We found that, at point of identification, around 21% of patients at the Kancheepuram site had never sought help from any source[6]. However, most studies that report on DUP comprise samples identified via mental health services, including those in low- and middle-income countries. These, by definition, systematically exclude those who are untreated, and consequently underestimate the full extent of untreated psychosis in specific settings.

There are several implications that follow from the above findings. First, it is possible to discern several interconnected factors that influence DUP at societal, community, interpersonal and individual levels. The precise ways in which these factors combine and interact in specific settings to influence DUP vary substantially by place, group and time. Second, the concept of DUP, particularly applied to settings with diverse and more plural health care systems, may be too linear and narrow to provide a meaningful primary target for intervention. In many settings, contact with mental health services is not necessarily an end point that signifies the beginning of sustained treatment. It is often one point on a winding, disjointed, sometimes circular trail, as individuals and families seek support and care from multiple sources.

From this perspective, other priorities come to the fore. For example, the potential value of closer collaboration and integration between mental health services and other components of local health care systems, including spiritual and traditional healers[9]; the importance of identifying and engaging those who are never treated; and the need to improve the quality of mental health services and ensure sustained follow-up to retain in care those who do make contact, including the use of telepsychiatry to reach remote populations. In the end, reducing DUP is no use if the end point is poor quality services and care, with limited follow-up and rapid disengagement.

All this also points to the need for more sustained programmes of in-depth research that can generate locally meaningful knowledge. This is essential to inform, in diverse settings globally, the development and implementation of more accessible, affordable and effective services and interventions for people with a psychotic disorder.

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Learning health systems for community-based mental health

Mental disorders are the top causes of morbidity and mortality globally[1]. However, over half of individuals with these disorders lack adequate access to mental health services. Even with adequate access, quality of care often remains suboptimal, as over a third of individuals do not receive an adequate follow-up treatment, which increases the risk of suicide and other adverse events[2]. Despite the availability of effective treatments for mental disorders, only a fraction of individuals are offered these interventions and, if so, fewer complete recommended regimens[3]. Frontline mental health providers (notably nurses, counselors and clinical social workers), who provide much of the care to these individuals, lack the time, tools or training to implement evidence-based mental health treatments.

While innovations in health information technologies may enhance individual access to mental health interventions, the quality of care from these modalities can vary widely, and there are potential safety risks when treatments are provided without direct practitioner supervision[4]. The rapid growth of artificial intelligence also brings forth opportunities as well as challenges with data privacy and accuracy of therapeutic delivery, and most providers to date are unprepared to implement these new technologies to ensure full benefit for their patients.

Learning health systems are promising approaches for improving quality and outcomes of care for persons with mental disorders in community practices, because they can provide the infrastructure and tools to help frontline providers deliver evidence-based treatments more effectively[5]. First defined by the US Institute of Medicine (now National Academy of Medicine), a learning health system involves a process by which scientific discovery, available data (e.g., from electronic health records), health care policies, and organizational culture are aligned to support progressive research innovation and direct quality improvement simultaneously, so that evidence-based treatments and practices are automatically embedded into routine health care practice.

There are three core features to learning health systems: a learning community; an underlying infrastructure to curate, summarize and manage data; and a repeatable cycle of research and quality improvement initiatives.

Learning communities typically include patient (as well as family and caregiver), provider, researcher, and health system leader representatives who identify a common health priority goal and pathway for new research and quality improvement initiatives. In particular, health system leader representatives should have direct line to authority and responsibility over care decision-making, data access, information technology governance, and other administrative requirements in the health system to maximize opportuni-

ties for practice change.

The underlying infrastructure of learning health systems involves ascertainment of data from electronic health records, symptom and diagnostic assessments, and other sources. This infrastructure also includes governance (e.g., standardized processes) to allow use of data for research and quality improvement purposes, and appropriate privacy ad ethics reviews. Data can include utilization, procedural, laboratory, medication, and diagnostic information; care processes such as completion of guideline-recommended care; patient-centered outcomes; co-occurring conditions; social determinants of health such as environmental factors, and, increasingly, genomic information. A common data infrastructure enables providers to more immediately identify gaps in quality or outcomes of care in their patient population, understand how new treatments can reduce gaps in quality or outcomes, and evaluate implementation or quality improvement strategies to scale up and spread effective treatments over time.

Finally, the repeatable cycle supports research and quality improvement initiatives that aim to enhance patient health outcomes for a given priority identified by the learning community. Using the underlying data infrastructure, the cycle supports continuous generation and analysis of data, and uses that knowledge to determine which treatment innovations are most effective (e.g., in a pragmatic clinical trial) and how to increase their scale-up and spread over time via quality improvement initiatives. For example, researchers may start with analyses of genomic, physiological or social determinants data embedded in the electronic health record to identify risk factors for a given condition. Then they use data curated from evidence syntheses, longitudinal studies, and clinical trials to identify optimal treatments. Finally, they use the electronic health record at the point of patient care to offer treatments and evaluate their implementation by frontline providers over time in real-world practice.

Community mental health systems are well-suited to implement learning health systems, in part because the above core features are primarily derived from measurement-based care[2] and the collaborative care model (CCM)[6]. Developed to better adapt the health system to address chronic illness management, including mental health care, the CCM involves alignment of leadership support, informatics, and quality improvement processes to help providers care for the ongoing needs of their patients using clinical guidelines, self-management support, ongoing care management, and linkage to community resources.

CCMs have been shown to improve quality and outcomes of care in community mental health settings for both physical and mental health conditions[6]. The initial "evolutionary leap" from CCMs to learning health systems occurred when it became possible to automate core features of the CCM, namely the systematic curation and analysis of data to identify at-risk populations and measure their clinical status (e.g., from electronic health records), and use these data to embed quality improvement processes such as audit and feedback or treatment reminders. To this end, providers are able to promote a culture of continuous learning through data, demonstration and evaluation of new discoveries and quality improvement methods.

In the ongoing evolution of learning health systems as a process for improving quality of care in mental health, emerging examples can be found across different community-based settings worldwide, such as the Mental health INTegration programme in South Africa (MhINT)[7], the OnTrack New York (OnTrackNY)'s coordinated specialty care learning health system[8], and the US Disparities Elimination through Coordinated Interventions to Prevent and Control Heart and Lung Disease (DECIPHeR) Center at Johns Hopkins University and University of Michigan[9].

Specifically, MhINT focuses on the role of data to empower frontline providers to task-share collaborative care management for mental disorders in the primary care setting. OnTrackNY leverages common data infrastructure to improve detection and treatment of early psychosis in a population-based cohort. The DECIPHeR Center is leveraging policy changes at the US state level that enable increased reimbursement for integrated physical and mental health care in community-based practices to improve the quality of cardiovascular disease care for persons with serious mental illness. Collectively, these initiatives seek to leverage common data that can empower frontline clinicians and the patients they care for to better manage mental disorders, especially when faced with organizational or financial constraints, and sustain best practices using quality improvement methods.

Overall, learning health systems hold promise for improving quality of care for mental health disorders. The next evolutionary leap of these systems holds great promise for improving the lives of people with mental disorders in three ways. First, there is ongoing interest in the further development, validation and implementation of informatics and artificial intelligence tools to better automate data ascertainment, synthesis and analysis to inform patient care in a secure way that minimizes risk of bias. Second, advances in pragmatic clinical trial methods have potential to enable more rigorous, cost-efficient and generalizable studies to evaluate novel treatments on changes in patient-centered Quintuple Aim goals, namely improved outcomes, experience, value, equity and access. Finally, learning health systems can be leveraged to better scale up and spread effective treatments using quality improvement methods, especially through automation of clinical decision-making, ultimately empowering frontline providers to adopt evidence-based treatments and practices more readily.

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