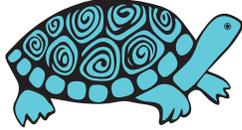


TERRAPIN



PHARMACY

**BETTER OUTCOMES,
LOWER COSTS:
Remote Medication
Monitoring with
Medherent™**

Executive Summary

During the peak of the pandemic period, over 40% of persons with a chronic health condition missed a needed medical appointment and greater than 15% of individuals missed filling a needed prescription.

[A Need Most Evident: The Glaring Need For Behavioral Healthcare In A Post-Pandemic World - OPEN MINDS](#). Health Plans, providers and state and federal government regulators responded with increased flexibility in rules and rates to support in-home and remote monitoring services to address critical health and complex health needs for the general and hard-to-serve populations.

One positive by-product of the pandemic crisis was the rapid uptake of technological innovations to reach underserved and hard-to-serve populations.

Preliminary research by the University of Maryland School of Social Work found that one such example, Medherent, (a medication dispensing device in the market since 2012 and developed and deployed to patient homes by Terrapin Pharmacy) resulted in:

- 90% or higher medication adherence rates
- 25% fewer emergency room visits
- 40% fewer dollars spent on ER and hospital visits
- Up to 7.6 fewer hours of staff time per month per consumer to manage medications

The device dispenses medication customized to the individual, alerts the patient to take the medication and sends real-time alerts to staff when medications are missed.

Patients using Medherent and interviewed as part of a National Institutes of Health-funded clinical trial reported feeling empowered, having greater independence and improved relationships with agency staff.

Direct support and administrative personnel reported fewer medication errors or missed doses, a reduction in the “power struggle” that can come with face-to-face medication monitoring, and more time for staff to devote to other duties.

Background

Individuals with serious mental illnesses (SMI) suffer higher rates of chronic medical conditions such as heart disease, diabetes, and cancer than the general population and tend to have poorer health outcomes¹. These outcomes are often not the result of the mental illness itself, but are influenced by poverty, poor health literacy, and fewer natural supports. Comorbidity of medical and mental health issues in this population often lead to higher

medical costs and adverse health outcomes².

While pharmacological treatments exist for these conditions, they have limited effectiveness in SMI populations because: (1) up to 60% of individuals with SMI do not take their psychiatric or somatic medications as prescribed, (2) individuals with SMI have poorer clinical outcomes and experience high rates of hospitalizations, and (3) individuals with SMI experience worse care in somatic care settings such as hospitals and out-patient medical services³. These factors lead to lower quality-adjusted life years and life expectancy of 25 years less than the general population⁴.

The pandemic and post-pandemic period only exacerbated these dire circumstances. Underserved persons, the elderly and persons with complex needs fared far worse during the pandemic period when compared to other age and population groups. Over 40% of the general population missed

¹ Daumit GL, Clark JM, Steinwachs DM, Graham CM, Lehman A, Ford DE. Prevalence and correlates of obesity in a community sample of individuals with severe and persistent mental illness. *J Nerv Ment Dis*. 2003;191(12):799-805;

Dickerson F, Brown CH, Fang L, et al. Quality of life in individuals with serious mental illness and type 2 diabetes. *Psychosomatics*. 2008;49(2):109-114;

Jones DR, Macias C, Barreira PJ, Fisher WH, Hargreaves WA, Harding CM. Prevalence, severity, and co-occurrence of chronic physical health problems of persons with serious mental illness. *Psychiatric Services*. 2004.; Miller BJ, Paschall III CB, Svendsen DP. Mortality and medical comorbidity among patients with serious mental illness. *Focus*. 2008;6(2):239-245;

Dickerson FB, Kreyenbuhl J, Goldberg RW, et al. A 5-year follow-up of diabetes knowledge in persons with serious mental illness and type 2 diabetes. *J Clin Psychiatry*. 2009;70(7):1057-1058.;

Dixon LB, Kreyenbuhl JA, Dickerson FB, et al. A comparison of type 2 diabetes outcomes among persons with and without severe mental illnesses. *Psychiatr Serv*. 2004;55(8):892-900;

Morrato EH, Campagna EJ, Brewer SE, et al. Metabolic Testing for Adults in a State Medicaid Program Receiving Antipsychotics: Remaining Barriers to Achieving Population Health Prevention Goals. *JAMA Psychiatry*. 2016;73(7):721-730.;

Sokal J, Messias E, Dickerson FB, et al. Comorbidity of medical illnesses among adults with serious mental illness who are receiving community psychiatric services. *J Nerv Ment Dis*. 2004;192(6):421-427

² Saha S, Chant D, McGrath J. A systematic review of mortality in schizophrenia: is the differential mortality gap worsening over time? *Arch Gen Psychiatry*. 2007;64(10):1123-1131;

Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. *JAMA Psychiatry*. 2015;72(4):334-341

³ Kreyenbuhl J, Leith J, Medoff DR, et al. A comparison of adherence to hypoglycemic medications between Type 2 diabetes patients with and without serious mental illness. *Psychiatry Res*. 2011;188(1):109-114.;

Mitchell AJ, Lord O. Do deficits in cardiac care influence high mortality rates in schizophrenia? A systematic review and pooled analysis. *J Psychopharmacol*. 2010;24(4 Suppl):69-80

Viswanathan M, Golin CE, Jones CD, et al. Closing the quality gap: revisiting the state of the science (vol. 4: medication adherence interventions: comparative effectiveness). *Evid Rep Technol Assess (Full Rep)*. 2012(208.4):1-685.;

⁴ World Health Organization Information Sheet. Premature death among people with severe mental disorders.

a critical health appointment and as many as 15% of persons needing medication missed filling a prescription. However, the death rate from COVID was significantly overrepresented by those over 65, those living in congregate settings, and the underserved (poor and minority populations with chronic health conditions). [1 million COVID-19 deaths: A look at the U.S. numbers - Los Angeles Times](#). Furthermore, post pandemic reports show that persons with complex needs, particularly those served in congregate settings, continue to report negative impact on health and increased feelings of social isolation and depression. A significant rise in overdoses during this same period (from 18% to 42%) is suggestive of futile and often fatale attempts at self-help through illicit medication means.

With the tsunami effect of the pandemic just at the tip of unfolding, health plans and providers have an increased urgency and emphasis for innovations focused on health equity and social determinants of health. There is clearly a need for innovation in serving complex needs and underserved populations such as those with serious mental illness or multi morbid conditions such as mental illness, chronic health and developmental disabilities comorbidities. One area of great promise and attention is improved medication adherence. Taking medication as prescribed is a significant contributor to overall health and life outcomes. Improved medication adherence also has a direct effect on preventable emergency room presentations, hospitalizations, and early death.

Complex populations, such as those with service mental illness, frequently have difficulty following their medication regimens for a variety of reasons often leading to health demise and preventable use of higher levels of care. Adherence rates of 80% in out-patient settings is considered sufficient for improved health or reduction in symptoms of somatic and psychiatric conditions; individuals with SMI tend to have adherence rates of 50-70%. Poor adherence is generally not due to a reluctance to take medications, but rather because of the complex multi-drug regimens that people with co-morbid conditions are prescribed, inability to afford medications, and lack of consistent access to pharmacies and medical providers. In one study, persons with SMI on average, experienced 3 or more chronic health conditions and were taking 22 medications—often with different and competing regimens. Medication non-adherence is responsible

for up to 10% of all health care costs, up to 40% of nursing home admissions, and approximately 125,000 deaths every year⁵.

Current Solutions

Challenges in the management of these complex chronic health and mental health conditions have led to the development of intensive community-based service delivery programs. However, as currently structured these intensive in-person interventions have only had limited impact optimizing service delivery and consequently on adherence to treatment and health outcomes.

Medication adherence support is crucial to controlling the symptoms and causes of chronic psychiatric and somatic disorders. Medication management is a particular challenge in community residential programs; it is difficult to deliver recovery-oriented patient-centered care while also providing error-free medication monitoring and support in group home settings.

Intensive adherence support interventions are expensive, labor-intensive, and intrusive for consumers. Typically, residential programs have staff members directly observe consumers taking their medications twice a day or more. Documentation of observed dosing, shift change and weekly counts of medications, weekly medication packing, monthly documentation, and facilitating medical appointments is time-consuming, burdensome, and prone to human errors.

Before, during, and now post pandemic, these labor-intensive interventions are further hampered by the crisis in direct workforce shortages. Survey data shows that over 70% of IDD agencies are unable to accept referrals due to workforce shortages and over 50% are closing programs due to staffing shortages. [The Workforce Challenge—Retirements, Wage Rates & Inflation - OPEN MINDS](#).

The substantial amount of effort spent ensuring that the right patient receives the right medication at the right time multiple times per day, with or without a workforce shortage, takes time and attention away from other therapeutic and rehabilitation skills. Assistance with ADLs and IADLs; teaching practical skills such as budgeting, using public transportation, shopping for basic needs, and interfacing with community resources; and providing support around managing psychiatric and physical symptoms are all important—and time-consuming—rehabilitation services that could be enhanced if the administrative burden and time needed for medication monitoring was reduced.

⁵Scapel S. Don't Blame Doctors for Medication Nonadherence. *Mo Med*. 2018;115(1):11

Preliminary research conducted by the University of Maryland School of Social Work has demonstrated that for a consumer who has 3 medications taken 2 times a day with one medication being a controlled medication such as a benzodiazepine or opiate, face-to-face medication management takes 7.6 hours per month per consumer⁶. This includes:

- 3.9 hours are spent directly observing and documenting medication consumption,
- 1.5 hours on tracking and counting controlled medications,
- 1.1 hours on medication packing, and
- 1.1 hours on monthly MAR accounting.

This is labor that is directly substituted for—and improved by—Medherent, allowing for a more efficient use of the short supply of direct support personnel.

Medherent

Medherent is a “smart” vending machine small enough to be mounted on a wall in consumers’ residences. It was developed and designed to specifically provide medication to individuals who have difficulty adhering to their complex regimens. As of August 31, 2021, there are 315 Medherent devices actively being used by consumers diagnosed with SMI and supported by community mental health agencies. This innovative technology has a proven ability to improve medication adherence, reduce medication errors, and reduce inpatient visits.

The wall-mounted medication dispensing units use a tablet-computer interface that is installed in an individual’s home or apartment. The unit alerts



⁶Unick, George Jay. Existing Evidence for Medherent.

Note: many individuals with SMI and co-occurring somatic conditions take far more medications; this is a conservative estimate of staff time use based on a consumer on a low-complexity drug regimen. Data does not include travel time, prescriber and pharmacy contact, quality checks to ensure medication errors are not med, and other activities.

⁷Ibid

patients when it is time to take medication and dispenses their standing dose oral medication in day- and time-specific heat-sealed packets. The packets clearly describe enclosed medications, including color, shape, strength, and number of tablets. The device requires a user-specific PIN, lowering the risk of diversion or overdose. Medherent devices are kept stocked by Terrapin Pharmacy and are updated when a consumer’s medications change or when the monthly supply is exhausted.

Medherent also offers real-time missed dose alerts, enabling direct support personnel to respond in real time and to target their interventions to patient-specific needs. Additional features include customizable settings which enable agencies to customize each device to the level of independence needed by a given consumer and offers the flexibility to support increased medication independence as part of rehabilitation service planning. Medherent offers secure videoconferencing through a variety of existing applications, so patients can participate in telehealth and teletherapy from the privacy and comfort of their own bedroom—also reducing the time burden on patients and caregivers to travel to in-person appointments and allowing for safe care even if quarantined during the COVID-19 pandemic. Medherent also integrates with Bluetooth-enabled “smart” medical device peripherals such as glucometers, scales, and blood pressure cuffs. Providers can monitor patient health indicators and medication adherence information in real time or view trends over time, enabling timely intervention before a patient’s disease worsens and more intensive treatments are needed.

Implementation Process

Medherent is simple to use; interviews with consumers and staff in community-based psychiatric rehabilitation programs have consistently recorded high levels of satisfaction and ease of use. Consumers interviewed as part of the initial NIH-funded clinical trial report feeling empowered, greater independence, and improved relationships with agency staff. Interviews with direct support and administrative personnel have supported this, with fewer medication errors or missed doses reported, a reduction in the “power struggle” that can come with face-to-face medication monitoring, and more time for staff to devote to other duties⁷.

When an agency decides to implement Medherent, a representative from Terrapin Pharmacy provides

hands-on training to consumers and employees in how to use the device. Employees are also provided training on the web-based remote console and, if desired, access to an electronic medication management software solution to record medications not in the device (such as PRNs or liquid medications) and vital signs. Written and video guides are also made available to agency employees and consumers, and 24/7 device support is available by phone.

Terrapin Pharmacy employees also work with the agency to determine which consumers will receive devices and how to configure them. With Terrapin's help, agencies will determine which individual consumers or will best benefit from the use of Medherent and/or which locations or programs will be most positively impacted by the introduction of Medherent. Factors often considered when determining which consumers should be targeted for the intervention include:

- Individuals for whom medication adherence is the primary barrier to moving to greater levels of independence;
- Individuals residing in programs with less intensive staff support who continue to require face-to-face medication monitoring services (often being "overserved" relative to reimbursement);
- Individuals who have a history of intermittent poor adherence in independent living situations and who require rapid intervention to resume medication and avoid hospitalization if they become nonadherent in the future;
- Individuals who have schedules which make face-to-face monitoring difficult on a daily basis, often due to work or school;
- Individuals who are resistant to frequent disruptive visits by staff multiple times per day;
- Individuals who have complex medication regimens or who take medications 3 or more times per day;
- Individuals who have poorly controlled chronic health conditions (either psychiatric or somatic) which are treated by oral medications; and
- Individuals who are high users of emergency rooms, hospitals, crisis programs, and other restrictive and high-cost services.

Once consumers have been identified and agreed to use the device, Terrapin employees work with agencies to customize device settings for each client. Options can include whether a client has the ability to dispense medications themselves; allowing self-dispensing only during the two-hour dose window, for same-day future doses, or for

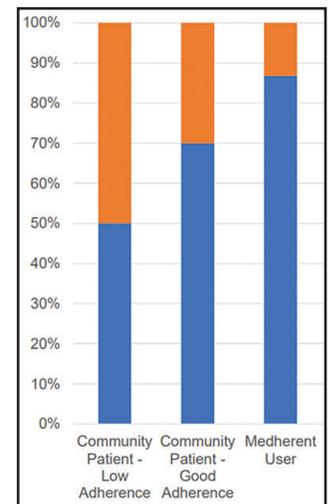
future days; enabling automatic dispensing for some or all doses; turning the audible chime on or off; configuration of missed-dose text alerts to the consumer or support staff; and whether or not to allow self-dispensing of missed/late doses. Terrapin provides a crosswalk with recommended device settings based on current levels of medication independence, and consultation with a Terrapin employee with experience working in community behavioral health settings. Additional guidance is offered on the use of the Medherent as a rehabilitation tool; a suggested order of steps to gradually increasing medication independence is available.

Results

Medherent has demonstrated proven results in the community behavioral health agencies currently using devices. Agency partners have reported a substantial reduction in medication errors; one agency who uses Medherent for all residential clients has reported zero medication errors for multiple consecutive quarters and other agencies with less widespread use of Medherent have reported a 57% decrease in medication errors⁸.

Preliminary data from the clinical trial being conducted in conjunction with the University of Maryland School of Social Work have shown very high levels of medication adherence among Medherent users⁹.

- On average 87% of doses are dispensed and the median is 91% of doses dispensed;
- Individuals in residential programs have even higher adherence rates, averaging 95% or higher;
- The middle 75% of Medherent users, or the most typical users, had adherence rates ranging from 84% to 96%;
- Only 13% of the population had dispensing rates below 80% which is the cutoff for good adherence.



Perhaps the most striking benefits of Medherent are shown through hospital use data. One agency

⁸Ibid

⁹Ibid

partner, Go Getters/Lower Shore (LSC), uses Medherent in all residential beds and has conducted an analysis of ER/hospital utilization and costs before and after implementing Medherent. The universal use of Medherent, as well as an onsite CCBHC that integrates psychiatric and somatic care, has produced impressive outcomes. One year pre- and post-Medherent installation data on 98 individuals has shown substantial reductions in emergency department use, all-cause hospitalizations, and commensurate cost savings to the health care system¹⁰.

- 76 unique individuals had at least one hospital or emergency room visit prior to using Medherent and 58 unique individuals had visits in the year after Medherent implementation: **20% fewer individuals had at least one hospital or ER visit in the year after Medherents were installed;**
- In the year prior to Medherents being used, 456 hospital/ER visits were recorded for all residential program consumers; 344 visits were recorded in the year after Medherent were adopted: **25% fewer hospital/ER visits occurred in the year following implementation of Medherent;** and
- The total cost of hospital and ER services in the year prior to Medherent was \$2,301,368, and the total cost of services in the year after Medherent was implemented was \$1,443,334; **40% fewer dollars were spent on ER and hospital visits in the year after Medherent was implemented.** Most of these costs were charged to Medicare and Medicaid.

Although clearly not all of the impact can be directly attributed to Medherent, it is clear that the use of the devices does have immediate benefits in health care utilization and cost savings. Data available on 134 consumers in the month before and month after devices were used also shows immediate reduction in hospital utilization and costs :

- **Inpatient medical/surgical charges declined by 86%** in the month after Medherent was installed;
- **Emergency room charges declined by 43%** in the same period; and
- **Inpatient medication/drug charges declined by 62%.**

This rapid reduction in utilization and cost once Medherents were used clearly demonstrates the positive impact that Medherent has on users. While year-over-year changes are less dramatic, probably due to the natural cycles and ebbs and flows of chronic illnesses, there is a clear value both to users and payers. Medherent, combined with quality somatic and psychiatric care and effective rehabilitation services, clearly improves the lives of users and demonstrates considerable value to service providers and the health care system.

¹⁰Unick, George Jay. Lower Shore Clinic Letter; Lower Shore Clinic. Pre/Post Analysis – Summary. Lower Shore Clinic. Breakdown of Charges.