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## Connecting Research and Practice: Implementation of Suicide Prevention Strategies in Learning Healthcare Systems

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### Abstract

The healthcare systems affiliated with the Mental Health Research Network strive to be learning healthcare systems that identify and address evidence gaps of importance to clinicians, patients and funders. This paper describes how research guides clinical care and how clinical care guides research in the area of suicide prevention, and some of the challenges of conducting embedded research.

The transformation of healthcare systems into learning healthcare systems - where science, informatics, incentives and culture align for continuous improvement - could improve clinical care and decrease delays in implementing best practices. However, it can be challenging to ensure the necessary elements are present: a well-developed infrastructure to organize and analyze health records data, a culture of shared responsibility, and an organizational philosophy promoting bidirectional learning between healthcare practice and research. Nonetheless, strengthening research-practice partnerships to accelerate the adoption, implementation and improvement of evidence-based mental healthcare is a priority for federal funding agencies and healthcare organizations. This paper discusses the benefits and challenges of establishing and maintaining engaged clinical partnerships in the area of suicide prevention.

## Building Partnerships

We previously described an evolving model of a learning healthcare system in the Mental Health Research Network (MHRN; [mhresearchnetwork.org](http://mhresearchnetwork.org))(1), a network of 14 research institutes embedded in healthcare organizations across the U.S. NIMH funding supports infrastructure work, including establishment and maintenance of a virtual data warehouse at each site, as well as pilot and signature projects.

MHRN-affiliated healthcare systems care for and insure 25 million patients across 16 states, with embedded mental health researchers who conduct federally-funded research and maintain relationships with healthcare system leaders and clinicians at each site. This engagement varies and includes researchers attending leader and departmental meetings to learn of system priorities and disseminate research findings, engaging with or working as frontline clinicians, and serving on or acting as advisors to healthcare system committees. Challenges to building and maintaining these partnerships include competing organizational priorities, limited leadership and clinician bandwidth, and the perception of research as being too slow to meet the demands of pressing clinical decisions (with leaders often required to make decisions in weeks, not years). Researchers have addressed these challenges by scheduling quarterly meetings with leaders, supporting organizational priorities, identifying and leveraging overlap between funding agency and organizational priorities, serving as interpreters of external evidence and generators of internal evidence, and designing pragmatic trials that can quickly adapt as needed.

## The Patient Health Questionnaire (PHQ9) and Suicide Risk

MHRN healthcare systems were early adopters of the PHQ9 to screen for and monitor depression and suicide risk. These PHQ9 data revealed that approximately 6% of respondents reported thoughts of suicide more than half the days in the previous 2 weeks on item 9, with 0.5% attempting suicide in the next 30 days and 3% within 2 years.(2) These PHQ9 findings led to four streams of clinical or research activities in our healthcare systems: (1) Use of the Columbia Suicide Severity Risk Scale (CSSRS), (2) The Suicide Prevention Trial (SPOT), (3) Evaluation of Zero Suicide implementation, and (4) Use of machine learning to improve suicide risk prediction.

## Use of the CSSRS to Assess Suicide Risk

Despite evidence that elevated scores on item 9 of the PHQ9 were reasonably good at identifying people at increased risk of suicide, there is no evidence that suicide screening by itself prevents suicide attempts or deaths. Despite this evidence gap, health system leaders felt compelled to act and implemented workflows for patients reporting suicidal ideation. In many systems, this led to systematic use of the CSSRS for patients with elevated PHQ9 item 9 scores. Implementation varies across healthcare systems, but most prompt completion of the CSSRS in the electronic health record (EHR), followed by such actions as further clinical assessment of risk/protective factors, lethal means counseling, and/or completion of EHR-based suicide safety plans. The clinical use of the CSSRS in MHRN healthcare

systems provides an opportunity to study whether clinicians use the CSSRS, whether its use prompts subsequent clinical actions, and whether these actions impact suicide attempts.

Researchers and health system leaders also sought to understand the limitations and how to improve self-reported measures such as the PHQ9 and CSSRS. In one health system, researchers conducted semi-structured qualitative interviews with suicide attempt survivors (3) and primary care patients (4), who described the value of being asked about suicidality, but also how disclosing suicidal thoughts often involved weighing hope for help against fears of negative consequences associated with stigma and loss of autonomy. This research confirmed and extended research among Veterans who reported similar fears and underscored the importance of direct and caring communication about suicidality and relationships with trusted providers (5). Recognizing these limitations, MHRN investigators are collaborating with health system leaders to improve screening/assessment practices, and are developing and evaluating alternative methods to identify risk using medical records data, discussed below.

### **The Suicide Prevention Outreach Trial (SPOT)**

To generate evidence to guide large-scale secondary interventions for populations at risk of suicide, we conducted a pragmatic trial enrolling 18,882 patients (67% women, 12% non-white, 8% Hispanic) from March 2015 through to September 2018 across four healthcare systems.(6) Patients who reported suicidal ideation on the PHQ9 were randomized to receive ongoing usual care or an invitation to one of two interventions: an online dialectical behavioral therapy skills training program supported by a health coach or a phone-based care management intervention designed to keep patients connected with their behavioral health clinicians. Of note, SPOT care managers used the CSSRS to assess suicide risk and to inform risk-based care pathways, which will ultimately contribute information as to whether the CSSRS may be useful for suicide prediction and prevention. The primary outcome is suicide attempt assessed via EHR and state mortality data. Importantly, patient and clinician stakeholders were engaged in the design and implementation of this study, and healthcare leaders helped design the intervention to minimize disruption of clinical workflows, maximizing sustainability should either intervention be found effective. Study results are expected in 2021.

### **Evaluation of Zero Suicide Implementation.**

In response to MHRN findings, healthcare systems began implementing a series of suicide prevention and intervention approaches as part of large-scale Zero Suicide (ZS) initiatives (<http://zerosuicide.edc.org/>). Henry Ford Health System began this work in 2001, while Kaiser Permanente (KP) began evaluating varying models of Zero Suicide implementation across five regional healthcare systems in 2016.(7) Systems chose from a range of evidence-based interventions, including screening and assessment, safety planning, engagement in care, care management, caring contacts, follow-up after hospital or emergency discharge, means reduction, and intensive suicide risk treatment. An NIMH-funded grant has supported evaluation of the model at each system using the Normalization Process Theory framework. Researchers partner with leaders and clinicians to document the implemented interventions,

develop metrics aligned with each approach, facilitate a learning collaborative across sites, and support ongoing improvement efforts.

### **Use of Machine Learning to Improve Suicide Risk Prediction.**

While PHQ9 item 9 data was reasonably good at identifying patients at increased suicide risk, we adopted machine-learning methods to develop potentially more accurate suicide risk prediction models. Models use data from nearly 20 million visits from almost 3 million patients (61% women, 32% non-white, 23% Hispanic) to better consolidate multiple factors for suicide risk than use of the PHQ9 alone.(8) This could allow healthcare systems to provide more intensive interventions for those at highest risk while opting for less intensive interventions for patients at lower risk. Importantly, and in contrast to PHQ9 item 9 results, healthcare systems have the ability to set these risk thresholds to match available interventions and resources. Our models and others have global classification accuracy of 80% or more, but given relatively low baseline rates of suicide attempts, positive predictive values (PPVs) are low, often below 0.01.(9) We do note, however, that models with similar PPVs are widely used in other clinical areas. For example, many guidelines recommend statins for people with at least 10% risk of a cardiovascular event in the next 10 years. Similarly, using suicide risk models, we can accurately identify those with a 5% risk of a suicide attempt in the next 90 days. Essentially, the threshold for acceptability of a PPV depends on the balance of risks and harms with the indicated subsequent clinical actions. Most would agree the risk of starting a statin is low and a reasonable secondary prevention strategy; the equivalent strategy for elevated suicide risk is not yet known but represents an opportunity for future research within this learning health system.

### **Next Steps: Using Suicide Risk Models to Address Suicide Risk.**

Researchers have been working with care delivery leaders to adopt suicide risk models for clinical use. At KP Northern California, suicide risk models have been embedded in the EHR and run in the background (without display to clinicians), demonstrating similar model performance in this diverse external validation cohort. Researchers are now working with clinical leaders to determine an appropriate risk alert threshold and suitable workflows.(10) At HealthPartners in Minnesota, suicide risk models are integrated with the EHR to produce weekly reports of members with serious mental illness or increased risk of hospitalization who are also at elevated risk for suicide. This prompts behavioral health case managers to complete CSSRS assessments and evaluate the need for more intensive interventions. Behavioral health clinicians at one outpatient clinic at KP Washington are piloting use of a column in clinicians' EHR calendars flagging patients with elevated suicide risk; clinicians are encouraged to have flagged patients complete the CSSRS.

Discussions between researchers and clinicians about these implementation strategies have led to shared recognition of the importance of research to understand how patients and clinicians interpret these risk models, how they experience conversations about suicide risk and prevention, and what clinical capacity is needed to respond to at-risk patients to inform future implementation strategies. A qualitative study at three healthcare systems uses the Consolidated Framework for Implementation Research to interview administrators,

clinicians, case managers, patients and insurance members to assess these needs. Interviews are conducted at different stages of pre-implementation and implementation as an important step in improving patient-centered care and soliciting stakeholder perspectives about the appropriate uses and limitations of predictive modeling. Understanding the implementation context at various levels across organizations will serve to inform future implementation strategies in other clinical settings.

## **Conclusions: The Value of Ongoing Partnerships between Clinical Care and Research**

A learning healthcare system where care informs research and research informs care hinges on ongoing relationships and shared priorities between healthcare system leaders, frontline clinicians and researchers. These partnerships are built on trust that has evolved over many years of collaboration, shared common interests and goals, and frank conversations. To forge successful partnerships, in some cases researchers hear clinical concerns that are translatable to fundable research ideas. In other cases, researchers learn of research priorities that are translatable to care system priorities. Over time, researchers have become more embedded in clinical operations and clinical leaders have become embedded members of the research teams. Bidirectional communication and collaboration between research and clinical staff requires fostering on both sides to keep these partnerships viable and valuable to both groups.

As described in this paper, successful learning healthcare systems do not undertake just one kind of research. A variety of research methods have been utilized, including observational studies, pragmatic clinical trials, implementation, machine learning, and qualitative research. This broad array of approaches allows researchers flexibility to tailor approaches to specific research or clinical questions, making use of existing data sources when possible and fitting into clinical workflows as necessary. Researchers need all of these tools to function effectively in learning healthcare systems and better understand implementation issues across cultures, diverse patient populations, and varied clinical contexts.

In the end, the goals of healthcare systems and researchers are the same: to improve the care, outcomes, and experiences of patients. Conducting embedded research in a learning healthcare system provides opportunities to improve patient care more quickly than traditional research models, but also requires researchers to be flexible and adept at designing pragmatic research that minimizes clinical disruptions. Aligning healthcare system, funder and research priorities is key to success.

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**Highlights:**

- Achieving learning healthcare systems requires partnerships and shared priorities between healthcare leaders, clinicians and researchers.
- This paper describes the development of a learning healthcare system in the area of suicide prevention and describes research methods and clinical strategies used in this effort.