Reduce Unsafe Opioid Prescribing (engagement)
- Ming Tai-Seale, University of California, San Diego: Embedded Patient-Centered Research in three Real-World Learning Health Systems (system factors)

In each case, the researchers were addressing a complex, high-priority issue for the health system, from opioids to virtual care coordination, to sepsis, to improving communication. Further, presenters offered...
common essential components in LHS engagements that are becoming part of our blueprint for effective conduct of embedded research in real-world settings. Among these components is the central importance of building effective relationships with all health system stakeholders from the frontline to the C-Suite. Additionally, presentations underscored that this relationship-building process entails attention to how we communicate the value proposition for LHS research. In other words, as researchers, we need to affirm to our system leaders, clinical teams, and patients that we all want the same thing, even though we may use different approaches to attain it—equitable, high-quality, and cost-effective care for all.

With these presentations as a springboard, the 50+ attendees divided into small groups aligned with the four, emergent Challenge Contest themes to continue energetic discussions and to learn from one another. The small groups were facilitated by authors from selected cases not chosen for rapid-fire presentation and joined by the presenting authors:

**Patient Factors:** Margo Brooks Carthon: Implementing a Care Delivery System To Improve Transitional Care Outcome for Medicaid-Insured Individuals.

**Data:** Jason White and Kelly: Small: TeleICU Collaboration to Decrease Pressure Injuries (PrI) with Ostomy Wound and ICU Nurses: Tic DOWN PrI.

**Engagement:** Beata Debinski: Text Message Follow-Up for Patients Who Have Missed Well-Child Visits and
Karen J. Coleman: How Research and Operations Partner To Implement Collaborative Care for Depression in Large Primary Care Settings.

**System Issues:** Ana M Progovac: Lessons Learned: Implementation of Measurement-Based Care in a Psychiatry Department Within An Urban, Safety Net Health System
Andrew J Knighton (not present): Sustaining High Adherence To Lung-Protective Ventilation: Results of a Multi-Year Embedded Research Program in a Community-Based Learning Health System.

We invite you to read brief abstract descriptions of the 10 LHS challenge cases described by our selected contest winners. Interested readers are invited to learn more about AcademyHealth at [https://academyhealth.org/](https://academyhealth.org/) and the AcademyHealth LHS Interest Group at [https://academyhealth.org/professional-resources/interest-groups/learning-health-system-interest-group/page/learning-health-systems-interest-group](https://academyhealth.org/professional-resources/interest-groups/learning-health-system-interest-group/page/learning-health-systems-interest-group).

A learning health sciences strategy to reduce morbidity and mortality after sepsis

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**Funding Information:** Atrium Health Adult Medical Specialties Division; National Institute Of Nursing Research of the National Institutes of Health, Award Number R01NR018434; The Duke Endowment, Award Number 7056-SP.

**Project Overview:** Despite increased sepsis awareness and improved early hospital management, sepsis remains the leading cause of hospital and post-hospital morbidity, mortality, and healthcare costs in the United States. As part of our learning health system’s coordinated strategy to address persistent care gaps and improve outcomes for patients after sepsis hospitalization, we initiated a multiphased study to (1) test the effectiveness of a Sepsis Transition and Recovery (STAR) program to reduce mortality and hospital readmission after sepsis; (2) examine barriers and facilitators to successful program implementation in diverse hospital and community settings; and (3) identify core program functions and forms to guide optimal model scale-up. Here, we describe our embedded research approach leveraging multidisciplinary clinical-research partnerships, system leadership support, and a combination of institutional resources and federal- and foundation-issued awards to conduct a pragmatic evaluation at multiple hospitals within a single, large health system in North Carolina.

**Stakeholder Prioritization:** Health system leaders identified improving sepsis outcomes as an enterprise priority—with limited evidence to guide how to achieve the desired progress. Based upon the work of our research team and best-practice recommendations for post-sepsis care (eg, monitoring medications, functional deficits, new or worsening chronic conditions, goals of care), Atrium Health developed the STAR program to enhance the transition process for sepsis survivors. STAR deploys nurse navigators connected virtually to all participant hospitals and provides proactive care coordination and monitoring of high-risk patients, with clinical oversight by a Hospital Medicine team.

**Challenges:** We anticipated and proactively addressed two challenges prior to our study: (1) identification of sepsis survivors for targeted intervention; and (2) barriers that hinder patient participation in transitional care (eg, travel, costs). During implementation, we also experienced challenges to effectively balance between frontline clinician engagement and avoid unnecessary burden.

**Resolutions:** STAR leverages advanced analytics to equitably align resources to high-risk patients and an efficient, telehealth-based approach that includes centralized nurse navigators for proactive monitoring, education, and support, along with community paramedicine and strong ambulatory care partnerships to promptly address issues during transition. As an ongoing challenge, we continue to evaluate acceptance and value of EHR-based strategies to right-size clinician involvement in aspects critical for program awareness and effective engagement, without overburdening frontline teams.
Lessons Learned: Our IMPACTS trial (NCT03865602) at three hospitals showed a near 5% absolute reduction in readmission and mortality within 30 days for patients randomized to STAR compared to usual care (n = 691; 28.7% vs 33.3%; OR, 0.80; 95% CI, 0.64-0.98)—with observed benefit up to 12 months.12,13 Building from this work, our ENCOMPASS trial (NCT04495946) is ongoing at eight hospitals, leveraging a hybrid effectiveness-implementation design to test hospital-level practice change.14 To date, nearly 3000 patients have been enrolled, and initial implementation assessments have been completed with patients, clinicians, and administrators (Aims 1, 2). Adaptation-focused evaluation is planned to begin this year (Aim 3). Our findings will provide urgently needed, practical information to advance understanding of how to integrate post-sepsis management across care settings and facilitate implementation and dissemination in diverse health systems to improve care and costs for millions of sepsis survivors.

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Lessons learned from implementing a care delivery system to improve transitional care outcome for Medicaid-insured individuals

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Project Overview: Individuals with multiple chronic conditions require complex care management and often experience significant challenges when transitioning from hospital to home. These transitions are compounded for low-income individuals, including adults insured by Medicaid who are disproportionately Black, Indigenous, People of Color (BIPOC), and experience a higher burden of chronic disease. In our own healthcare system, disparities among individuals insured by Medicaid were on clear display. Penn Presbyterian Medical Center (PPMC) is a level 3 trauma center located in West Philadelphia. Approximately 75% of individuals on PPMC’s Medicine Service are Black/African American, 58% are insured by Medicare, and 24% are insured by Medicaid. Of note were disparities in post-discharge outcomes among Medicaid-insured patients discharged from the Medicine service. Over 20% of individuals insured with Medicaid experienced a readmission within 30 days compared with 6% of commercially insured individuals. Similarly, 17% of individuals insured with Medicaid experienced an ED visit within 30 days of a prior hospitalization, compared with 4% of commercially insured individuals. In addition to unfavorable post-acute outcomes, the social needs of Medicaid-insured individuals were inconsistently addressed.

Project Participants: To address these concerns, our interdisciplinary team of researchers, hospital and home care nurses, community health workers, and physicians co-developed the THRIVE clinical pathway with funding support from the Leonard Davis Institute of Health Economics ($10 000), the Center for Health Care Innovations ($7500).1 THRIVE provides intensive 30-day post-discharge support to individuals with Medicaid insurance and a Philadelphia zip code.
With THRIVE, patients insured by Medicaid are (1) identified during the discharge planning process, then (2) referred to home care services, (3) receive ongoing clinical supervision after discharge by hospital-based physicians for 30 days until (4) connected to primary or specialty care. Finally, (5) intensive case management is conducted via weekly virtual interdisciplinary case conferences for a full month following discharge.

Challenges, Solutions, and Lessons Learned: A study of our first year of the THRIVE quality improvement initiative revealed preliminary impact on utilization metrics including reduced readmissions and ED utilization and increased connections to community-based services to address social needs. Despite success, our team also faced early challenges related to participant identification of eligible THRIVE participants from the inpatient units. At THRIVE’s inception, hospital-based Nurse Case Managers manually identified Medicaid-insured individuals using a daily report. This identification process, however, posed an additional burden to nurse Case Managers and resulted in ~6 participants identified per month (well below estimates of >50 eligible participants per month). Using Case Manager feedback, we revised our identification procedures by leveraging a predictive algorithm developed by our team. This algorithm was embedded into the electronic health record (EHR) and resulted in the creation of an electronic “flag.” The THRIVE EHR flag provides a visual cue in the EHR to “nudge” Case Managers to activate a THRIVE referral for eligible patients and has resulted in a significant increase in monthly referrals. Our experience with THRIVE enrollment helped solidify the value of embedding processes to ensure ongoing stakeholder engagement to reduce workload strain among frontline workers and increase acceptability of the intervention.

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Challenges in the evaluation of a Virtual Nursing Program

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Project Overview: We aimed to evaluate how outcomes for a novel institutional Virtual RN program (ViRN) compared with similar, traditional units. ViRN was implemented at Mayo Clinic Rochester in November 2020 and involves experienced nurses providing virtual care for patients through telemedicine. In ViRN units, tele-doc tablets have been placed in patient rooms to facilitate video communication between the ViRN nurses and local care teams. Key responsibilities of ViRN nurses include: serving as a resource for clinical questions; mentoring staff for new procedures; checking medications; and tracking patients at risk for deterioration. This work was funded internally by the Kern Center for the Science of Health Care Delivery.

Stakeholders Involved: In October 2021, Mayo Clinic’s Chief Nursing Officer and Chair of the Department of Nursing in Mayo Clinic’s Midwest Practice as well as the Nursing Administrator for the Rochester campus who oversees ViRN reached out to Mayo Clinic’s Kern Center for support in an evaluation of ViRN. They identified the need for research and provided detailed background on ViRN including the goals of the program, how the program functions, and the units participating in the program.

Challenges Encountered: The primary challenge was the identification of a suitable comparison group. ViRN was implemented in all general units at the Rochester campus in November 2020 during the COVID-19 pandemic. Given this widespread implementation, we were limited to comparison groups using historical data or data from another Mayo Clinic facility. However, given significant differences in care delivery and patient case-mix during the pandemic and across regions, identification of a valid comparison group was challenging.

Resolution: We compared the ViRN patients with a historical comparison group of patients receiving care in the same units before COVID-19 as well as a concurrent comparison group of patients receiving care at Mayo Clinic Arizona. We utilized propensity score matching and difference-in-differences approaches to control for observed differences in these groups. We found that ViRN was potentially associated with a small increase in length of stay, but no differences in inpatient mortality or transfer to the ICU. Our results have informed the evolution of ViRN at Mayo Clinic.

Lessons Learned: First, this project necessitated the identification of appropriate comparison groups to study the independent impact of ViRN care. We identified both historical and concurrent comparison groups and compared the findings across several methodological approaches, enabling us to triangulate the findings and provide more confidence in our results. Second, we recognized that the meaning of measures may change over time and by setting. For example, use of our institutional patient portal grew over time, impacting the comparison of ViRN patients to patients in the historical comparison group. Additionally, admission source differed greatly between Rochester and Arizona, with 33% of patients not being admitted through the emergency department in Rochester and only 5% in Arizona. As such, admission source may not indicate the same level of acuity across
TeleICU collaboration to decrease PrI with ostomy wound and ICU nurses: TIC DOWN PrI

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Project Overview: Pressure injuries (PrIs) worsen patient morbidity and increase hospital costs. Early recognition is imperative for reducing preventable harm. A process improvement project, TIC DOWN PrI, was undertaken to decrease PrIs by increasing the performance of a 2-RN skin assessment within 24 hours of admission using video technology and TeleICU RNs. TeleICU RNs document assessment findings, review PrI prevention best practices, and discuss missed opportunities with the bedside RNs. Wound Ostomy Continence RNs are consulted for validating skin alterations, when necessary. The project is being conducted in three medical ICUs (79 beds) within the BJC Healthcare System from October 2021 to March 2023. No funding was received for the project.

Stakeholders Involved: The goals of TIC DOWN PrI are to improve PrI identification and assessment documentation upon admission and reduce risk of Hospital Acquired PrIs (HAPrIs). The collaborative project includes experts in PrI and clinical informatics along with TeleICU/bedside RNs, and ICU leaders, with the goal of timely recognition of PrIs upon admission and reduced risk of HAPrIs.

Challenges and Ensuing Adaptations:

- Timely and accurate documentation of 2-RN skin assessments on admission—Established workflows for communication and collaboration between TeleICU and bedside RNs for execution of 2-RN skin assessment.
- TeleICU RNs historically did not enter documentation into the electronic medical record (EMR) before—Created RedCap survey to measure TeleICU RN documentation of PrIs (presence/absence of, location, provision of prevention best practices, and discussion of missed opportunities).
- Lack of staff engagement—Recruited project champions in each ICU to discuss the importance of the project and encourage participation with peers.
- Staff and leader turnover—Developed standardized education specific to each ICU.

- Lack of standardized reporting across ICUs, inefficient data extraction, lack of infographics, and delayed communication of compliance to ICU leaders threatened sustainability—Merged EMR documentation and RedCap survey results into automated Clarity report, which was exported to a dashboard for real-time leadership review of process metrics.

Preliminary Results: Analyzing the average 8-month baseline to average 9-month post-implementation data across the three ICUs, 2-RN skin assessment documentation compliance increased by 62% and identification of PrIs present on admission/transfer increased by 142%. Next steps include evaluation of patient-specific prevention measures implemented within 24 hours of admission and the financial impact associated with decreased PrI rates. Due to the interrupted time series methodology, currently, we are unable to report an overall % decrease in PrI rates.

Lessons Learned:

- Early success can be attributed to participation from key stakeholders, designated RN champions, and bedside leaders to promote change management, accountability, sustainability, and celebrations.
- Consultation with clinical informatics experts at project initiation is integral for extracting accurate data, merging of multiple data sources, and report development and distribution.
- Collaboration between TeleICU and bedside teams provides an innovative approach to inform and create new standards of care to reduce preventable harm and improve safety and quality across the organization.

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Engagement strategies to support adaptation and implementation of an evidence-based program to reduce unsafe opioid prescribing

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Project Overview: Prescription opioids killed more than 14,000 people per year in the United States for the last decade and opioid overdose deaths continued to rise during the COVID-19 pandemic. Kaiser Permanente Washington (KPWA) care delivery leadership identified the need to reduce high-dose opioid prescriptions for chronic pain. In response, researchers at the KPWA Center for Accelerating Care Transformation (ACT Center) funded and developed the Integrated Pain Management program where we engaged care teams and patients to co-design an intervention that uses a patient-centered, destigmatizing approach to chronic pain care and opioids, then implemented the intervention through practice facilitation and multidisciplinary Opioid Safety Committees, which review patient cases, make holistic care recommendations, and regularly review outcome data. We implemented the program in eight primary care clinics and will spread to another six clinics over the next year.

Stakeholders Involved: Stakeholders included leaders from care delivery operations, primary care, quality and safety, pharmacy, addiction, and mental health; patient partners; primary care providers and staff; and the embedded research team from translational research and implementation science.

Challenges Encountered: Our team faced many challenges. Challenges unique to opioids include (1) chronic pain treatment is complex and non-opioid alternatives are often expensive, time-consuming, inaccessible, or unavailable; (2) tensions exist between providers and their patients, and providers and the health system. Providers are caught in a gap between patient expectations and organizational requirements, experiencing stress and conflict in patient visits while feeling unsupported by the health system in implementing new guidelines. Other challenges were related to COVID-19 and the ongoing burnout and fatigue experienced by care teams due to staffing shortages, access issues, and broader political and environmental stressors. Finally, we faced challenges related to implementing a complex intervention in a large health system including difficulty aligning stakeholders at all levels, issues accessing actionable data, and cultural and logistical issues in changing practices and behaviors.

Resolution: We addressed these challenges by building partnerships and leveraging strategies defined in the Engagement domain of AHRQ’s Learning Health System Competencies. From the outset, we built diverse teams by engaging leaders, patients, and representatives of relevant clinical roles in program design. We aligned our program’s objectives with the organization’s priority metrics to respond to the health system’s needs and invested time to understand the values and communication preferences of our partners. We shared relevant data on opioid metrics and provider experience throughout the project to improve implementation and clearly communicate the value proposition to stakeholders, and our practice facilitators employed strategies to foster trust and accountability. We integrated all changes into existing workflows and worked chairside with clinical staff to ensure alignment with their needs and daily activities. Finally, we fostered partnership with patients who have experience with chronic pain and opioids to provide guidance and input on our work to ensure the intervention was patient-centered and directly addressed stigma and disparities in treatment.

Lessons Learned: Intentional engagement across stakeholders, responsiveness to stakeholder priorities, and strategies that promote an improvement mindset are central to successful implementation of complex learning health system interventions in care delivery settings.

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Piloting text message follow-up for patients who have missed well-child visits

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Project Overview: Sending reminders to caregivers prior to appointments via text or phone call is an effective and common strategy for reducing missed appointments. However, after a missed appointment, follow-up procedures are not standardized, typically leaving the onus on the caregiver to reschedule, with one study finding that fewer than one-third of caregivers reported trying to reschedule a missed well-child visit (WCV) or other appointment type. We sought to promote rescheduling and attendance of missed (or “no-showed”) WCVs by sending text messages to caregivers of patients in the Pediatric and two Family Medicine outpatient clinics within Atrium Health Wake Forest Baptist, based in Winston-Salem, North Carolina. An open trial phase tested the feasibility and acceptability of text message reminders using different message types, followed by a pilot randomized control trial with one message type vs treatment as usual. The research was launched with an internal pilot award from the Center for Healthcare Innovation, and made possible by external funds from the National Center for Advancing Translational Sciences, NIH (award TL1TR00316: BD effort; award UL1TR00142: SSD effort, RedCap, and other resources).

Stakeholders Involved: Authors Beata Debinski and Katherine A. Poehling identified the need for research about novel ways to address the perennial challenge of WCV no-shows and began by engaging providers on the Pediatric Primary Care Service Line to ensure we would not duplicate existing efforts and to gain buy-in. After
receiving the award, we met with clinic managers at all five locations to solicit their support and gather input on message content and potential pitfalls, and similarly gathered feedback from Family Medicine faculty. We kept clinical stakeholders appraised throughout. The Digital Communications Core (“DComm”) approved the project for use with the cloud-based platform Twilio and informed content and process; our Maya Angelou Center for Health Equity translated all project materials into Spanish; Informatics worked with us to generate data extracts; and the REDCap support team was instrumental in helping us navigate REDCap/Twilio integration and in making back-end changes.

**Challenges Encountered**: We expected challenges with non-working or incorrect phone numbers, or that the primary “home” contact on file could be a landline instead of a mobile number. Unexpectedly, no-show data were unavailable consistently until 1 week post-no-show.

A central challenge was, however, that the use of RedCap/Twilio integration at our institution was in its infancy; we faced hurdles in data import, executing two-way SMS communication, managing complexities of tailored message variations, and particularly how these interfaced with bi-lingual implementation.

**Resolution**: Twilio data from the first study phase indicated that our text messages were delivered over 90% of the time, alleviating our first expected challenge. We adjusted initial message timing based on data availability, then worked with our RedCap team and DComm to evolve our text message campaign protocol to meet technological capabilities.

**Lessons Learned**: Our findings from the first study phase suggest text message follow-up for no-showed WCV is a promising low-cost strategy, but piloting such an approach necessitates extensive engagement with clinical stakeholders and with numerous technological resources in the institution to make implementation and evaluation feasible.

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**How research and operations partner to implement collaborative care for depression in large primary care settings**

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**Overview**: The Kaiser Permanente Southern California Depression Care Management (KPSC DCM) collaborative care program began in 1999,\(^2\) and was further refined as a Center for Medicare and Medicaid Innovation (CMMI) Health Care Innovation demonstration project beginning in 2012.\(^1\) After the end of this trial (2015), the program was fully institutionalized.\(^4\) A total of 50 831 patients with mild-to-moderate depression symptoms have been treated in the KPSC DCM program from 2015 to 2021: 50% of whom experienced remission in their symptoms after an average of 4 months of treatment. Remission rates remained high at 48% 6 months after discharge.

**Stakeholders Involved**: Stakeholder engagement followed the Veterans Affairs’ Quality Enhancement Research Initiative (VA QUERI) approach of having the research team serve as expert consultants to help guide the institutionalization of the program.\(^5\)\(^6\) Department administrators were some of the most critical stakeholders because they oversaw the work of several staff who were instrumental in developing workflows and processes critical to the success of the DCM initiative.

**Challenges**: There were several challenges in implementing a multi-visit treatment program in a high-volume primary care setting; however, the most important ones were cost and access. Each primary care physician at KPSC has approximately 2000 patients on their panels. Although several decision-support tools were implemented to assist primary care physicians with the diagnosis and treatment of depression, none could replace the conversation with their patients about their condition. Although the best-case scenario was to have the DCM program staff physically co-located for “warm hand-offs,” this was impossible to achieve in a health system with 4.8 million members, nearly 400 000 with depression, in 15 hospitals and 236 medical office buildings spread throughout the Southern California region.

**Resolution**: Challenges were addressed by using the Institute for Healthcare Improvement (IHI) for rapid improvement in healthcare systems as the main implementation approach.\(^7\)\(^8\) There are several elements from the rapid improvement process that are uniquely suited to institutionalizing the care of patients with depression in primary care settings: (1) capacity building within the organization to
adapt evidence-based interventions to address organizational concerns; (2) providing several temporary Plan-Do-Study-Act (PDSA) learning cycles for people to “try out” change without committing large amounts of organizational resources for long periods of time; and (3) allowing for incremental and dynamic change in that goals is revisited depending upon the feedback from the PDSA learning cycles. Another added advantage of this implementation approach is that data collection is essential to the process of change, helping the organization see the value of research as an inherent activity for capacity building. The research team becomes a partner and an asset for organizational development rather than one more outside force to contend with when trying to make decisions.

**Lessons Learned:** Collaborative care for depression can be institutionalized in large healthcare systems and be sustained with a specific, detailed roadmap that includes workflows, training, treatment guidelines, and clear documentation standards that are linked to performance metrics. Extensive stakeholder engagement at every level is also critical for success.

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**Project Overview:** Funded by the Patient Centered Outcomes Research Institute, this multi-center, large-scale cluster randomized controlled trial aims to improve patient engagement in shared decision-making by evaluating the comparative effectiveness of three interventions: in-person training of primary care providers (PCPs) conducted by standardized patient instructors; virtual training of PCPs with a mobile app; and bi-lingual posters placed on clinic exam room walls. The study, conducted from September 2017 through August 2022, took place in 21 outpatient primary care clinics in three, multi-specialty health systems in Southern California, Northern California, and central Massachusetts.

**Stakeholders Involved:** Patients, health system leaders, PCPs, and embedded researchers identified the need for this research and served as stakeholders.

**Challenges Encountered:**

The following are a few of the encountered challenges.

a. Balancing standardization with honoring local circumstances in multiple aspects of the study. EHR intervention implementation and patient recruitment approach variations (email vs MyChart® patient portal to EHR and challenges in leveraging the EHR's Research Module in identifying and recruiting eligible patients) resulted in long delays and slow recruitment in two systems until they switched from MyChart® to email.

b. Barriers to patient participation due to requirements for informed consent and HIPAA.

c. COVID-19 interrupted in-person visits. The speed of deploying telehealth visits varied across the three systems. Virtual visits precluded viewing the posters in clinics assigned to that arm, necessitating a pause in recruitment.

d. Statistical analyses and power calculations are complex due to cluster randomization by clinic and multiple patients per PCP. Observed baseline data showed different within-PCP correlation values for the three systems.

e. PCP and staff’s bandwidth to support research and turnover challenged recruitment and retention. The COVID-19 pandemic exacerbated these challenges.

**Embedded patient-centered research in 3 real-world, learning health systems: Challenges and lessons**

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ABSTRACTS

Project Overview (setting, scale, funding): In psychiatry, measurement-based care (MBC) is more effective than usual care, yet remains underutilized due to multilevel barriers, leading to mixed provider and patient experiences. In 2021, during the COVID-19 pandemic, a safety net hospital's Adult Outpatient Psychiatry Department embarked on MBC implementation using an online, computerized-adaptive, patient-reported mental health symptom assessment. We used qualitative and quantitative methods to (1) identify appropriateness, acceptability, and feasibility of MBC prior to its implementation; (2) identify MBC challenges via repeat provider surveys during the first 6 months of roll-out at the first pilot site; and (3) measure MBC uptake using electronic health record data from the first 6 months at three pilot sites.

Stakeholders Involved (including why this was undertaken): Psychiatry department leadership and selected clinical champions identified the need for MBC implementation, and mental health services researchers and clinical leadership jointly selected a symptom tool (Computerized Adaptive Test-Mental Health; CAT-MH). An additional group of researchers (this study team) used implementation science research to study the pilot implementation.

Challenges Encountered (or expected): Most prior psychiatric MBC studies were conducted with patients in waiting rooms before the rapid expansion of telehealth due to COVID-19. Given the context, this effort anticipated novel challenges related to increased mental health service demand, access disparities, and provider burnout.

Lessons Learned: Implementation of measurement-based care in a psychiatry department within an urban, safety net health system

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Lessons learned: Implementation of measurement-based care in a psychiatry department within an urban, safety net health system

f. Interventions requiring EHR build may not be implemented according to the research project's timeline when informatics analysts prioritize operational needs.

Strategies Used to Address Challenges:

a. To align goals and problem solve, we held regular and ongoing consultations with site leaders, study sponsors, stakeholders, and Information Services leaders and staff.

b. Simplified the informed consent and HIPAA forms and processes.

c. Worked closely with PCORI and consulted with the Data Monitoring Board to adjust research plan.

d. Used statistical simulation for power calculations. Derived optimal distribution of patients between baseline and follow-up as a function of the within-PCP correlation. We modified the analysis plan to account for the difference in within-PCP correlation between health systems, in consultation with the Data Monitoring Board.

e. Clinician co-investigators invited colleagues to participate and stay in study. Beyond financial incentives, the study provided 5 to 20 units of Performance Improvement CME to increase the value of participation to PCPs.

f. We funded dedicated efforts of informatics staff to build and train users on the EHR interventions.

Lessons Learned: Embedded researchers serving alongside operations leaders in a health system contribute to effective LHS research. It was essential to have the study sponsored by multiple senior leaders. Their enthusiastic support facilitated clinic and clinician recruitment and the design and implementation of changes to the EHR and clinic workflows in each system.

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Resolution (actual or hoped-for): Clinical leadership and research partners used data and experiential learning to address these challenges including: sharing data and workflow decisions with the first pilot site (culture challenge), increasing trainings and clinical team discussions about MBC (culture), decreasing the frequency of CAT-MH administration (burnout, staff shortages), hiring support staff to reach out to patients and discuss barriers (burnout, equity challenges, staff shortages), feeding back data to operational leadership (culture, burnout, and equity), improving patient messaging (culture and equity), and conducting patient surveys to understand differences between completers and non-completers of the MBC tool (equity).

Lessons Learned: Safety net organizations providing mental health care and seeking to implement MBC after the onset of the COVID-19 pandemic continue to be impacted by health system strains, including rising levels of demand for mental health services, disparities in the health and economic impacts of COVID-19, and ongoing provider burnout and staff turnover. MBC may have the potential to address these ongoing challenges, but will require optimizing implementation strategies that facilitate trusting patient-provider relationships, shared understanding of MBC utility, additional resources and staffing to...
Sustaining high adherence to lung-protective ventilation in a community-based learning health system

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Project Overview: Intermountain Healthcare’s (Intermountain) 17 ICUs are part of a hospital system that ventilates 4000 adult patients annually. About 20% of these ventilated patients have acute respiratory distress syndrome (ARDS), a syndrome diagnosed when an acute insult (eg, pneumonia or sepsis) triggers severe, bilateral non-cardiogenic, pulmonary edema requiring invasive mechanical ventilation.1,2 Lung-protective ventilation (LPV) is an evidence-based protocol that improves outcomes for patients with ARDS.3-7 Physicians are not able to identify all patients with ARDS and use of LPV remains variable.2,8,9 The purpose of this project was to achieve sustained system-wide full adherence to LPV (defined as ≥85% encounters having LPV delivered for >90% of time patient on mechanical ventilation).

Stakeholders Involved: Beginning in 2015, implementation strategies to encourage LPV use, including deployment of computerized ventilation protocols, were successful in achieving 75% adherence system-wide by January 2019 with considerable site variation. To achieve full adherence system-wide, a Center of Excellence in Critical Care Implementation Research was organized with two co-production cores: a Clinical Effectiveness Core led by the Senior Medical Director, Critical Care and project sponsor, which included physician, nurse, and respiratory therapist (RT) representatives; and a multifunctional Implementation Science Core, led by Senior Medical Director, Intermountain Healthcare Delivery Institute, including a health system engineer, biomedical informaticist, and health services researchers. Key system stakeholders included enterprise critical care physician, RT and nursing leadership, site level leadership counterparts, and frontline teams.

Challenges Encountered: A scoping review confirmed that agreement exists among clinicians that LPV is warranted for patients with ARDS but with a substantial disconnect between belief and practice.8 Determinants to LPV use include physician ability to recognize ARDS in a timely manner;10,11 lack of written protocols;12,13 lack of concordance with clinician perceptions of patient need;8,10,12,11 and perceptions by nurses and RTs that LPV is labor-intensive with present staffing inadequate to achieve full adherence.8,12 Site qualitative interviews provided further contextual data that most clinicians felt that LPV was warranted for treating patients with ARDS; the computerized ventilator protocols were easy to use with advantages for physicians and RTs; but that some sites were accustomed to a degree of local autonomy, with some clinicians resisting standardization.14 Clinicians wanted a clear measurement standard to understand appropriate deviations from computerized protocol instructions and case-level data to diagnose performance problems in real time.

Resolution: Three strategies were deployed to complement prior efforts: (1) development of an agreed-upon, system-wide adherence metric, goals and real-time reporting adjusting for appropriate care improvement teams empowering local sites to review case-level data and to identify and overcome local barriers to adherence. The organization achieved full adherence system-wide within 1 year and has sustained adherence for ≥2 years.

Lessons Learned: When possible, design simple interventions able to succeed even if subtle conditions are not formally diagnosed. In the present case, evidence supported implementation of LPV protocols on all mechanically ventilated patients and timely, concrete examples of non-adherence aided active engagement of clinicians in improvement activities.15

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