Improving the State of Medication Adherence

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Lack of medication adherence can have tragic personal consequences.

Pillo Health’s founder, Emanuele Musini, was personally motivated to work on medication adherence when his father tragically passed in 2005 after suffering from a chronic condition and not fully adhering to his medication regimen.

Since then, Emanuele has been studying the issue, seeking to develop a solution where a socially engaging device could assist people with these conditions 24/7 to ensure they take the right medications on time every day.

In 2015, the time was right. Thanks to advancements in voice technology, facial recognition, and cloud platforms, it became possible to build a voice-first, personalized, medication assistant who could help people maintain their medication regimen through social connectivity delivering health at home.

Emanuele pulled together a multidisciplinary team of doctors, entrepreneurs, engineers, and user experience professionals who implemented this vision of a health platform centered around a digital assistant and created Pillo—the premier voice-first medication management solution.

Since the release of Pillo and then Pria by Black + Decker, Pillo Health’s entrée into the consumer market, we have been engaging with end users to measure and improve daily, hourly, and average medication adherence rates.

Our feature device, Pillo, delivered an average medication adherence rate of over 87%—a meaningful 20-30% improvement from conventional reported standards—in a 2018 pilot study of Pillo conducted with AARP over a four-week period among diabetic patients who were prescribed Metformin.

Learn more about Pillo Health at pillohealth.com
The Problem: Poor Medication Adherence

In the US today, 25% to 50% of all adults fail to take their prescribed medication on time, contributing to poor health outcomes, over-utilization of healthcare services and significant cost increases.[1]

The causes of low levels of medication adherence are multi-faceted and include factors like carelessness, fear, supply, cost, and lack of understanding or information, with forgetfulness as the primary cause.[2]

Multiple studies have been done on this topic, providing a range of evidence:

- A study by the Boston Consulting Group found the reasons include forgetfulness, perceived side effects, high drug costs, and other factors.[3]
- Gadkari and McHorney (2012) further studied medication non-adherence using a cross-sectional survey of over 24,000 adults with asthma, hypertension, diabetes, hyperlipidemia, osteoporosis, or depression. They also found that forgetfulness (62%) was the most reported reason for non-adherence. Other reported reasons included running out of medication and carelessness.[2]
- Education and lack of appropriate and meaningful information has also been found to contribute to non-adherence, illustrated by Egan, Lackland and Cutler’s (2003) finding that 68% of respondents did not believe high blood pressure was a serious health concern.[4]
- Beyond forgetfulness and misinformation, Goldman, Joyce and Zheng (2007) also identified the cost of prescription medications as a barrier to adherence.[5]

The factors contributing to poor medication adherence have created a problem too costly to ignore, both in terms of price to our healthcare system, and overall health and well-being of our nation.

As our nation ages, the problem will only become more acute, as greater numbers of older adults battle with conditions ranging from increased forgetfulness to more acute chronic diseases and conditions.
Tracking Adherence: The Problem with Current Measurements

Compounding the problem of non-adherence is a problem with current measurements of adherence.

Currently, the most frequently used measure of adherence is the Medication Possession Ratio (MPR), where an 80% MPR is considered passing. This is similar to the Proportion of Days Covered measure and is defined as the number of days in supply period, over the difference between the first and last fill dates. MPR ranges from 0 to 1, with 1 representing full adherence. Medication adherence measures do not provide this information and contribute to sub-optimal care.

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\text{MPR} = \left( \frac{\text{Sum of days' supply for all fills in period}}{\text{Number of days in period}} \right) \times 100\%
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Image Source: Pharmacytimes.com

In a study on medication adherence by Jha and colleagues (2012), the authors found that on average, a 10% increase in medication possession rates translated into a 1.2% decrease in hospitalizations and emergency department visits. Although this may seem like a small change, it represents expensive and unnecessary healthcare usage—a typical Emergency Department visit cost $1,052 while a hospitalization cost $11,575.[6]

Beyond implications on healthcare use and consequent spending, medication adherence rates are used by Medicare in rating Medicare Advantage drug plans and Medicare Advantage star ratings. Specifically, Medicare looks at MPRs for diabetes medications, hypertension management medications, and cholesterol management medications.[7]

Currently used measures of possession ratios are relatively crude and do not provide a clear picture of medication adherence patterns.

For example, calculations are usually based on insurance claims data, and therefore do not account for the use/possession of free samples or regimen changes. They also do not provide information beyond possession—for instance, if the medication was actually taken, if the correct dose was used, or if it was taken at the right time.

Sometimes patient recall is used to obtain information regarding adherence. However, there is evidence that patient recall tends to overestimate adherence behavior. In clinical studies, blood
and urine samples are collected in order to examine drug concentration as it is the most reliable and direct method available. However, validation method is intrusive, time consuming, and expensive—it is not a viable solution for the US population.[1]

In order to provide optimal care, healthcare providers need to understand their patients’ medication taking behavior. For instance, Gabapentin is an effective treatment for neuropathic pain when taken on the prescribed schedule, two to three times a day. However, when taken inappropriately, it may put patients in an altered mental state. For these patients, an extended release version of the drug may be more appropriate. However, current medication adherence measures do not provide this information and contribute to sub-optimal care.

**Consequences of Poor Adherence: $1 trillion+ lost to US economy**

While the challenges surrounding adherence and adherence metrics are well documented, current solutions have been ineffective, and average medication adherence in the US has held at 50% for decades. The result has been several decades of sub-par adherence with high cost care, resulting in a $1 trillion or more lost to the US economy, in addition to the painful, and personally harmful experience of adverse and declining health conditions from not properly following medication regimens.

The costs associated with non-adherence are compounded for the nearly half of all adults in the US who have a chronic disease and take at least one prescription drug.[1]

Low adherence has also been linked to a nearly 2% increase in mortality, for example, among Type 2 Diabetics.[8]
The Opportunity: Cost Savings and Better Health Outcomes

Improved adherence for conditions like COPD, Depression, and other chronic conditions such as Diabetes would result in overall healthcare savings, ranging from $100 to $300 billion annually in the US.[1]

The greatest savings would come from targeting older adults (65+), for whom consequences of poor adherence is greatest.[9] Jha and colleagues estimated that if everyone in the US were adherent to their diabetes medications alone, the healthcare system could potentially save over $8 billion. Savings come from fewer emergency department visits and hospitalizations.[6]

But cost savings to the health care system is just one piece of the complex problem surrounding poor adherence.

For adults struggling with chronic conditions, especially older adults and their family caregivers, the psychological, emotional, and physical impact of non-adherence not only compounds the wasteful direct and indirect costs of the systems, but also puts undue strain on family relationships.

Finding a solution to effectively and sustainably address the primary causes of non-medication adherence would result in significantly improved health outcomes not only for adults suffering from chronic illness but for their caregivers as well.

Current figures [pdf] estimate between 40-70% of family caregivers reporting clinically significant symptoms of depression with an estimated 25-50% meeting the diagnostic criteria for major depression.[10]

Efforts to Improve Adherence: A Better Solution Needed

Given the vast body of research on reasons for non-adherence, solutions in recent years have attempted to address them.

Existing efforts to improve medication adherence target behavioral, social, and demographic factors[1] and include reduction of copayments for medications, patient education, and adherence tracking.[6]
Decreasing or eliminating copayments for medications has shown to improve medication adherence by 1.5 to 3.8 percentage points among those with chronic conditions. They had adherence rates ranging from 74 to 84% before the intervention.[11]

However, this is likely only part of the solution, for one group of patients. Even for these patients, there is still room for vast improvement in adherence rates, calling for use of effective patient education, adherence tracking tools, and other solutions.

One way in which Medicare has attempted to improve patient education and medication tracking is through the Medication Therapy Management program, which is a medication review program for beneficiaries with chronic illnesses. This review program must follow a standardized format specified by Medicare. Although this program is a great start—and places value in reviewing and managing medication—fewer than half of study respondents found this review process and format helpful to them in managing their medications, indicating the need for a better system.[12] Moreover, because the most commonly reported reason for not taking medications is forgetfulness, this program fails to address the most prominent problem.[3]
A New Adherence & Tracking Solution: Pillo Health

Pillo Health was created for the sole purpose of creating an effective solution for addressing the challenges surrounding non-adherence, tackling the primary issues of forgetfulness and tracking inefficiencies as well as other factors including misinformation, fear, confusion, and carelessness.

Pillo is a smart home healthcare companion that is proactive and employs a voice-first technology. When it’s time for a dose of medication, Pillo wakes up and proactively alerts users, improving attention to health regimens, gently encouraging and guiding users through the process, providing helpful tips and facts about their health regimen and if needed, connecting them to the right information and people.

Real-time alerts and video-calling capabilities allow professional and family caregivers to monitor the health of a loved one remotely, improving compliance and adherence without sacrificing their independence.
Pillo Health devices use camera and biometric technology to ensure that information and medication are provided to the correct user and personalizes the experience to their needs.

Pillo not only encourages adherence but collects precise data to track adherence in a meaningful way—providing an understanding beyond medication possession (i.e., pick-up from the pharmacy). Pillo’s sensors allow it to know and record when its user has retrieved their medication dose and when they replace the medication cup back onto the device. This allows Pillo to record a time along with the adherent event, vastly improving current measurement capabilities.

This data allows healthcare providers to prescribe more appropriate regimens based on patient-level adherence behavior, ultimately improving health outcomes and lowering overall system costs. For example, for the patient taking Gabapentin inappropriately, adherence data from Pillo could be used to support the use of a higher cost drug, as it would improve health and decrease the probability of acute episodes requiring expensive care and lower overall healthcare spending.

**Results: AARP Study**

Pillo Health collaborated with AARP on a study using Pillo to improve disease management for individuals newly diagnosed with diabetes. AARP and Pillo Health evaluated how Pillo's countertop device could empower participants to better manage their health while connecting them to caregivers and family members.

Pilot details:

- Conducted over a 4-week period
- Involved 7 diabetic patients, whose average age was 58.5
- All were prescribed Metformin

The Pillo Health and AARP teams found an average medication adherence rate of over 87%—a meaningful improvement from conventional reported standards.
Over the study period, Pillo answered over 200 user questions on topics including care plans, blood sugar, diabetic food recommendations, and additional disease-related information. Participants also participated in diabetes education through the Pillo device, which delivered diabetes tips and videos.

**Conclusion**

The pilot study shows promising results in improving medication adherence rates.

Future pilot studies will focus on validating this result in other populations and understanding the impact of Pillo’s other functionalities on health and overall well-being.

As the Pillo Health team works to increase the number of Pillo users, we will obtain more useful and actionable adherence data to improve health outcomes.

Pillo Health is continuing to work hard to solve the adherence problem and to provide a powerful, accessible platform for better health at home.
Works Cited


