Medication Management

HIDO

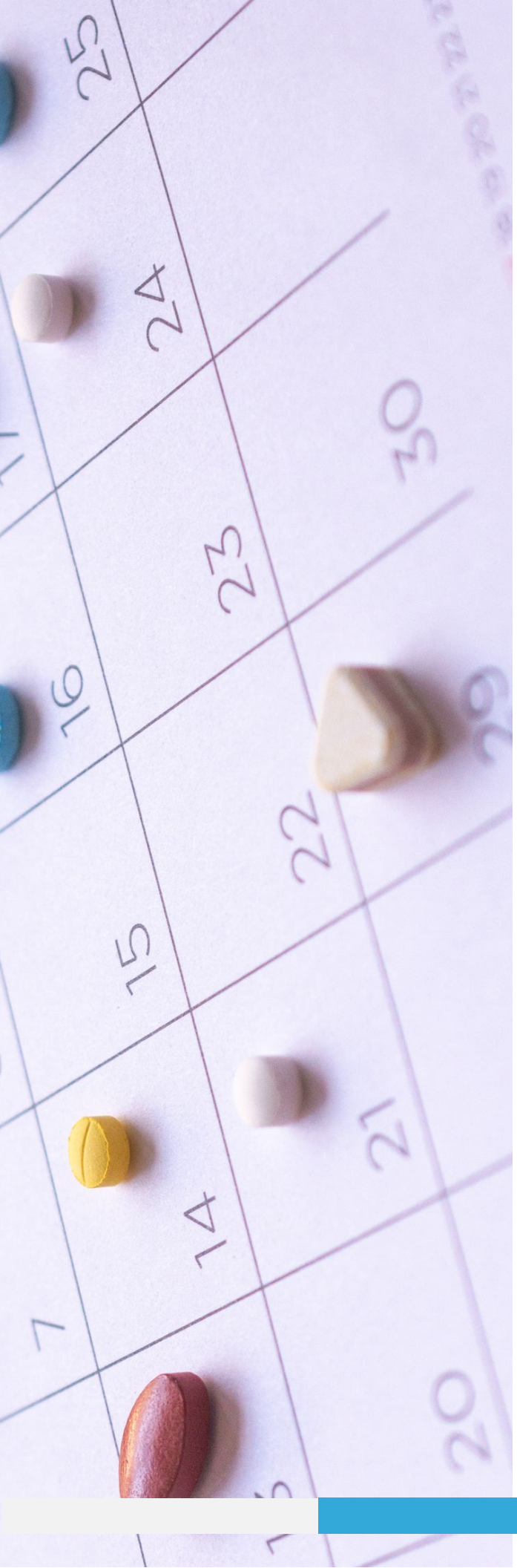


Table of Contents

Overview

Patients with Heart Failure and Diabetes are 3-5X more likely to be Hospitalized

- Heart Failure - **$43.6B/yr**
- Diabetis Mellitus - **$327B/yr**

There are currently over **6.5M individuals in the U.S.**, and over **26M globally**, impacted by heart failure (HF) [1, 2]. HF is a chronic condition which impacts the ability of the heart to pump or fill with blood. Cocktails of drugs classes often treat HF including angiotensin-converting enzyme (ACE) inhibitors, diuretics, aldosterone antagonists, beta blockers, renin-angiotensin system inhibitors (RASI), angiotensin II receptor blockers (ARBs), & angiotensin-receptor neprilysin inhibitors (ARNIs). Total cost of care (direct and indirect costs) for HF in 2020 in the **U.S. was estimated at $43.6B**, with over 70% of costs attributed to medical costs [3]. The largest economic burden linked to HF is from **hospitalizations and rehospitalizations with 75% to 80%** of the direct costs for HF are attributable to inpatient hospital stays [8]. Medication mismanagement is a common problem in HF patients, and can result in worsening symptoms, hospitalizations, and even death [9].

Type 2 diabetes mellitus (DM), another growing chronic healthcare condition and 7th leading cause of death, occurs when the body ineffectively utilizes insulin, resulting in elevated blood glucose. **Over 29M U.S. adults are impacted by DM** [4]. Globally, type 2 DM has increased by 30% recently with the number affected increasing from 33 million in 2005 to 435 million in 2015 [5]. **Costs per year total $327 billion** including $237 billion for direct medical costs and $90 billion in reduced productivity. *People living with diabetes are three times more likely to be hospitalized than individuals without a chronic condition* [2]. The largest cost contributors to diabetes care are **inpatient hospital care (30% of total cost) and prescription medications for chronic complications of diabetes (30%)** [11].

Medication Mismanagement

Medication mismanagement is common in HF patients, and results in worsening symptoms, hospitalizations, and even death. In fact, studies have shown **medication non-adherence is a leading cause of hospital readmissions in HF patients** [9]. Patients who fail to take medications as prescribed experience fluid overload, electrolyte imbalances, and worsening heart failure symptoms, leading to hospitalization. Similarly, medication mismanagement in diabetes can lead to serious complications and hospitalizations. Studies show **medication non-adherence is a significant predictor of hospitalization in patients with diabetes** [10]. Therefore, healthcare providers should focus on medication education and adherence monitoring in patients impacted by HF or DM to prevent complications & reduce risk of hospitalization.

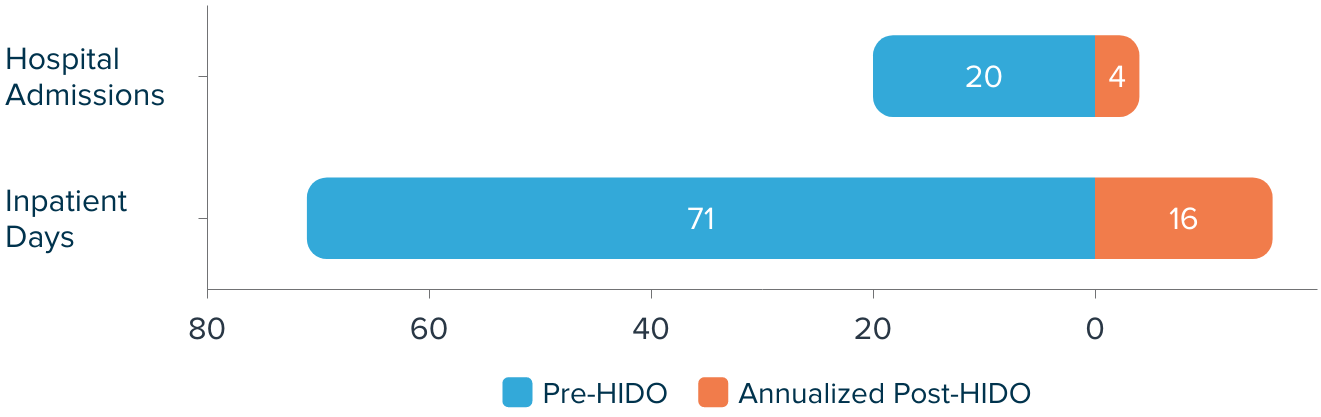
Non-adherence = Hospitalization

26% of hospital admissions among elderly resulted from nonadherence to prescribed meds, particularly cardiovascular meds

Elderly populations commonly take a wide variety of medications, each with its own dose & timing, which creates a complex schedule to remember and execute. Additionally, HF most often occurs in older populations, who may also be beginning to experience cognitive decline which impacts their ability to remember & execute complex medication protocols independently. 26% of hospital admissions among elderly resulted from nonadherence to prescribed meds, particularly cardiovascular meds [6].

In a review of 30,000 Medicare enrollees over 12 months, the majority of patient errors leading to adverse events (n=129) occurred in administering the medication (31.8%), modifying the medication regimen (41.9%), or not following clinical advice about medication use (21.7%) [7]. Patient-related errors most often involved hypoglycemic medications (28.7%), cardiovascular medications (21.7%), anticoagulants (18.6%), or diuretics (10.1%) [7]. The risk increases substantially (up to 3.3-fold higher risk) as number of medications and complexity of the medication regimen increase.

Hospitalization Reduction and Biomarker Outcomes in Patients with HF & DM



Hospitalization

↓ 80%

Cost

↓ 67%

Subject Recruitment

Inclusion Criteria

- 45-84 years old
- Prescribed at least one cardiovascular medication
- Have missed at least one dose in the past 30 days
- Have access to a personal smartphone and home Wi-Fi connection
- CHF, Mental Health, Diabetes, COPD, Undiagnosed Dementia, Obesity, Substance Abuse and Suicidal risk factors

Exclusion Criteria

- Over the age of 85
- No Internet
- Homeless

Study Results

A twelve month research study with 10 subjects impacted by congestive heart failure (CHF) and other underlying conditions in inclusion criteria is determining the impact of the HIDO platform on hospitalizations and laboratory biomarkers across several diseases associated with HF. While the national averages for readmission for CHF are around 20% for 30 days, 31% for 90 days and 65% within a year with a 25% mortality rate [12], subjects using HIDO dramatically reduced these metrics. More specifically, for these 10 subjects, their hospitalization metrics were calculated for the 12 months preceding HIDO use, and then subjects were enrolled to use HIDO over the next 12 months. This study is currently two quarters into data collection. Overall adherence of subjects is currently at 77% with 6 subjects achieving >80% medication adherence, and the lowest subject achieving 67% adherence. Most importantly, there has been a dramatic reduction in hospital admissions, in patient days, and costs since HIDO was implemented.

Patients in the HIDO program have had a dramatic decrease in hospitalizations (80%)

What is HIDO?

HIDO stands for **H**ealth **I**nformation **D**ata **O**utcomes and is the **BLUEPRINT** for patient home healthcare.

HIDO is a patient friendly device accompanied with a mobile application that helps automate home care by assisting patients with medication compliance. HIDO automates the medication experience and removes much of the patient burden to remember the right medication, the right frequency, the right dosage and validates the right person through a remote video record.

Innovation

HIDO technology is the first device of its kind to integrate continuous medication monitoring, patient reported outcomes, drug dispensing, & remote/recorded observed therapy in a single platform. While existing offerings provide some benefit, none can solve all workflow challenges and care integration across all stakeholders as HIDO. Importantly, HIDO is the first device to automate the entire medication synchronization process, potentially eliminating medication errors & ease of patient burden.

First, the HIDO technology passively executes both observation and accurate dispensing in a single product. By integrating both features in the design, the platform ensures the 6 rights of medication use (the right patient, the right drug, the right dose, the right route, the right time, and the right documentation), and that the patient actually consumes the medication. Furthermore, these features greatly reduce burden for care providers, while still allowing them to monitor patient medication events.

Second, sensing modalities, alerting, and connectivity are integrated directly in the stand-alone product, with multiple cameras enabling machine vision. This eliminates the need for patients to directly interact with a smart phone device. All required sensor integration, RFID sensors to detect bottle labeling, biometrics, & alerts are integrated in the product ecosystem.

Third, platform automation is driven by AI and machine vision which automatically detects patients, accurate medication, and medication ingestion. The AI engine runs behind the scenes to automatically capture and track key events, which can then be reported to caregivers and providers. The platform also auto recognizes medication name, dosage, frequency, and pill count. This significantly reduces caregiver burden as they no longer must sort, sift, or manage medications. Finally, the low burden, intuitive platform can easily scale care to underserved & socio-economic disparate populations, who are commonly impacted by HF and DM.

How Can HIDO Change Care?

National health spending was $4.3 trillion in 2021 or 19.7 percent of GDP. Spending on Hospital Care (31 percent share) was $1.3 trillion and Retail prescription drugs (9 percent share) was $378 billion in 2021. The estimated annual cost of drug-related morbidity and mortality resulting from non optimized medication therapy was $528.4 billion, equivalent to *16% of the total US health care expenditures in 2016* [13]. HIDO can potentially reduce hospital care expenditures by 30-50% depending on the disease state. That is roughly $400 billion to $650 billion annually.

Patients and providers have limited resources to maintain good health while at home. 99.9% of a patient's time resides at home and the infrastructure to communicate to providers is often a hospitalization, Emergency Room visit or scheduling a visit. **Providers now can remotely monitor their patient populations and communicate when help is needed. This is a home clinical intervention meeting a patient when needed, as needed in the convenience of their home.** One of the many challenges for providers is investigating the root cause to a patient's disease state. They often lack trustworthy information to determine if medications are working as prescribed or if the patient is communicating accurate information about medication regimens.

HIDO care is **Patient** Care

It's really about simplifying the patient journey. Our mission at HIDO is to help patients thrive at home, live healthier and happier lives. Most chronic care patients can maintain good health if adequate support is delivered in the home care setting. This shift of integrative care will swing the cost pendulum of healthcare from hospital to homecare. HIDO has the ability to create the most unique data sets for drug outcomes based on real-world evidence among at-risk populations with chronic diseases. Thousands of medications have been approved but the combination of prescribed drugs for patients is primarily based on caucasian males in most clinical studies. HIDO can bring health equity and precision medicine to underserved populations and optimize medication delivery to enhance patient outcomes now. We can move beyond the four walls of the hospital to deliver high quality of care in the home.

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