



Toward Population Health: Using a Learning Behavioral Health System and Measurement-Based Care to Improve Access, Care, Outcomes, and Disparities

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Abstract

Achieving population behavioral health is urgently needed. The mental health system struggles with enormous challenges of providing access to mental health services, improving quality and equitability of care, and ensuring good health outcomes across subpopulations. Little data exists about increasing access within highly constrained resources, staging/sequencing treatment along care pathways, or personalizing treatments. The conceptual model of the learning healthcare system offers a potential paradigm shift for addressing these challenges. In this article we present an overview of how the three constructs of population health, learning health systems, and measurement-based care are inter-related, and we provide an example of how one academic, community-based, safety net health system is approaching integrating these paradigms into its service delivery system. Implementation outcomes will be described in a subsequent publication. We close by discussing how ultimately, to meaningfully improve population behavioral health, a learning healthcare system could expand into a learning health community in order to target critical points of prevention and intervention.

Keywords Population health · Learning health system · Measurement-based care · Patient-reported outcomes · Disparities

Introduction

Much of the behavioral health (mental health and substance use disorder) service delivery remains stubbornly mired in the crippling challenges of inadequate service access for those with behavioral health needs, and, for those who do manage to receive care, profoundly variable and inequitable care quality and outcomes. Moreover, despite large expenditures in the public sector, we lack information about what works, for whom, when, and for how long. The conceptual models of population health, learning health systems, and measurement-based care offer potential paradigm shifts for the field that hold promise for addressing some of these dire problems. We present here a consideration of these frameworks and provide an example of how our academic, community-based, safety net health system is approaching integrating these paradigms into its behavioral health service delivery system. Outcomes of this implementation effort will be described in a subsequent publication.

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Background

The concept of population health has been growing in importance since the publication of a seminal definition of the term in 2003 (Kindig & Stoddart, 2003). By 2013, the Institute of Medicine (IOM) convened a workshop to consider the implications of U.S. federal healthcare reform for its citizens, concluding that the population as a whole should be considered as the patient (Population Health Implications of the Affordable Care Act, 2014). For a service delivery system, this represents a fundamental shift: from focusing on the patients who come through the (actual or virtual) doors, to assuming responsibility for the larger population, including those unable or uninterested in seeking care (Simon et al., 2020). Nowhere is population health needed more than in psychiatry, where only a minority of individuals with behavioral health needs in a given year actually have access to any form of care; of those that do receive some treatment, fewer than half receive care that can be considered minimally adequate; and of those that receive minimally adequate care, recovery rates remain stubbornly low (Walker et al., 2015; Wang et al., 2005). As challenging as this situation is overall, racial and ethnic subpopulations are considerably less likely to have access to high quality care and to experience improved outcomes (Alegría et al., 2002; Narrow et al., 2000).

In part for these reasons, in 2006 the IOM proposed a Learning Healthcare System (LHS) as a possible solution for these myriad problems facing the US healthcare system (Olsen et al., 2007). The IOM noted that despite the widespread acceptance of evidence-based medicine principles, individuals did not typically receive recommended/needed services, clinicians lacked evidence to guide the choice of treatment options for individual patients, and health systems lacked the ability to measure treatment fidelity and outcomes in actual practice. In a LHS, consistent measurement of patient-reported outcomes, clinical informatics, and organizational culture support continuous learning through the process of clinical care delivery, facilitating continuous improvement in the quality of care delivered (Kilbourne et al., 2020). It does this by harnessing information technology to generate information needed at the point of care to optimize clinical decision-making and innovation.

Progress has been slow in the intervening years. Principles of population health have been more frequently promoted, but have not yet been put in practice outside of health systems in a way that has meaningfully improved outcomes. There have been notable efforts to develop LHS's, including the sharing of health data within large health systems and using observed patterns and outcomes

to drive changes in service delivery (Greene et al., 2012). The VA has also leveraged its integrated health system to support explicit translation of research into practice (Atkins et al., 2017). These early efforts have generally addressed challenges of leveraging electronic health records (EHRs) across multiple systems. An alternative to this 'top-down' approach has also been proposed, in which integration between clinical services, research, and quality improvement priorities forms the basis of a locally developed LHS before expanding successes within and across organizations (Smoyer et al., 2016).

This early progress in developing LHS's has largely occurred outside of behavioral health (BH) settings, despite the dire need within psychiatry for improved systems to manage the population's exploding behavioral health needs (Simon et al., 2020). One example within psychiatry is the national data-sharing effort among first episode psychosis clinics (Humensky et al., 2020). Aside from this important effort, most of BH service delivery has not yet attempted to leverage data systems to support ongoing learning through the delivery of care. This is particularly striking when considering how little practical data exists in psychiatry about what works, and for whom, compared to other fields in medicine (Simon et al., 2020). Indeed, BH clinicians are at times wedded to beliefs about treatment options that are often determined by the particulars of their own training. Developing evidence from existing clinical practice could be helpful in unpacking these factors, particularly given the highly complex nature of BH conditions and the interplay with psychosocial contexts. Using data to guide treatment decisions could also help address the burnout endemic in the psychiatric workforce, since anything that makes it easier to achieve desired clinical outcomes should in turn improve provider satisfaction.

Psychiatry also needs the LHS model because persistent and dramatic inequities in access, quality, and health outcomes at the population level continue to plague our field (Quality & Disparities Report, 2018). The systemic nature of these inequities suggest a need to shift from business as usual to use of dynamic integrated data systems much earlier in the treatment process—at the point of care delivery—to enable clinical decisions that account for context-specific data. The learning healthcare system model has been explored outside of psychiatry to mitigate disparities (Blizinsky & Bonham, 2018; Brooks et al., 2017; Man et al., 2018). Within psychiatry, a model that has shown promise to mitigate disparities is collaborative care, a widely used approach for integrating BH services into primary care that uses measurement to guide the efforts of a multidisciplinary care team. A systematic review of this approach showed that it mitigates disparities in care and outcomes experienced by racial and ethnic minorities (Hu et al., 2020). The potential for collaborative care's use of data in clinical service

delivery to impact disparities lends reason for optimism that LHS might be similarly useful for mitigating disparities.

Because of the need for accurate data, measurement is a foundational building block of both the LHS and population health. A measurement system provides local data on which referrals, clinical decisions, assessment of treatment efficacy, measurement of disparities, and ultimately development of generalizable care pathways can be made. Measurement has been adopted more slowly in BH clinical settings compared with other areas of medicine, both due to a relative dearth of objective somatic/cognitive indicators as well as historical patterns of practice (Lewis et al., 2019) While measurement-based care is a key feature of collaborative care in primary care contexts, no robust analogous model has emerged for behavioral health service delivery in other settings.

There is, to our knowledge, no health system that has established a systematic approach to measurement in community psychiatric practices in order to develop a LHS. While the VA has made headway in implementing MBC in BH clinical practice (Aldea et al., 2021), these efforts have not generalized to other community settings. When measurement has been used, there have been significant limitations to the measurement tools either because they focus on only a single diagnosis (i.e., use of PHQ-9) (Mulvaney-Day et al., 2018), or due to survey fatigue, in which repeated administration of traditional instruments leads service recipients to disregard questions (Le et al., 2021). Feasibility is a further barrier to measurement implementation in psychiatric settings, as many BH treatment settings lack non-clinician staff who are central to administering instruments in primary care practices.

Adaptive testing based on multidimensional item response theory offers an alternative approach to measurement that addresses some of these challenges (Gibbons & deGruy, 2019). Traditional approaches to measurement include very brief screening instruments, and tools in which severity of symptoms is assessed using the same fixed set of questions, with all questions weighted identically and summed at the end. In contrast, in adaptive testing, questions are drawn from large item banks that are adaptively selected depending on the respondent's answers, to more quickly and precisely assess severity of illness. It also reduces test familiarity that can affect response selection over time. Computerized adaptive testing therefore has the potential to reduce both patient and clinician burden associated with traditional measurement strategies.

We describe here our health system's approach to implementing a comprehensive mental health assessment using computerized adaptive testing in community-based outpatient BH practice. This includes a novel computerized adaptive testing module that assesses level of satisfaction with the presence and severity of social determinants of health (SDoH). This module is paired with

a hospital-wide yearly screen assessing patient-reported SDoH (i.e. current housing, food, utility, transportation, safety, support, employment insecurity). These two measures are designed to identify modifiable adverse social conditions, which determine approximately 40% of the variance in mental health outcomes (Hood et al., 2016). Ultimately, systematically assessing modifiable SDoH among individuals in the community will be necessary to establish a Learning Health Community (LHC) and develop preventive interventions.

Context

Our health system is an academic public safety-net system serving approximately 140,000 patients annually outside of Boston, MA. The system includes two hospitals and 15 community-based primary care practices. The Department of Psychiatry provides a continuum of clinical services from acute care to ambulatory settings for both child and adult populations, and also provides integrated behavioral health services within primary care. The adult ambulatory services, the focus of the current effort, are staffed by approximately 250 providers in psychiatry, psychology, and social work, of which ~100 are trainees. The patient population is approximately 65% either publicly insured or uninsured, and 45% insured under risk-based payment contracts, including 20% under an Accountable Care Organization in partnership with the state's Medicaid program. In 2021 there were approximately 14,000 patients seen for outpatient BH visits.

Access has long represented a major challenge for the psychiatric outpatient department. Even pre-COVID-19 pandemic, as in many other health systems, there was insufficient BH clinician capacity to meet referral volume from the system's primary care providers. There has also been no common way of assessing symptom severity or progress in treatment that could be used to systematically allocate and adjust resources based on risk, severity, and improvement with treatment.

In this context, an initiative was undertaken to begin using measurement-based care in the outpatient psychiatry department, both to guide individual clinical care and also to erect a central tenet of a LHS. A pilot site was selected for initial implementation. The measurement tool selected was CAT-MH (Computerized Adaptive Test—Mental Health), a patient-reported assessment of multiple mental health conditions (depression, anxiety, mania/hypomania, substance use disorder, psychosis, PTSD, adult ADHD, and suicidality) as well as social determinants of health (Gibbons & deGruy, 2019).

General Approach

The overall approach for this effort was adapted from a quality improvement framework (Batalden & Davidoff, 2007; Taylor et al., 2014). The team was steeped in the local context and used a specific approach to culture change; planned a series of iterative pilots informed by provider and patient data; obtained input from patient, family, and community constituencies from the outset and throughout implementation; and laid groundwork for informatics needs. A single site was selected to pilot on a small scale before spreading the effort across the department. The initiative had both an executive sponsor (departmental chair/chief), an overall leader (outside the practice site), and local champions (site clinical leader and medical director).

A driver diagram shown in Fig. 1 shows the potential mechanisms of change in measurement-based care. This driver diagram addresses critical questions such as “What changes can we make that will result in improvement?” (when read from left to right) as well as “What are we trying to accomplish?” (when read from right to left). As noted in the figure, the changes that might support the

initiative’s overall aim of using measurement to drive more effective and efficient behavioral health services include a variety of change ideas operating at the level of the health system, provider, and patient. To be effective, this initiative requires system-wide involvement with ongoing regular implementation planning.

An evaluation plan was developed to enable intentional learning about multiple aspects of the pilot that could then drive rapid, iterative changes. A waiver from the institution’s IRB was obtained as this effort represented a quality improvement initiative. The evaluation includes both qualitative elements (feedback from surveys and focus group of clinicians) as well as data available from operational reporting (i.e., response rate both overall and by clinician, language of completion, distribution of scores in survey components). The premise from quality improvement that one should hold one’s hypotheses lightly was embraced from the outset; project leaders made clear to the clinical team that while there was very clear rationale for why a change needed to be made, the details of how this might go, and the particular ways it might be helpful or problematic, were not known. There was a shared understanding that these would need to surface through early implementation efforts, with solutions co-created with the pilot site.

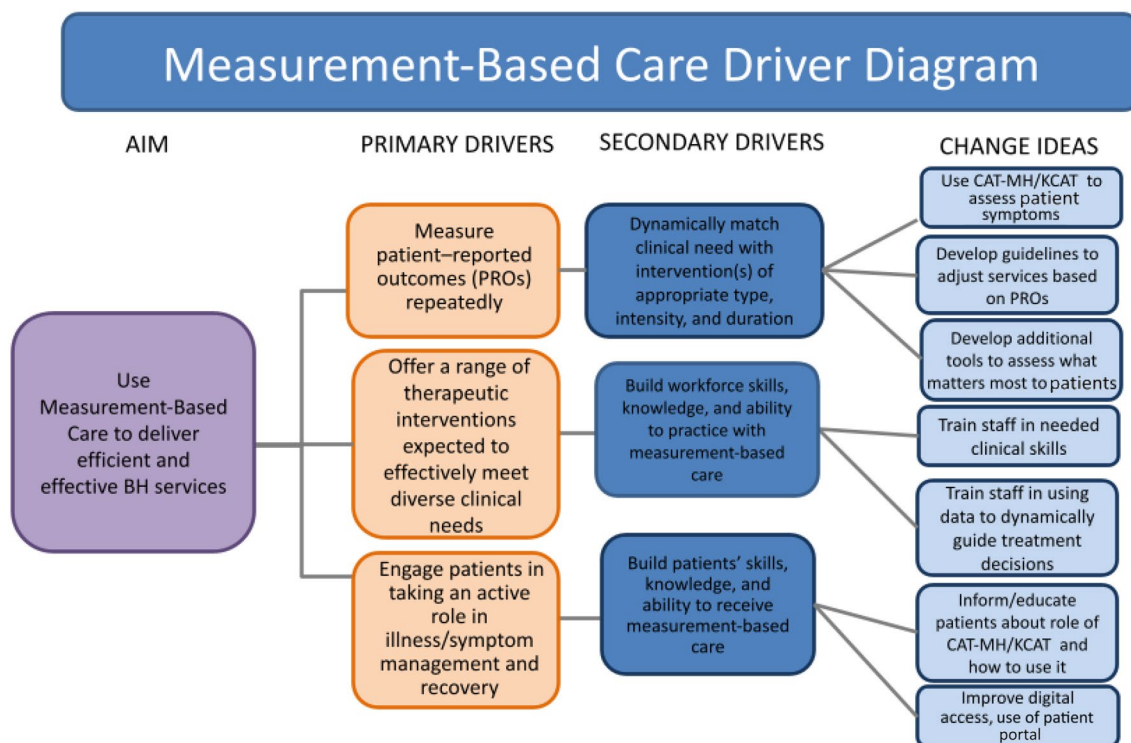


Fig. 1 Driver diagram

Change Process

We used the framework of a culture change process to approach this work. Using Rogers' Diffusion of Innovation Framework (Rogers, 2003), a communication strategy was developed in order to engage both from the top down and the bottom up. Key communication points were approved by departmental leadership and then disseminated through written communication in weekly departmental updates, discussion at departmental staff meetings, and grand rounds presentations. There were multiple preparatory discussions with the pilot site (discussed further below). We cultivated support of key thought leaders within the department and across the institution including representation from IT, billing, primary care, and accountable care to ensure alignment of the initiative with other institutional priorities. We also undertook an engagement process with key external and community stakeholders, including a workgroup of patients and families as well as a group with representation from local social service agencies, school systems, and other community members. Communication with these stakeholders included informing them about the initiative and its progress, and for the patient and family advisory board, gathering feedback in an interactive fashion, and represented a deliberate effort to improve acceptability by diverse service users.

Because of our department's preexisting very low use of measurement as part of clinical practice, it was assumed that there would be significant concern from clinicians about the initiative. We developed a proactive approach to addressing these adaptive challenges (Heifetz, 1994), including clarifying values, surfacing and holding tension that arose, and titrating the pace of change to what seemed feasible at different time points. Given the profound nature of this culture change, a deliberate attempt was made to address both the adaptive and technical aspects of challenges that arose.

Technical Aspects of Change Process

In the early stages of this initiative, work was undertaken to integrate CAT-MH into the EHR. EHR integration was recognized as critical to incorporate measurement into routine practice, and to ensure it was as feasible and least burdensome to clinicians as possible. The technical approach was developed in collaboration with the health system's IT department, with a goal of providing clinicians and patients with the right information at the right time via the right format (Osheroff et al., 2012). The resulting approach involved sending CAT-MH modules to patients through the patient portal prior to an appointment. This

process was chosen to ensure that results could be viewed by clinicians during an appointment, thereby minimizing the additional clinician workload that would occur from managing results outside of a clinic visit, while still allowing results to be followed up on in a timely manner. In the EHR, CAT-MH results were displayed as part of the visit workflow, eliminating the need for extra clicks to access results. Workflows were developed for administrative staff, who were responsible for sending out CAT-MH modules, and clinical staff, who were responsible for reviewing results with patients, incorporating findings into clinical appointments, and documenting accordingly. Documentation shortcuts were created in the EHR that enabled clinicians to easily incorporate CAT-MH results and CAT-MH related clinical decision-making into notes.

Training administrative and clinical staff was accomplished through multiple modalities. In-person trainings were held to demonstrate new workflows and EHR capabilities. Written tipsheets were developed to have a written reference guide. In the several days after the initiative began, there was live IT help available daily so questions could be asked and answered in real time. Clinicians were given a small amount of additional non-clinical time to become accustomed to reviewing CAT-MH data. Clear processes were developed for providing feedback, asking questions, and making suggestions for optimization; these were compiled and prioritized so as to guide modifications. An online shared resources drive was established for clinicians that included a variety of tools and resources.

Adaptive Aspects of Change Process

Early on, there were extensive preparatory in-depth discussions with the pilot site. Initially this included repeated review of the "why" of making this change, which were distilled into five key talking points, and included a focus on improving outcomes for underserved communities. Early discussions were also designed to actively solicit and engage with clinician concerns, clarify particular local challenges unique to their practice site, and identify ways to use the initiative to support operational changes that would help with clinicians' most salient concerns. For example, in the context of significant concerns about clinician exhaustion and burnout, the change was framed as one that could potentially have an impact on clinician well-being. To this end, we were able to help establish urgent care slots for therapists, with CAT-MH results helping to guide which patients were in need of these urgent slots, which had long been requested.

As the pilot site got closer to its go-live date, discussions shifted to include how clinicians might use the data. Sample scripts were provided with suggested language for talking about results with patients in order to co-create treatment and planning. Three ideas were developed and shared with

the team for what they might do with the data, including referral to case management if social needs were identified, using data to guide who gets scheduled in an urgent slot, and using persistently high or low scores to prompt clinicians to discuss the patient at their team meeting. Inclusion of referral to case management was designed to help clarify the scope of therapists' practice, and move closer to the desired team-based model of care. An emphasis was placed throughout on using results as part of a shared decision-making process, as well as the varied ways this initiative might be perceived among diverse patient subgroups.

Over the course of these important discussions, bigger picture topics arose. For instance, early discussions included how to talk about the end of treatment when a treatment is just beginning; clinicians shared what can make this challenging, and the team brainstormed ways of navigating this discomfort. Clinicians also wondered about the role of therapy when patients have so little other social contact in their lives, and in this context, to what degree care can be shifted to community-based opportunities for social connectedness. Questions about the appropriate model of care, including long-term vs time-limited therapy, arose early and often. Finally, questions about the utility and practicality of using symptoms as a measure of outcome also emerged, particularly among individuals with such varied and significant social determinants of health needs. The approach to addressing these topics was carefully coordinated with the clinical team leader, who guided these conversations. The foundational nature of these questions made clear that the work of culture change had begun.

To complement and support work occurring at the pilot site, a new meeting was established of key clinical leaders and IT to ensure communication and support for the implementation of measurement-based care. Key decisions about EHR integration, processes at the pilot site, and optimal models of care were reviewed with this group. As we began planning for additional sites, clinical leaders from these onboarding sites were folded into this meeting. Key conversations occurred at these meetings that supported the culture shift underway and ensured alignment across key sites and leadership.

Next Steps

We have described early work to integrate patient-reported outcome measurement into routine outpatient psychiatric practice. Implementation outcomes will be described in a subsequent publication. Given its ambitious scale, this will be a multi-phase process that is still early in its overall development. Several critical steps remain.

First, in this initiative we are committed to reducing racial and ethnic disparities in access and outcome

(Parsons et al., 2021) Ultimately, we expect that measurement will help ameliorate these disparities, as objective approaches to assessing need and tracking progress in treatment have been among the few interventions shown to mitigate disparities in treatment outcomes (Hu et al., 2020) In our SDoH paired screeners, patients who answered positively on any domain were referred to a care manager who would offer to connect patients to resources. In the short term, however, there is concern that disparate uptake of the measurement initiative might worsen existing disparities. To address this, we are tracking use of the tool in different racial/ethnic groups of our population, as well as in different age and linguistic groups. We are seeking input from communities with historically lower use of such tools to ensure that their particular experiences and suggestions for improvement are incorporated. Low use of our EHR's patient portal, and the potential for disparate use of the portal itself, mirrors usage patterns in other health systems (Wallace et al., 2016), and has made this process challenging. We also plan an alternate workflow for in-person visits for those who do not have access to electronic devices or internet connectivity. It will be critical to stratify and track data by race/ethnicity and make ongoing steps to ensure its acceptability and usefulness in historically marginalized populations. User-centered design that includes users of varied backgrounds is one way of addressing this need, and we have attempted to incorporate this approach into the initiative's implementation and improvement processes.

A further complication is the current availability of the EHR's patient portal, and CAT-MH itself, in only English and Spanish, which excludes two of our system's primary languages (Portuguese and Haitian-Creole). To address these limitations, we have begun exploring alternate approaches to ensuring access to these linguistic communities, such as beginning a translation process, and administering the tool by tablet (with live translator support) during in-person clinical care. We have worked with leaders from specialty linguistic teams around these ideas, and need to continue to work with community members to ensure that any translation efforts are culturally relevant. Ultimately, we believe that supporting measurement and team-based care in traditionally underserved racial and ethnic minority populations holds great promise for achieving greater health equity.

In addition to careful attention to equity, next steps also reflect the fact that the implementation of a measurement system is only the first step in using data as part of a shared decision-making process. As with the implementation change process, there are both technical and adaptive components to this future work.

Technical Next Steps

A key technical next step is developing decision support tools to help clinicians make meaningful use of available data. Extensive work has been done in primary care around incorporation of decision support into routine practice, and we aim to adapt this knowledge for psychiatry. An initial step is developing dashboards, ideally for patients, clinicians, and administrators. Given the lack of existing data in psychiatry about how to personalize treatment, we do not plan to start by imposing externally-derived treatment guidelines. Rather, we plan to track what referral patterns and treatment approaches emerge from data from pilot implementation sites. Knowledge gained about the outcome of these treatment approaches can then be built into decision-support systems. In this way, the LHS will be maximally relevant to our local patient population and the real-world practice patterns of our clinical staff.

This approach will require developing processes by which aggregated data can be analyzed and tracked over time to drive relevant, practical changes at the level of the clinician and patient. It will also need to include the capacity for continual refinement and modification as additional data emerges. Over time, emerging data will allow development of predictive analytic tools for personalized treatment options (Browning et al., 2021; Gunlicks-Stoessel et al., 2020). These efforts will require the ongoing expertise of a physician informaticist. For clinical acceptability, it will be essential that data sharing with clinical staff occurs in a quality improvement frame in which measurement occurs for the purposes of improvement (Solberg et al., 1997).

Adaptive Aspects of Next Steps

For this approach to permeate a whole system of care, there remains extensive ongoing change work to help clinicians not only be technically facile with accessing data, but also find it valuable so it is incorporated into clinical practice. This process—discussing data in routine conversations with patients, looking together at results, and using them to inform next steps in treatment—will be most effective when it incorporates the collaborative nature of shared decision-making and principles of co-creation of care (Batalden et al., 2016).

A particularly salient aspect of this change process in our institution is how it interfaces with historical practice models. Our system is steeped in a traditional psychodynamic therapy tradition, and clinicians have been concerned about to what degree this paradigm shift might impact their traditional way of practicing. However, the measurement approach used here is itself agnostic to the model of care; the goal in a LHS is to have the tools to do what works. We hope to address this concern by aligning

around the shared mission of improving outcomes for patients, and for this goal to supersede allegiance to a particular therapeutic approach. As with any culture change process, this will require sustained attention.

Conclusions and Future Directions

We have described how one community-based safety net health system is approaching integrating the concepts of population health, learning healthcare system, and measurement-based care into its clinical service delivery system. An initial focus has been on the implementation of a measurement system, a process that has attended to technical and adaptive aspects of the change process and used a quality improvement approach. Key themes include the importance of ongoing and consistent communication, ensuring clinical applicability, the enormity of culture change, and incorporating inputs from diverse constituencies as an equity-building strategy.

Thus far, LHS efforts more broadly have not been widely adopted or utilized in a way that serves to optimize population health. To improve access, quality, outcomes and equity, systematic, comprehensive and longitudinal measurement of patient reported outcomes must occur not only in psychiatry but also primary care. Integrating such data and sharing it with patients and healthcare providers is a critical step in developing integrated team-based care models. Additionally, spread of costly interventions is challenging in resource-constrained settings. While our health system made significant investments as part of this change process, our hope is that lessons from our experience, including the development of infrastructure and analytic tools, may help other institutions in the future with their own implementation.

Ultimately, the LHS would ideally expand into a Learning Health Community (LHC), initially by using available data to make thoughtful decisions about how to best allocate scarce resources in order to meet population level needs. Learning at the LHC level could then highlight critical points of prevention and early intervention, and meaningfully impact non-medical factors that are among the more potent determinants of health. Indeed, in moving to a LHC, SDoH could be routinely assessed among individuals in the community, and social needs met before they cause adverse medical and behavioral health outcomes. In this way, cost-efficient preventive measures could be implemented in communities that help relieve the pressures on highly constrained health care systems. We envision the LHS and LHC as highly synergistic components for achieving the promise of population health.

Authors Contribution All authors contributed to the manuscript conception and design. The conception framework for this work was developed by PSW. MCT and MCW led on-site implementation. RA guided technical aspects of this work. CF developed the initial idea for the article. The first draft of the manuscript was written by MCT. ML provided critical input to manuscript. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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