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Medication Adherence Via a Smartphone Application

By Robert B. Marsh

DNP Scholarly Project Committee

Dr. Mary Ellen E. Roberts

Dr. Katherine Hinic

Melanie O'Hara

Submitted in partial fulfillment of the requirements for the degree of Doctor of Nursing Practice

Seton Hall University

2023

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College of Nursing
Graduate Department

APPROVAL FOR SUCCESSFUL DEFENSE

Robert B. Marsh has successfully defended and made the required modifications to the text of the DNP Final Scholarly Project for the Doctor of Nursing Practice during this Spring, 2023

Final Scholarly Project COMMITTEE

Dr. Mary Ellen Roberts

Date

Dr. Katherine Hinic

Date

Melanie O'Hara

Date

Dedication

This project is dedicated to all of those struggling with mental illness. My hope is that at some point, someone with mental illness reads this and implements this smartphone application into their toolbox, to aid in their overall mental well-being. To my father who passed away in 2007, an educator, who was a huge part of my pursuing my academic endeavors as well as a profession in academia. To my grandmother who passed away in 2014 at the age of 96, the smartest person I had ever known, with only a formal eighth grade education. She worked with the mentally ill for nearly 50 years, up until the age of 90. To my mother who struggles with mental illness, schizoaffective disorder, who had her first psychotic break at age 48. I was 24 years old at the time and understood none of what was happening to her. Not initially wanting to pursue a career path in mental health, I gravitated towards it in my late 20's. In hindsight, I am certain it was to learn as much as I possibly could about mental illness, to understand her suffering and be able to help her anyway possible.

Acknowledgements

I entered the Doctor of Nursing Practice program eight years ago after meeting Dr. Maryellen Roberts. I am positive that without her guidance and support I would not have completed this program. She has helped me navigate both professional and personal crises that had set my progress towards completing the program back. She is one of the kindest and most genuine people I have ever met; Seton Hall University is truly blessed to have her as a faculty member! Thank you to Dr. Hinic for reading my quality initiative project and providing me with invaluable feedback. I would like to thank Melanie O'Hara for her support and expertise. Finally, I would like to thank all my family and friends for the support, encouragement, and love given to me throughout the Doctor of Nursing Practice program.

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Background

Mental illness affects approximately 25% of the United States population (Johns Hopkins Medicine, 2022) and 11% of the worldwide population (Dattani et al., 2021). It ranks as one of the costliest forms of sickness for the United States, if not the costliest, in terms of Gross Domestic Product (GDP) (Penn State, 2018). Mental illness includes the following primary classes of mental health disorders according to the DSM-V (*Diagnostic Statistical Manual 5th Edition*): schizophrenia spectrum, bipolar and related, depressive, anxiety, obsessive-compulsive and related, trauma and stressor related, attention deficit and attention deficit hyperactivity, somatic symptom and dissociative, eating, personality, neurocognitive, substance-related and addictive disorders, elimination, and sleep wake (Morgan & Townsend, 2020). This study also included patients with the following subclasses of the above-mentioned disorders: Major Depressive and Seasonal Affective (Depressive), Social Anxiety, Generalized, Panic (Anxiety), Posttraumatic Stress (Trauma and Stress), Attention Deficit and Attention Deficit Hyperactivity primarily inattentive type (Neurodevelopmental), Bipolar II (Bipolar), Alcohol Use Disorder and Opiate Use Disorder (Substance-Related and Addictive Disorders), and Insomnia (Sleep-Wake) (Morgan & Townsend, 2020). Psychotropic medication was prescribed for these patients from standing doses up to three times daily, and as needed. A smartphone application “Medisafe” (Medisafe, 2021) was used to track medication adherence among those in the study.

Definition of Terms

Mental illness: A “maladaptive response to stressors from the internal or external environment, evidenced by thoughts, feelings, and behaviors that are incongruent with the local and cultural norms, and interfere with the individual’s social, occupational, and/or physical functioning” (Morgan & Townsend, 2020, p. 16).

GDP (Gross Domestic Product): “measures the monetary value of final goods and services, that is, those that are bought by the final user, produced in a country in a given period of time (say a quarter or a year). It counts all the output generated within the borders of a country” (Calleja, 2020).

DSM-V: The fifth edition of the *Diagnostic and Statistical Manual of Mental Health Disorders* (DSM-V), an authoritative volume that defines and classifies mental health disorders (American Psychiatric Association, 2022).

Mental Health Disorders: according to the DSM-V, 5 factors must be considered:

- A behavioral or psychological syndrome or pattern that occurs in an individual that reflects an underlying psychobiological dysfunction.
- The consequences of which are clinically significant distress (e.g., a painful symptom)
- Or disability (e.g., impairment in one or more major areas of functioning).
- And must not be merely an expected response to common stressors and losses (e.g., trance states in religious rituals).
- Or primarily a result of social deviance or conflicts within society (Raskin & Raskin, 2022).

Major Depressive and with Seasonal variance: Characterized by a depressed mood or loss of interest or pleasure in usual activities. Evidence will show impaired social and occupational functioning that has existed for at least two weeks, no history of manic behavior, and symptoms that cannot be attributed to use of substances or a general medical condition. The diagnosis will also identify the degree of severity of symptoms (mild, moderate, or severe) and whether there is evidence of psychotic, catatonic, or melancholic features (Morgan & Townsend, 2020, p. 383).

Social Anxiety: Social anxiety disorder is an excessive fear of a situation in which a person might do something embarrassing or be evaluated negatively by others. The individual has

extreme concerns about being exposed to possible scrutiny by others and fears social or performance situations in which embarrassment may occur. In some instances, the fear may be quite defined, such as the fear of speaking or eating in a public place, fear of using a public restroom, or fear of writing in the presence of others. In other cases, the social phobia may involve general social situations, such as saying things or answering questions in a manner that would provoke laughter on the part of others (Morgan & Townsend, 2020, p.457).

Posttraumatic Stress: Re-experiencing the traumatic event, a sustained high level of anxiety or arousal, or a general numbing of responsiveness. Intrusive recollections or nightmares of the event are common. Some individuals may be unable to remember certain aspects of the trauma. The full picture of the symptoms must be present for more than one month and cause significant interference with social, occupational, and other areas of functioning. The disorder can occur at any age. Symptoms may begin within the first three months after the trauma; otherwise, there may be a delay of several months or even years (Morgan & Townsend, 2020, p.485).

Attention Deficit, primarily inattentive: The essential behavior pattern is one of attention and/or hyperactivity and impulsivity. Hyperactivity is excessive psychomotor activity that may be purposeful or aimless, accompanied by physical movements and verbal utterances that are usually more rapid than normal. Inattention and distractibility commonly accompany hyperactive behavior. Impulsiveness is the trait of acting without reflection and without thinking about the consequences of the behavior; it is an abrupt inclination to act (and the inability to resist acting) on certain behavioral urges (Morgan & Townsend, 2020, p.608).

Bipolar II: Characterized by recurrent bouts of major depression with episodic occurrences of hypomania. The individual presents with symptoms of depression or hypomania and has never experienced a full manic episode. A diagnosis may specify whether the current or most recent

episode is hypomanic, depressive, or presents with mixed features. If the current syndrome is a major depressive episode, psychotic or catatonic features may be present (Morgan & Townsend, 2020, p.423).

Alcohol Use Disorder and Opiate Use Disorder: (Substance Use Disorder, same criteria for both alcohol and opiates):

11 different criteria:

- Taking the substance in larger amounts or for longer than advised.
- Wanting to cut off using the substance but not managing to.
- Spending a lot of getting, using or recovering from use of the substance.
- Cravings for and urges to use the substance.
- Not managing to do what is expected at work, home, or school because of substance use.
- Continuing substance use even when it causes problems in relationships.
- Giving up important social, occupational, or recreational activities because of substance use.
- Using the substance again and again, even when it poses a danger.
- Continuing to use the substance even in the knowledge that an existing physical or psychological problem may have been caused or made worse by the substance.
- Needing more of the substance to get the desired effect (tolerance).
- Development of withdrawal symptoms, which can be relieved by taking more of the substance (Morgan & Townsend, 2020, p.279).

Insomnia: a predominant dissatisfaction with sleep quantity or quality, associated with one (or more) of the following symptoms:

- Difficulty initiating sleep (in children, this may manifest as difficulty initiating

sleep without caregiver intervention).

- Difficulty maintaining sleep, characterized by frequent awakenings or problems returning to sleep after awakenings (in children, this may manifest as difficulty returning to sleep without caregiver intervention).
- Early-morning awakening with the inability to return to sleep.
- Sleeping difficulty has been present for at least three months (Sachdov et al., 2015).

Psychopharmacology: The development, study, and use of drugs for the modification of behavior and the alleviation of symptoms in the treatment of mental health disorders (Encyclopedia Britannica, 2022).

Smartphone: a mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, internet access, and an operating system capable of running downloaded applications (Oxford Advanced Learner's dictionary, 2022).

Smartphone Application: A mobile application, most often referred to as an “app,” is a type of application software designed to run on mobile devices, such as a smartphone or a tablet computer. Mobile applications frequently provide users with similar services to those accessed on PCs. Apps are generally small, individual software units with limited functions (Techopedia, 2020).

Medication Adherence: the degree to which the person's behavior corresponds with the agreed recommendations from a healthcare provider (Jimmu & Jose, 2011).

Medisafe Smartphone Application: A medication reminder application for smartphones that reminds a patient to take their medication (Medisafe, 2021).

Description of the Project

I conducted an eight-week quality improvement project by tracking adherence rates among 10 mentally ill patients that I work with at a drug rehabilitation facility in northern New Jersey. The patients downloaded the Medisafe application to their smartphones, and once the application was downloaded, we uploaded their current psychotropic medication regimen's to the application, which included both their standing and as needed medication. Throughout the day, the patient received reminders each time a medication was to be taken. They acknowledged the reminder by tapping on "taken" or "not taken". The patient was considered adherent and adhering to their medication regimen if they tapped on the "taken" reminder. These acknowledgments or lack thereof were sent to me at the end of the day to track adherence rates.

Purpose of the Project

To implement this application and increase medication adherence rates; improvement is needed in psychotropic medication adherence rates among patients with a diagnosed mental illness.

Goals and Objectives

To improve, via reminders sent to the patient's smartphones, the adherence rates of patients who are prescribed psychotropic medication as compared to the psychotropic medication adherence rates found in previous studies.

Significance of the Project

Increasing the psychotropic medication adherence rates of mentally ill patients is extremely significant. When patients are adherent with their psychotropic medication's, they lead healthier and more productive lives (National Alliance on Mental Illness, 2022). In this state they become less of a burden to society and to their families and loved ones, from both an emotional

and financial standpoint (Semahegn et al., 2020). Moreover, patients that are court mandated to adhere to involuntary outpatient commitment can avoid being hospitalized if they are adherent with their medication(s) (Department of Human Services, 2022).

Even for patients that are not court mandated to take medication, non-adherence with medication is one of the major reasons why people are hospitalized (Olson et al., 2022). This can be avoided. Again, the reasons for improving adherence in mentally ill patients and prescribing psychotropic medication, is to allow the patient to live a more productive and fulfilling life, to make it easier for families to interact with their mentally ill loved ones, and to decrease the cost of mental illness for individuals and societies at large.

Literature Review

A literature review was conducted to find evidence of medication adherence in patients who were prescribed psychotropic medications. The search consisted of attempting to obtain as many controlled trials involving medication adherence as possible. A thorough examination of the literature revealed several relevant studies. The literature search was conducted via the search engines and databases of PubMed, Google Scholar, EBSCO (Elton B. Stephens Co.), MEDLINE (United States National Library of Medicine), and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) from 1997 to 2022.

The words used in the search were a combination of the following: smartphone, smartphone application, medication, psychotropic medication, psychiatric medication, Adherence, nonadherence, forgetting, forgetfulness, hospitalizations, medication, reminders, adherence, non-adherence, mental illness, mental health, disorder, schizophrenia, obsessive compulsive and related, trauma and stress are related, attention deficit and attention deficit

hyperactivity, somatic symptom, dissociative, eating, personality, neurocognitive, substance related and addictive, elimination, sleep weak, bipolar, depressive, and anxiety.

According to a secondary analysis of primary data by Nageotte et. al (1997), approximately 50% of schizophrenic patient s were nonadherent with their medication, while Bulloch et al. (2006) did a telephone survey that revealed that nearly 50% of patients who are prescribed antidepressants were nonadherent with their medications. A correctional study of respondents with a diagnosis of schizophrenia, bipolar disorder, or severe depression revealed that 50% of patients demonstrated a sub-optimal level of medication adherence (Ibrahim et al., 2015). In a cross-sectional study Eticha et al. (2015) found that 27% of schizophrenics were nonadherent with their medication, and in a retrospective cohort study, Davé et al. (2012) found that 42% of patients who were diagnosed with major depressive disorder and prescribed antidepressants had stopped taking their medications after six months. Furthermore, the same study revealed that approximately 80% were non-adherent at the two-year mark. Interviews with patient s who were diagnosed with Major Depressive disorder revealed that 25% of patients discontinued their antidepressant medication after three months (Goethe et al., 2007). A double-blind study of patients diagnosed with Major Depressive disorder revealed that 37% of them had an adherence rate of less than 70% (Demyttenaere et al., 1998).

A further look revealed statistical nonadherence rates with reasons for nonadherence. In a 2001 study, participants aged 18 to 65 years with anxiety or mild to severe depression were randomly selected by their physicians and sent an invitation to complete a 42-question survey. Three hundred physicians nationwide assessed the severity of each respondent's depression and symptoms of anxiety. According to their judgment, 175 (50%) were mildly to moderately depressed, 84 (24%) severely depressed, and 91 (26%) displayed symptoms of anxiety. 344

patients currently being treated with an antidepressant, 75 (22%) reported nonadherence. The most common reason for nonadherence was "having trouble remembering to take it" (19/44 patients [43%]) (Ashton et al., 2005).

According to Bulloch & Patten (2010), a 12-month long, 2002 Canadian community mental health survey was conducted. It was made up of 6,201 patients who were taking psychotropic medications. The study revealed that nearly 50% were nonadherent with their medication's and that nearly 75% reported the main reason for their nonadherence as "forgetfulness". This is not only the most severely mentally ill, i.e., those on the spread of the schizophrenia spectrum, but patients with depression, anxiety, bipolar disorder, and insomnia who were prescribed sedative hypnotics, anxiolytics, mood stabilizers, anti-depressants, and anti-psychotics.

In 2005, 128 psychiatric patients from Aga Khan University Hospital participated in a study that assessed the patient's adherence with their psychotropic medication regimen. An interviewer assisted in the study, and the standardized questionnaire was used for data collection. Patients with a cognitive deficit or psychosis and those presenting themselves for the first time were not included in the study. Adherence among depressed patients was 61.53%, psychotic patients 58.82%, and patients with bipolar disorders 73.91%. "Forgot to take the medication" was the reason that 36% of the patients reported nonadherence (Taj et al., 2008).

In 2007, a one month, cross-sectional, descriptive, qualitative, and quantitative study was conducted in a mental health service facility in Brazil. A total of 21 patients diagnosed with bipolar disorder participated. Participants were both male and female between 23 and 79 years of age. It was found that 57.2% of the patients did not adhere to the medication regimen due to non-

intentional behavior (forgetfulness and careless behavior regarding medication time) (Miasso et al., 2009).

In 2010, a survey was developed containing 39 questions (521 options) that asked about adherence problems in patients with schizophrenia and bipolar disorder with risk factors for nonadherence. The survey was completed by 41 experts (identified according to research publications and funded grants on adherence problems and serious and persistent mental illness). These experts worked on guidelines for serious and persistent mental illness, and/or participated in previous expert consensus surveys on psychotic disorders and/or bipolar disorder. The experts endorsed "percentage of medication not taken" as the preferred method for defining nonadherence, with 80% or more of medication taken considered adherent. The experts reported that the average patient with schizophrenia or bipolar disorder in their practices took only 51% to 70% of their prescribed medication and noted that reasons for not taking it included forgetfulness, misunderstanding of instructions, and financial or environmental problems (Velligan et al., 2010).

Shrestha Manandhar (2017) conducted a prospective study to determine medication adherence patterns in patients with depression who were prescribed an antidepressant. The study included 60 patients, 78% of whom were females and 22% males with a mean age of 43.16 years. Only 37% of the patients adhered to their anti-depressant therapy in most cases, forgetfulness was the main reason for missing their doses (50%).

Furthermore, a systematic review and meta-analysis by Semahegn et al., (2020) that was comprised of 35 studies was conducted. 9 studies involved patients suffering from schizophrenia, 16 studies involved patients with a depressive disorder, and 10 studies involved patients with bipolar disorder. The overall percentage of patients who were nonadherent with their

medication's was 49%. Broken down by mental illness, those with schizophrenia were 56% nonadherent, major depressive disorder 50% nonadherent, and bipolar disorders 44% nonadherent. Nonadherence due to forgetfulness and job-related activities were major contributors, e.g., farmers busy throughout the day and forgetting to take their medication. (Semahegn et al., 2020).

Most recently, in 2021, a comprehensive literature review was conducted using 21 articles to assess patients diagnosed with a depressive disorder and their adherence with prescribed antidepressants. The review concluded that the patient-related factor “forgetfulness” was a significant barrier to antidepressant adherence (Marasine & Sankhi, 2021).

There are few studies specifically aimed at increasing adherence rates among the mentally ill. One double-blind study with 66 major depressive disorder patients estimated adherence, using an Electronic Medication Event Monitoring System. Adherence was defined as the percentage of days when the correct dose was taken out of the medication container. It found that 37% of patients were adherent less than 70% of the time (Demyttenaere et al., 1998). Ho et al. (2017) found that, for patients who were diagnosed with depression and prescribed an antidepressant, reminders like using pillboxes, keeping medications in a visible place, and prompting from family members helped them adhere to their antidepressant regimens.

Studies that were not specifically mental health driven have shown that “reminders” for patients can statistically increase medication adherence rates. Raynor et al. (1996) found that patients who were discharged from a hospital had an average medication adherence rate of 86% if not given a reminder chart; 91% if given a reminder chart without an explanation; and 95% if given a reminder chart and an explanation. In a 2006 systematic review conducted by Heneghan et al. (2006), reminder packaging increased medication adherence by as much as 11%.

Project Methodology

Theoretical Framework

The theoretical framework of this study was based on Hildegard Peplau's "The Mother of Mental Health Nursing" theory. Peplau believed that a mental health nurse has 7 specific roles: the stranger, the resource person, the teacher, the counselor, the surrogate, the technical expert, and the leader.

- The stranger roll: receives the patient the same way one meets a stranger in other life situations and provides an excepting climate that builds trust.
- The resource role: answers questions, interprets clinical treatment data, gives information.
- The teaching role: gives instructions and provides training; this involves the analysis and synthesis of the learners' experiences.
- The counseling role: helps the patient understand and integrate the meaning of their current life circumstances and provides guidance and encouragement to make changes.
- The surrogate role: helps the patient clarify domains of dependence, interdependence, and independence and acts on the patient 's behalf as an advocate.
- The technical expert role: understand various professional devices and how to implement them to best aid the patient.
- The leadership role: helps the patient assume maximum responsibility for meeting treatment goals in a mutually satisfying way (Morgan & Townsend, 2020, p.785).

All aspects of this project implemented Peplau's roles in one way or another. First the patient and I met for an initial evaluation. During the initial evaluation, a rapport was established between us along with a modicum of trust, and the technical aspects of the smartphone

application was explained as well as the benefits it could provide. After completing the initial evaluation, I offered patients the ability to participate in this project and answered any questions they had. We also discussed the importance of medication adherence for themselves, and how this project could benefit others moving forward. The patient s with whom I was able to establish trust and rapport bought into the importance of the study. They were happy to participate, knowing that they were able to improve their own lives by being more adherent to their medication regimens as well as possibly helping future patients.

Risk Analysis

A SWOT (Strength, Weakness, Opportunity, and Threat Analysis) (Roberts, 2019) was used to analyze the internal external risks, strengths, opportunities, and threats of the study that would determine whether it would be a success or a failure.

When looking at the internal strengths, there were positive attributes of the organization that would help achieve the project's objective (Haughey, 2018). The following were identified:

- Some of the team members I work with are dedicated to improving the patient 's medication adherence rates.
- I have a vested interest in seeing these patients do well.
- I am always emphasizing the importance of medication adherence.
- The application gives real time feedback as to whether the patient was adherent with the medication, making the tracking of data easy for myself.
- The application is user-friendly.
- A patient s medication schedule is downloaded onto their phone only once and is adjusted only if their medication regimen changes.
- The application is free of charge for our patients.

On the other hand, there were also internal weaknesses as well as negative attributes of the organization that could interfere in meeting the project's objective (Haughey, 2018). For one, some of the team members were not invested in tracking the patient's medication adherence rates because they feel that psychotropic medication should not be a part of a patient's treatment. They believe that a 12-step program and a "higher power" are the only appropriate interventions for a substance abuser to recover.

Furthermore, it would have been beneficial if the patient's counselors had followed up with them regarding adherence; however, they were not on board with the idea, claiming that "it is too time consuming" in their eyes. So, I am the only one within our organization tracking adherence rates. If a participating patient is put on a "house restriction", that is, punishment for not following the facilities protocols, will staff allow them to have their phones so that they can respond to the reminders? Will organizational leadership continue to be invested? And finally, some patients unfortunately, will just not want to participate in the quality improvement initiative.

In contrast, there are external opportunities and conditions that could help achieve the project's objective (Haughey, 2018). For one, society at large is trending toward more electronic medical interventions (e-health), which has led to greater patient satisfaction (Daniel & Sulmasy, 2015). More satisfaction may lead to more patients following or participating in the initiative. Furthermore, there are studies that show that external reminders are beneficial to increasing medication adherence rates (Heneghan et al., 2006).

Some of the major external threats or negative conditions that could cause harm to the project (Haughey, 2018) are as follows. For one, patients initially enrolled in the study may decide at some point that they do not want to complete the project because, for example, they

find it bothersome to respond to the reminders. Also, the patient could claim that they were adherent to a medication at a certain time via electronic feedback, but with no one visually observing the patient taking their medication, the accuracy of their adherence could be affected. In other cases, a patient may not remember to carry their smartphone with them to respond to the medication reminders. They may experience practical difficulties in responding to reminders during the day while at work, e.g., amid completing a work task. Or, if the patient has an illicit substance or alcohol relapse, he or she may not be capable of interacting with the application.

Unfortunately, most of the internal and external risks, strengths, opportunities, and threats that were identified became trivial, and what transpired was much more complicated than one could have foreseen.

Prior to the global pandemic, leadership changes and patient displacement from the organization due to a fire were some obstacles that had to be dealt with. I initially had to discuss and get approval from the Executive Director to implement the initiative. I did this in the spring of 2019, and he approved the initiative. Next, I had to get an IRB determination to satisfy the Corporate Compliance Officer at WEconnect. WEconnect is the smartphone application I was going to use to track medication adherence rates. After submitting the IRB determination forms there was a delay of two months in the wait for the determination. When I did receive the IRB determination in August 2019, I was informed that my initiative did not fall under their purview. Nevertheless, this was submitted to the CCO of WEconnect, and he was satisfied.

I was set to move forward. However, later that month, the patients I work with in the halfway house had their building burned to the ground and were displaced and not completely settled until late fall 2019. While I was waiting for the IRB determination the Executive Director at the rehab resigned. There was a delay of several weeks until a new Executive Director was

hired. I then approached the new Executive Director with the initiative proposal, and they informed me that she had to seek approval from the Board of Directors despite the previous Executive Director not seeking approval from the Board of Director. Apparently, they were going to allow me to implement the initiative without it. I was never informed of this and did not know that I needed their approval. The new Executive Director then submitted my initiative request. I received approval at the beginning of 2020. I was working with several patients in the spring of 2020, discussing the implementation of this study, when COVID-19 struck.

Approximately 75% of our patients contracted Covid and we're not able to work. This was a problem, since ideally this initiative would have been implemented while patients carried their smartphones to work. That would have been the ideal scenario of “real-world” application, as opposed to just having their smartphones while sitting in the halfway house quarantining.

As we went through 2020 and 2021, we were discharging patients but not accepting new ones. Our census had dropped from 45 patients to 12 patients, and not all the substance users had been prescribed psychotropic medication. Once we did start accepting new patients, the Omicron variant became prevalent, and limited my access to patients again due to them being ill and not working. Patients were being discharged, but admissions once again were put on hold. During this frame we also terminated our relationship with WEconnects' smartphone application. The application was initially used for the purpose of recovery from drug addiction. For example, if a patient went to an AA meeting the application was able to track them to verify their attendance. The patient would then earn a \$5 Dunkin' Donuts card. I would have had the ability to upload each patient's psychotropic medication regimens to the application and track the adherence rates. It was not until late fall of 2021 that I was able to implement this initiative. Unfortunately, the

project was only eight weeks in duration with 10 participants because our census was still low due to the ongoing pandemic.

Implementation Timeline

As previously mentioned, this was to be a 12-week quality improvement initiative that tracked adherence rates among 20 mentally ill patients using WEconnects' smartphone application at a drug rehabilitation facility in northern New Jersey. In the end, I was able to implement an 8-week initiative with 10 mentally ill patients at the facility using a different smartphone application, Medisafe. The primary benefit of using this new application was its cost.

Budget

Initially, the quality improvement initiative using the WEconnect smartphone application would have cost the rehabilitation facility \$6,588.00 annually for 20 patients (Taylor, 2019). Those numbers break down to \$329.40 per patient annually. Patients need a smartphone. Some patients do not have one. The cost of the smartphone would have to be included.

Another cost would be the time it would take for the prescriber to sit with the patient, download the application, and then follow up regarding the patient's adherence. At a wage of \$100 per hour, a onetime download will cost the organization \$100 per patient based on a one-hour period to download and educate the patient about the application. Annually this would cost \$2,000.00 for all 20 patients.

Statistics are captured in the WEconnect database. These statistics, access to representatives to analyze the statistics, IT support, etc. are provided by WEconnect and are included in the initial \$6,588.00 annual fee. The cost for the medication adherence rate evaluation is based on how frequently the prescriber wants to access the database. The only cost related to this is the prescriber's time. To track each patient and observe statistics would probably

take 5 minutes per patient. So, for 20 patients that would be 100 minutes. A reasonable timeframe for measuring statistics would be once a week. Thus, at an hourly rate of \$100.00, that would cost the organization \$166.67 to assess each of the 20 patient's adherence rates weekly, or \$8,666.84 annually.

The organization does not pay any additional fees for the prescriber as they are an independent consultant. This means no insurance, retirement plan funds, malpractice insurance, etc. need be allocated to the prescriber.

Based on these figures it would cost the organization approximately \$17,254.84 annually (\$6,588.00 for the WEconnect application and support services, and \$10,666.84 in prescriber salary). However, with the use of the current application "Medisafe", costs are significantly lower because the application is free. So, by eliminating WEconnects' costs, the annual cost for 20 participants falls to \$10,666.84 or, based on 10 patients as in this case, the cost is \$5333.42 annually.

Marketing Plan

I informed the organizational leadership at the facility, as well as the patients who have been prescribed psychotropic medications, that this initiative has the potential to increase adherence rates among patients who are prescribed psychotropic medications. The benefit of increased adherence rates is its potential to decrease the use of illicit substances or alcohol to manage their mental illness. The organizational leadership and patients understood this to be a "self-medicating" technique for treating their mental health issues, as opposed to treatment via psychotropic medications. As a rehabilitation facility they are in the business of preventing relapses, meaning that there is a culture of abstinence from alcohol and/or illicit substance abuse and dependence. The initiative is in line with these core values.

In 2014, 12.25% of the United States population, approximately 20.2 million adults aged 18 or older, had a substance use disorder in the past year. Of these adults, 16.3 million had alcohol use disorder diagnoses and 6.2 million had an illicit substance use disorder diagnoses (Lipari & Van Horn, 2017). Moreover, the proportion of residents of the United States with a mental health disorder is approximately 25% (Johns Hopkins medicine, 2022), those with a “dual diagnosis” comprise approximately 37% of the United States’ adult population. Of those 37%, 51% self-medicate to treat their mental health disorder (Harris & Edlund, 2005). “Prescribed medications play a key role in the treatment of co-occurring disorders. They can reduce symptoms and prevent relapses of a psychiatric disorder. Medications can also help patients minimize cravings and maintain abstinence from addictive substances” (Hazelden Foundation, 2016).

From purely a business standpoint, this initiative is beneficial to the organization because if relapse rates are lower it is something they can tout when promoting the organization. This would increase consumer engagement with the organization and increase its revenue. From a social standpoint, this initiative would benefit the patient ’s overall wellbeing and allow the organization to improve upon its core mission.

Project Outcomes

The adherence rate of the 10 patients over the eight weeks was an average of 85.8%. No one dropped out of the Quality Improvement Initiative. Each patient was given a \$100 Amazon gift card at the end of the study if they completed it.

Patient 1, had been diagnosed with Generalized Anxiety disorder, Seasonal Affective disorder, and Opiate Use disorder. They were prescribed 37.5 mg of Venlafaxine XR daily, 50

mg PO of Quetiapine XR Q6H PRN for anxiety, and 8 mg of Buprenorphine daily. They were 85% adherent.

Patient 2, had been diagnosed with Generalized Anxiety disorder, Social Anxiety disorder, and Opiate Use disorder. They were prescribed 50 mg of Sertraline once daily, 50 mg PO of Vistaril Q4H PRN for anxiety, and 100 mg of Methadone daily. There were 98% adherent.

Patient 3, had been diagnosed with Attention Deficit disorder, primary inattentive type, Social Anxiety disorder, and Opiate Use disorder. They were prescribed 20 mg of Paroxetine once daily, 25 mg PO of Hydroxyzine Q6H PRN for anxiety, and Atomoxetine 40 mg once daily. There were 100% adherent.

Patient 4, had been diagnosed with Major Depressive disorder, Generalized Anxiety disorder, and Alcohol and Opiate Use disorder. They were prescribed 50 mg of Sertraline once daily and 50 mg of Naltrexone once daily. They were 96% adherent.

Patient 5, had been diagnosed with Panic disorder and Opiate Use disorder. They were prescribed 15 mg of Buspirone three times daily and 50 mg PO of Quetiapine XR Q4H PRN for anxiety. They were 34% adherent.

Patient 6, had been diagnosed with Bipolar II disorder, Posttraumatic Stress disorder, Panic disorder, Insomnia and Alcohol use disorder. They were prescribed 200 mg of Lamotrigine twice a day, 30 mg of Buspirone twice daily, 30 mg of Vortioxetine daily, 450 mg of Bupropion XL daily, 50 mg of Naltrexone daily, 50 mg of Doxylamine daily, and 50 mg of Quetiapine XR Q4H PRN for anxiety. They were 78% adherent.

Patient 7, had been diagnosed with Posttraumatic Stress disorder, Insomnia, and Alcohol Use disorder. They were prescribed 50 mg of Paroxetine daily, 30 mg of Buspirone twice a day, 200 mg of Quetiapine once daily, and 50 mg of Naltrexone daily. They were 93% adherent.

Patient 8, had been diagnosed with Major Depressive disorder, Panic disorder, Insomnia, and Opiate Use disorder. They were prescribed 30 mg of Olanzapine once daily, 80 mg of Fluoxetine once daily, 0.1 mg of Clonidine three times a day, 0.1 mg PO of Clonidine Q12H PRN for anxiety, 380 mg IM of Naltrexone Q 28 days, and 15 mg of Mirtazapine once daily. They were 87% adherent.

Patient 9, had been diagnosed with Posttraumatic Stress disorder, Insomnia, and Alcohol Use disorder. They prescribed 30 mg of Busiprone twice a day, 200 mg of Sertraline daily, 150 mg of Bupropion XL daily, 50 mg of Naltrexone daily, and 30 mg of Melatonin daily. They were 100% adherent.

Patient 10, had been diagnosed with Major Depressive order, Generalized Anxiety disorder, Insomnia, and Opiate and Alcohol use disorder. They were prescribed 40 mg of Fluoxetine daily, 15 mg of Buspirone twice a day, 450 mg of Bupropion XL daily, 50 mg of Naltrexone daily, 666 mg of Acamprosate three times a day, and 100 mg of Quetiapine daily. They were 87% adherent.

There were seven responses in the “Medisafe” application to choose from when missing a dose of medication:

1. Medication isn't near me
2. Forgot/busy/asleep
3. Ran out of the medication
4. Don't need to take this dose
5. Side effects/other health concerns
6. Worried about the cost
7. Other

The number one reason people were non-adherent with a dosage of medication was “Forgot/busy/asleep”, as reported by 5 people. They went on to say that they did not have their smartphone next to them when they forgot to take the medication; otherwise, they would have been adherent. “Medication isn't near me” was reported by two people that were nonadherent. They said that they had left their medication at home when they were supposed to take a midday dose and did not have access to it because they were at work. The application would not have helped them in this situation. “Other” was reported by two people as well. No other responses were given for nonadherence.

Summary of Conclusion and Recommendations

Overall, this is a small sample that was given an incentive to complete the project. However, the nearly 86% adherence rate is significant. 6 out of the 10 participants said that they really liked the application because it "reminded me to take my medications regularly". 7 out of 10 said that they would continue to use the application now that the study was complete. The person with the 34% adherence rate reported that they were more adherent than before; however, they found the application "annoying" and turned off the notifications frequently.

Given that we have the technology to aid people in medication adherence via a smartphone application that is free of charge to the public, it should be promoted and marketed heavily.

In my organization, we will continue to encourage patients to download the application. While our patients are willing to allow me to track their adherence rates, the caveat is that I do it when I follow up with the patient; so, there is no additional cost to the organization if it is part of my follow up appointment. The problem with this is that I may only see a patient once every 4 to 6 weeks when they are stable, or once a week to once every two weeks if they are not stable. If

the patient is stable, then there is no reason for them to check in with me more frequently than every 4 to 6 weeks.

A concern I have is that if I see the patient and they are stable, I schedule them for a follow up appointment in 4 to 6 weeks. If they are non-adherent with their medication in 2 to 3 weeks and decompensate prior to the 4-to-6-week mark this creates a problem with tracking their adherence rates. The only way that this could be prevented is if they sent me their data daily or weekly and I were to go over it on my own time.

Hopefully, this could benefit patients that tend to be nonadherent with medication, like those that are court mandated to do so. Nevertheless, when tracking patients that are court mandated to take medication, they can get credit for taking their medication by acknowledging the alert without taking it because there is no one there to observe them. A remedy may be to use their smartphone camera along with the application.

This way, when they get an alert, they can acknowledge the reminder and then take a video of themselves with the pill in their hand and then put it in their mouth and lift their tongue to show that they are not “cheeking” the medication, meaning medication is placed into the mouth but not swallowed (Tamburello, 2015).

Overall, given the tremendous financial and emotional cost to those suffering with a mental illness, their families, and society at large, I think this study was worthwhile and yielded some positive results that should be investigated further.

Sustainability

This initiative would be sustainable if there is “buy in” from the patient, the organizational leadership, and the medication prescriber. It is not difficult, nor significantly time-consuming to download the application, a patient’s medication regimen and track their adherence

rates. The cost to sustain this certainly seems like a prudent investment for the organization on many levels, and minimal to one of its size.

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June 26, 2019

Robert B. Marsh
114 Alexandria Way
Basking Ridge, NJ 07920

Dear Mr. Marsh,

The IRB is in receipt of the application for your research entitled "Medication Adherence/Compliance Rates Using Electronic Monitoring via a Smartphone Application."

Your Application does not fall under the purview of the IRB because, as you describe it in your Application, it is a quality improvement, non-generalizable case study.

Sincerely,

A handwritten signature in cursive script that reads 'Mary F. Ruzicka, Ph.D.'.

Mary F. Ruzicka, Ph.D.
Professor
Director, Institutional Review Board

Cc: Dr. Mary Ellen Roberts