Addressing Modern Challenges Of Self Chronic Disease Management

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Overview

A disease that lasts for a year or longer and necessitates continuing medical attention, restrictions on daily activities, or both are referred to as a chronic disease. (Centers for Disease Control and Prevention, 2022) Chronic disease management is a combination of monitoring and coordinating treatment, screenings, check-ups, and education of chronic patients. Avoiding or lessening the consequences of chronic disease can enhance one's quality of life while lowering medical expenses(*Healthcare.gov, 2022*).

The essence of chronic disease management is the productivity of interactions between the patient and medical professional in alleviating complications associated with their chronic illness. To ensure maximum productivity and success in their treatments, patients need to be active and constantly engaged with their prescribed treatment plan (Reynolds,2018).

The healthcare industry is heavily decentralized with most clinics being independent of one another. As a result, patients' experience revolves around network providers and insurance as opposed to the patients themselves. Such a system allows room for miscommunication which ultimately leads to ineffective treatment plans, reducing the overall quality of patient's treatment. The treatment plans can manifest in the form of medication or a change in lifestyle. Furthermore, physicians are not often informed about patients' comorbidities and comedications. As a result, patients can be overwhelmed, decreasing their engagement and adherence to the treatment plan.

Leading providers of CDM adherence systems include Medisafe, Omnicell, BrightInsights, and Glucose Buddy. For each unique customer, Medisafe offers a solution that is tailored to their needs. Some solutions limit patient access because they are expensive, have stringent insurance restrictions, or need access to a doctor. Medisafe is able to collect user behavior data and anonymized medical data from its users, which it may then sell to pharmaceutical companies. 90% of Medisafe users have reportedly seen gains in CDM engagement and adherence, according to research.

As technology evolves, simple tasks in daily life can be done within a reach of a pocket. Smartphones are accessible yet powerful tools that increase efficiency in communication, productivity, and many more aspects of life. Mobile medical applications are observed to have astonishing growth and are projected and valued at 38.47 USD Billion by 2029 (Data Bridge Market Research, 2022). Through multiple experiments, researchers have shown that mobile phone interventions increase patients' medical adherence. With this information in mind, the mobile application is the next logical step to take to resolve medical adherence issues. \

We propose the use of Medisafe, a personalized medication intake app for patients with chronic disease. The app simplifies patients' treatment and utilizes an AI management system that keeps track of the patients' health data and analyses it to make changes. The app's content changes as patients enroll through treatment and recovery, place medication orders, assess eligibility for financial assistance programs, order refills, and collect provider information through surveys which streamlines the chronic health management process.

To further address the challenges of chronic disease management, however, we also propose a ranking-based recommendation system integrated into Medisafe's application framework. Google is able to utilize its Google Health Study data to create a ranking algorithm for CDM programs that fits the user's medical profile. To prevent the arduous task of comparing different treatment programs and misinformation, the machine learning-powered recommendation system will rank and give users the liberty to choose their own CDM programs that suit their financial or logistical needs.

Competitive Analysis

"According to the CDC, more than 60% of the adult American population suffers from at least one chronic disease, and 40% suffers from two or more chronic conditions. Moreover, more than 125,000 deaths caused by chronic diseases could have been prevented with proper chronic disease management. However, access and adherence to CDM programs are limited due to

psychological, social, and financial factors(*Centers for Disease Control and Prevention*). In developed countries, nonadherence to the treatment of chronic diseases ranges from 30% to 50% and is even higher in the US (Kleinsinger, 2018). Potential customers are those who suffer from at least one chronic disease and are either prospects or are currently on a CDM management plan but are struggling with adherence.

Currently, many companies provide solutions to help encourage CDM engagement and help provide easier access to medical information from patients to doctors. As shown in table 1, companies that lead the way in CDM adherence solutions are companies such as Medisafe, Omnicell, BrightInsights, and Glucose Buddy. Each company has a specific focus on particular aspects of CDM and approaches it in different ways. Omnicell: a producer of medication adherence packaging and patient engagement software used by retail pharmacies. BrightInsights: a medical company that provides software solutions that track the patient journey and reports progress to patients' doctors. Glucose Buddy: an app and glucose level testing service that focuses on the management of diabetes. And Medisafe: a CDM medication management software. However, some solutions presented by these companies restrict patient access due to high pricing, strict medical insurance requirements, and the need for access to a doctor or medical professional.

Company	**Medisafe**	**Omnicell**	**Glucose Buddy**	**BrightInsight**
Revenue ($ Millions)	**15.4 (Estimated)**	**1,130**	**<5 (Estimated)**	**37.5 (Estimated)**

Plans and Price	**Standard plan: Free Premium plan: $4.99 Month $39.99 Year**	**To be negotiated**	**Standard Plan: Free Digital Control: $19.99 Month $215 Year Complete 50: $29.99 Month $324 Year Unlimited: $59.99 Month $648 Year**	**To be negotiated**
Business type	**B2C**	**B2B**	**B2C**	**B2B (PaaS)**
Biz model	**Subscription Selling anonymized data**	**Contract-based**	**subscription**	**Contract-based**
Users	**10 million**	**According to enlyft.com 2000+ Companies**	**Half a million downloads on both IOS & Android.**	**Data unavailable**
Employees	**51-200**	**3800**	**<25**	**201-500**
Platform	**App**	**Desktop software**	**App**	**App+Website+Desktop software**
Geographics	**Global (available in 15 languages)**	**Multinational**	**US only**	**Global**
App Review	**4.7/5**	**4.3/5**	**4.5/5**	**No App**
Accessibility	**Medical professional not required**	**Medical professional required**	**Medical professional not required**	**Medical professional required**
Special Features	**- (JITI) AI management system - Care Integration Engine - Medisafe Maestro - Real-World Evidence**	**-Medication packaging services**	**- Share blood sugar level readings/data with doctors - Provides assessment for meals.**	**- Provide platforms and software to ease the development of CDM software**

Table 1: Comparison of Medisafe and its main competitors.

We've deduced that Medisafe presents itself as an industry leader with its personalized approach toward improving CDM adherence. Using its cutting-edge JITI (Just-In-Time Interventions) AI technology, and its intuitive platform, Medisafe provides a solution that is personalized for each individual user(*JITI Medisafe,* 2022).

Medisafe creates personalized plans for users. With their Just-In-Time Interventions technology and predictive machine learning engine, they can provide comprehensive patient support. Their App is intuitive and easy to use, with a 4.7 out of 5 rating on the App store. Their app is available in 15 languages and is globally accessible. (Inc., *Medisafe Medication Management* 2012) Patients can download it without the need for a medical professional and manage their plans easily. Its pricing model includes a standard plan or a premium plan. The standard plan is free and the premium plans are $4.99/month or $39.99/year, which is affordable compared to other similar products. For instance, Glucose Buddy's most basic plan starts from $19.99 a month. (Glucose Buddy,2022) In Medisafe, users do not have to rely on medical professionals to manage their data; they can directly import data from Apple Health medical records or input the data themselves and start to work on their plans. It has a high success rate compared to its counterparts. According to Medisafe, there is a reported proven success rate of 90% that Medisafe users experienced improvements in CDM engagement and adherence (Matt, 2022). Similar results were found with Omnicell as well, with 86% success demonstrated by its patients. But due to the pricing, availability, and effectiveness of its product, Medisafe has taken a competitive advantage over its competitors.

Medisafe also consists of a business model that is much more compatible with Google compared to its competitors. Boasting an astounding 10 million users, Medisafe is able to amass anonymized medical data and user behavioral information from its users that can be monetized and provided to pharmaceutical companies (Matt, 2022). To date, Medisafe has currently logged 4 billion individual dosage behaviors from its user base, 800 million patient journey engagements, and 35

million medications added to its database (Matt, 2022). Unlike Omnicell or Glucose Buddy, whose revenue is single-sourced, Medisafe has the potential of expanding total revenue as it amasses more users and collects more data. According to our research, Medisafe is the most compatible company to be integrated into Google. With Medisafe's user-friendliness, accessibility, and affordability, Google can expand its user base and collect medical data from billions of users.

Company Profile & Product Offering

Medisafe is a mobile-based application that helps people integrate healthier lifestyles with a cloud-synced mobile medication management system. Medisafe is a solution to the current healthcare system and focuses solely on patients' experiences. Medisafe's mission is to "empower patients by daring to go beyond the status quo, focusing on patients first and giving them the tools they need to simplify their treatment regimen, and improving lives."(Solutions,2022). Medisafe simplifies and increases the accessibility of treatment while integrating patient support programs to overall improve patients' quality of life.

Medicare leverages technology in unique ways. Medisafe views the treatment plan holistically and does not focus on solely medication adherence. Medisafe is a platform for communication between doctors and patients, a tool that empowers patients to commit to their treatment plans. Through their integrated patient care support and personalization, patients will feel that they are being cared for. Medisafe operates on JITI, Just In Time Intervention, an analytic-driven artificial intelligence that "influences and supports patients' behaviors throughout their medication treatment to drive adherence" (*Patient support*, 2022). Medisafe also significantly improves and simplifies the administrative process of doctor visits which encourages doctor visits and consultations. Through Medisafe's ability to streamline the entire medical process, comprehensive

inventory system, and integrated medical outreach, Medisafe is able to effectively combat interruptions and barriers to treatment associated with adherence and engagement.

Medisafe's Just-In-Time-Intervention (JITI) is a cutting-edge machine learning-based technology that greatly improves personalization and overall patient experience in Medisafe's mobile application (*Just-in-time-interventions (JITI)*™ 2022). JITI focuses on boosting patients' engagement with the treatment plan by improving adherence, and activity, and "extending treatment retention through personalized patient support". Additionally, JITI utilizes machine learning and draws personas based on behavioral science and comprehensive data which determines what is used for patient support. JITI's predictive model automatically adjusts the patient experience based on known treatment milestones, barriers, and recognized behavior patterns. JITI also draws information from a massive database with more than 4 billion registered medication doses which provides a comprehensive inventory with personalized proactive reminders for its users. Ultimately, JITI empowers patients to be adherent and confident in their medical goals while proactively intervening with patients to extend engagement.

Aside from Medisafe's complex machine learning model, the software also increases patients' overall access to healthcare. Firstly, Medisafe's integrated digital solution reduces the complexity of getting and paying for treatments and medications. Medisafe truncates the intermediate steps of receiving the treatment that patients need. With their integrated document exchange feature, Medisafe enables seamless administrative processes and keeps patients updated and connected with their respective healthcare providers (*Care Integration Engine* 2022). Through this, Medisafe reduces the arduous patient process and increases the care team's efficiency and transparency with digital document submission. Additionally, Medisafe's shipment and tracking feature grants patients visibility into shipment and tracking for their medications. Furthermore, Medisafe's open API allows extended integration such as financial support, specialty pharmacies, etc.

Medisafe prioritizes patients' ability to connect to the day-to-day support they need in managing their medication. Medisafe effectively helps break the medical barrier in getting treatments by guiding and harnessing resources they need such as financial support programs or even connecting patients with their caregivers, care team, and clinicians all in the palm of their hand. In general, it is a difficult task to stay motivated in adhering to a medical plan, especially with a chronic disease. Medisafe's patient support system supports users with the right resources, at just the right time, to keep them confident and adherent throughout their treatment journeys.

New Opportunities and Recommendation

The healthcare industry is composed of multiple layers of complex structures that are further broken down into specializations of different diseases or body parts. Most patients choose a general practitioner as their primary care. A general practitioner can be seen as the frontline in a patient's health management. They utilize test labs and assess a patient's overall health and refer patients to specialists if they diagnose any complications or chronic conditions that require experts in that particular field. 40 percent of general practitioners are privately owned while the rest work in business-owned hospitals. Electronic Medical Record (EMR) has been around since the 1970s. Before the digitalization of patient records, hospitals kept their track record in paper charts. Nowadays, hospitals, clinics, and private practices use EMR to allow better data management and transparency for patients' future visits (Newman, 2020). The main problem with EMR is that every EMR company is not always compatible with the other, meaning that data transparency between hospitals and providers may be hindered. Moreover, since EMR is implemented on a large scale as a business solution, it is very pricey for smaller practitioners to implement. As a result, some private practices and smaller clinics might not opt into EMR. The challenge of transparency of a patient's

medical record can be very detrimental to the patient's care process. Without having a clear overview of the patient's medical history, diagnosis and treatment may be negatively affected depending on the patient's missing or unclear medical history.

Due to the decentralization of EMR, specialists often want patients to opt into a single treatment plan with limited alternatives without regarding their financial status or accessibility. Currently, there are many self-management tools and plans for chronic illness patients with various chronic diseases, but patients find it hard to find a program most suitable for them and their needs due to an abundance of complex information provided to them (*The top patient challenges of chronic disease*,2021).

After SWOT analysis for Medisafe, We propose a platform with a function that centralizes data information of medical records, utilizes machine learning to analyze the data, and gives recommendations for what program is most suitable for the patient. For this, we suggest a ranking system embedded in a form of a web application that can assist patients in finding the program that is most suitable for them as it learns from existing health data sets.

Strength: ● Mobile based application which simplifies accessibility of CDM. ● Enhance the communication between patient and ● Extending treatment retention through personalized patient support. ● Massive database ● Personalized proactive reminders ● Utilizing machine learning and other AI Tech	Weakness: ● Primary income comes from data monetization instead of subscription plans ● General concern of privacy of personal information ● The application is mainly focus on the medication

Opportunities: ● The healthcare industry is heavily decentralized with most clinics being independent of one another. ● Large portion of CD patients are older population needs methods to manage overwhelming information provided which can be contradict with each other. ● Many more possible use cases for their data such as ML models ● Potential Market in other fields of CDM.	Treats: ● BrightInsight: provides similar solutions, but instead of a single app, they provide tools for professionals to configure their own software. ● Omnicell: works directly with pharmacies by providing equipment and software solutions ● Glucose Buddy: provides more dedicated functions for diabetes patients. ● In case the US government come up with a better health care infrastructure.

Table 2: SWOT analysis for Medisafe.

Especially for senior chronic disease patients who don't have the ability and capacity to navigate through a myriad of online sources. There are numerous Chronic Disease Management programs that patients can choose from upon completing their doctor's appointments. However, patients often struggle in choosing the best program for them due to the vast amount of resources on the internet. As a result, patients often get conflicting information and relinquish adherence to their medical plan

The solution to the EMR problem is data centralization by adding a layer of standardized EMR for every single clinic and hospital in the United States. Medisafe has accomplished EHR implementation on an individual scale as well as a complex machine-learning-powered medical management system to boost patients' overall medical adherence. However, the software will be much more powerful and would benefit millions if a recommendation system is incorporated. As a new opportunity, Google Health could cooperate with Medisafe to establish a robust, standardized, and individualized Electronic Medical Record that will be transparent throughout all healthcare providers. While the EMR data itself will not be visible to the patient, combined with Google Health Studies, the app would run the data through an algorithm and machine learning program to

recommend treatment programs to the users. Additionally, through data and analytics, a ranking system would be implemented. Google Health Study, combined with algorithms, would provide significant data to produce a cohesive recommendation and ranking for the users. So aside from the wide variety of programs that are presented, patients would also be able to see which program has the highest quality without navigating through vast online resources. Having a ranking-based recommendation system is crucial as it considers patients' financial state and logistical needs while presenting information in a more intuitive way. In conclusion, by implementing Medisafe's business framework and implementing a new ranking-based recommendation system through existing data from Google Health Study and patients' EHR, patients will be given the opportunity to choose from a wide range of high-quality treatment programs depending on their financial state and logistic arrangements while simultaneously boosting their medical adherence.

We recommend Google build on an existing framework. In addition to Medisafe's personalized EMR system and its vision to improve medication adherence through technological means, Google can utilize existing data from Google Health Study to implement a ranking-based recommendation system. This addition will ultimately further address the challenge of self-chronic disease management through simplification and education which leads to significant improvement in patients' quality of life.

Citation

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