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Utilizing Digital Health Technologies to Promote Engagement in Behavioral Health Treatment Among Adults with Major Depressive Disorder

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Abstract

*Background***:** Major Depressive Disorder (MDD) is extremely common and is difficult to treat. Evidenced-based interventions, promising medications, and care provided by experienced clinicians can be ineffective when patients disengage from treatment. Within an outpatient behavioral health program, low engagement in treatment among adult patients diagnosed with MDD negatively affects patient outcomes while contributing to provider burden. The most promising intervention to increase patient engagement based on evidence and needs of the local site is utilizing digital health technologies (DHTs), such as an online or smart-phone application.

Methods: Telehealth treatment augmented with digital health technologies among adult patients diagnosed with MDD was implemented in an outpatient behavioral health program to increase patient engagement in behavioral health treatment, in order to improve patient outcomes and reduce provider burden.

*Intervention***:** DHTs were used to augment existing telehealth treatment to increase patient engagement for patients who met eligibility, based upon the DHT Guideline Algorithm. Providers and patients collaboratively selected a DHT application. Providers and patients were surveyed to assess feasibility, value added, and engagement with use of DHTs.

Results: A total of fifty-three patients screened eligible to participate in the project. Forty-seven percent of eligible patients (n=25) augmented telehealth treatment with DHTs. All of these patients remained engaged in treatment. The program disengagement rate reduced from pre to post implementation for both clinicians and prescribers. Patient Health Questionare-9 (PHQ-9) scores reduced by thirty-three percent and Generalized Anxiety Disorder-7 (GAD-7) scores reduced by forty-five percent. The patient satisfaction survey showed a majority of patients found DHTs to be feasible to use (n=15), adding value to their treatment (n=12), and enjoyable to use (n=14). The provider satisfaction survey showed that sixty percent of providers (n=3) found that DHTs added value to treatment and improved patient outcomes.

Conclusions: Implementation of telehealth treatment augmented with DHTs among adult patients diagnosed with MDD receiving care from an outpatient behavioral health program was effective in increasing patient engagement in treatment for the project site, while also showing improvement in patients' symptoms. Future work should explore provider training to increase confidence and competence with incorporating DHTs into practice.

Introduction

Problem Description

Major Depressive Disorder (MDD) is estimated to affect 8.4% of adults at least once in their lifetime (National Institute of Mental Health, 2022) and is difficult to treat due to the complexity of the disorder. It is further complicated by a patient's past medical history, co-occurring mental health diagnoses, and psychosocial factors. Evidenced-based interventions, promising medications and care provided by experienced clinicians can be ineffective when patients disengage from treatment (Zanjani et al., 2008). Patient engagement is defined as the "relationship between patients and healthcare providers as they work together to promote and support active patient and public involvement in health and healthcare to strengthen their influence on healthcare decisions" (Culter, 2011, p.10). Disengagement, also referred to as dropping out, or out of contact, is most often observed when patients do not attend a scheduled appointment or do not respond to outreach calls (O'Brien et al., 2009). This type of avoidance and lack of involvement in care can lead to negative outcomes such as increased hospitalizations or worsening symptoms for existing patients, extended wait-times for future patients, and provider burnout (AHRQ, 2017).

Currently, in many healthcare settings, patients utilize technology, known as interactive patient care systems or interactive patient technology (iPET). One example of this is patient portals, in which patients can access their health information, communicate with providers, and schedule appointments, promoting an active role in health care. Studies about the use of patient-centered Health Information Technology (HIT) systems utilized in outpatient settings have shown the potential of this technology to engage patients in treatment (Patmon et al., 2016).

In an interview, Dr. Karen Drenkard, former Chief Nurse at GetWellNetwork, a digital health company focused on patient and family engagement, reports that delivery of care has to focus on the needs, values, and preferences of the patient versus "medical establishment norms and routines" in order to promote accessibility to treatment (Reid-Ponte, 2018, p. 62). With the rapid shift to telemedicine (known as "going virtual") since the COVID-19 pandemic, there is an opportunity to implement other types of technology to augment telehealth treatments in order to engage patients by meeting their specific needs.

Local Problem

Within an outpatient behavioral health integrated collaborative-care model, patients are referred from their primary care or specialty providers for behavioral health treatment. Collaborative care programs are designed to deliver quick-access behavioral health treatment, providing short-term psychotherapy, and psychopharmacologic management. One of the most important quality measures tracked is the length of time from when the referral is received to when an appointment is scheduled. If a patient misses their scheduled appointment (i.e., they disengage from care), they forgo a valuable slot. Patient disengagement also lengthens access to care and wait-times for engaged patients in need of services and treatment. To maintain continuity of care and for safety reasons, providers must dedicate valuable time away from existing patients to focus on outreach and collaboration with referring providers.

Local program data shows up to 15% of patients do not respond to outreach after being referred from their primary care or specialty provider. For existing patients who have been seen at least once, the disengagement rate can be as high as 25%, based upon an appointment no-show or no response to outreach, which varies according to setting. In this setting, a patient is defined as disengaged two-weeks after an unable-to-reach letter is sent. This letter is sent following two

outreach calls with no response. These metrics are comparable to other outpatient mental health settings prevalence of drop out, measured by no-show rates, examined in a literature review by O'Brien et. al (2009). Also noted in this literature review was, those who disengage are more likely to have unmet needs than those active in care, leading to a higher rate of hospital readmissions and negative treatment outcomes.

Disengagement is related to access barriers, including stigma associated with seeking care (Ben-Zeev et al., 2018) and transportation expenses, scheduling, and costs from time off from work (Mohr et al., 2012). Severity of depressive symptoms including worsening mood, loss of interest, lack of motivation, or low energy, can also increase disengagement rates. Unfortunately, this is when patients most need treatment. Other contributing factors include concurrent mental health diagnoses including psychotic or personality disorders, symptom improvement, and unmet needs of care (O'Brien, 2009).

In March 2020, the outpatient behavioral health program, similar to other outpatient behavioral health practices, transitioned from in-person to telehealth treatment due to social distancing and safety measures brought on by the COVID-19 Pandemic. Telehealth has increased access and the opportunity to receive behavioral health care. Increased psychosocial stressors and pandemic fatigue are contributing factors to increased referrals to the program. Even prior to COVID-19, telehealth has been studied and shown to be comparable to in-person behavioral health services both clinically and with regard to therapeutic alliance (Ben-Zeev et al, 2018). The use of telehealth has led to a reduction in no-shows, although patients are still disengaging from care.

In April 2023, the outpatient behavioral health team was introduced to the M-Health Index and Navigation Database (Mindapp.org website) digital health technology application

library. Digital health technologies include smartphone and online applications, which can be used to enhance treatment by providing psychoeducation, psychotherapy resources, and self-monitoring. In June 2023, with the change in mask restrictions and hospital policies, the outpatient behavioral health program began to resume in-person follow up appointments. All intake appointments continued to be scheduled via telehealth. Most patients preferred to continue telehealth treatment due to accessibility and convenience.

Available Knowledge

A PRISMA-guided systematic review of the literature was completed to examine the most effective interventions used to increase engagement for adult patients over the age of 18 diagnosed with Major Depressive Disorder. The electronic databases used were CINAHL, PubMed, OVID, and PsychARTICLES. The keywords searched included “major depressive disorder” and “patient engagement.” Inclusion criteria included studies with adults, in English and full text.

Due to limited evidence specific for Major Depressive Disorder, a hand search of references was also completed which yielded several other articles. The majority of relevant research regarding patient engagement focused on chronic illnesses such as diabetes, cardiovascular disease/ hypertension, respiratory illnesses, and cancer. Several themes to promote engagement for chronic illnesses were identified, including: shared decision making, patient activation, family engagement, and patient literacy. Reported interventions included: implementing the use of nurse/case managers, community health worker/ patient navigator, peer support, team-based care, and telehealth/ digital health technologies (Aboumatar et al., 2022).

Based on discussions with the local leadership team, the local site determined that a digital health technology would be the preferred strategy. Supplementary hand searches were

conducted which resulted in additional articles focused on digital technologies. Ultimately, 13 articles were chosen for the evidence table. The research design of the studies included experimental, randomized controlled trials (n= 7), mixed-methods (n=2), quasi-experimental (n=2), and qualitative (n= 2) studies (Appendix A). The John Hopkins Tool (Dang et al., 2018) was used to rate the level of scientific research, evaluate the level of evidence and appraise the quality of the studies. There were a total of 2,629 diverse, adult participants over the age of 18. The studies were conducted in outpatient settings and carried out in the United States, Denmark and other parts of Europe.

As shown in Appendix B, the literature evidences multiple types of digital health technologies as potential strategies to enhance patient engagement, including telehealth (internet/ telephonic) delivered cognitive behavioral therapy (CBT) treatment, electronic screening tools, smartphone/ online applications, online support groups, and a telephone referral system.

Two studies examined the use of digital applications. McCue et al. (2022) found that the use of applications improved engagement in treatment and clinical outcomes when compared to standard care. Chang et al. (2023) augmented CBT telehealth treatment with a digital application. Although engagement measures did not improve, researchers did identify that this hybrid model was feasible and that applications should be used as augmenting tools versus monotreatment or stand-alone devices.

Three studies examined the use of internet-delivered treatment /cognitive behavioral therapy, which showed improvement in engagement measured by adherence while clinical outcomes were the same, if not better, than standard care (Rollman et al., 2018; Schuster et al, 2019; Wilson et al, 2018). Three studies compared telehealth to in-person treatment (Ben-Zeev et al., 2018; Ruskin et al., 2004; Zimmerman et al., 2023). All of the studies showed increased

engagement, measured by attendance, active involvement in activities, and comparable clinical outcomes to in-person treatment. Mohr et al. (2013) studied the use of a telephone-delivered cognitive behavioral therapy. Significantly fewer participants discontinued telephone-cognitive behavioral therapy compared with face-to-face cognitive behavioral therapy. Zanjanji et al. (2008) studied the use of a telephone referral management program which showed that patients who received the intervention were more likely to attend their scheduled psychiatric appointments compared to the usual care group.

One study obtained feedback from nine primary care providers regarding the use of an electronic depression screening tool (Krog et al., 2018). Responses showed that the electronic tool can increase patient engagement due to flexibility and can improve services for patients. Guinart et al. (2021) surveyed mental health clinicians and identified a reduction of no-shows as a potential advantage of telehealth. Topocco et al. (2017) identified potential disadvantages of telehealth to include the potential negative impact on therapeutic alliance, clinical effect, and patient commitment.

The literature review also included eight non-research articles consisting of expert opinions and clinical guidelines which contained high-quality level of evidence, based upon John's Hopkins Nursing Evidence-Based Practice guidelines, to compliment and support the information obtained from research articles (Dang et al., 2018). The non-research articles provided in-depth information about patient engagement including definitions, strategies, facilitating factors, barriers, and measurement instruments.

The most promising intervention based on the evidence and on the needs of the local site was the use of digital health technologies, such as an online or smart-phone application, to increase patient engagement. DHTs include telehealth, smartphone applications, social media,

artificial intelligence and wearable devices (Torous et al., 2021). Given that the site was already using telehealth, this project focused on incorporating the use of a digital application (known as an m-health application) selected from a behavioral health database called M-Health Index and Navigation Database (Mindapps.org). Research suggests that digital health technologies can enhance engagement by meeting patients' specific needs, requirements, and interests (Chang et al., 2023).

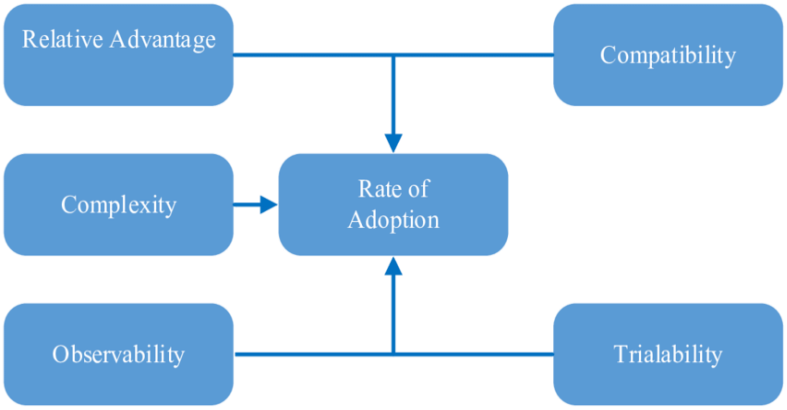
Rationale

There were two theories mentioned in the literature that informs the proposed intervention. One is Bandura's Theory of Self-Efficacy, which was mentioned in the study by Wilson et al. (2018) when measuring engagement with the Self-Efficacy Scale. The second theory is the Behavior Change Wheel mentioned by Krog et al. (2018), which will also guide the intervention. No other underlying theories emerged from the literature review.

The Theory of Self-Efficacy recognizes the behaviors necessary to influence outcomes patients are hoping to achieve (Bandura, 1977). The theory considers the effort individuals put forth in their lives, intrinsic motivating factors, and control they have over themselves. Patients with poor self-efficacy, lacking motivation, and self- activation would be more likely to engage in avoidance behaviors and disengage from treatment (Bandura, 1977). The Behavior Change Wheel identifies motivational factors working against the behavior and interventions used to change behavior including capability, behavior, and motivation (Michie et al., 2011).

The change theory that informs this implementation is The Diffusion of Innovation (DOI) Theory which can accelerate the adoption of new types of treatment such as digital health technologies versus standard traditional care, outlined in Figure 1. This model will help to identify factors that will assist this population to adopt this type of treatment and the rate of adoption (Rogers, 2003).

Figure 1. **Diffusion of Innovation Theory**



Source: Adapted from Rogers 1995

Assumptions used to design the intervention include a willingness by patients and providers to incorporate DHTS with treatment. Additionally, there is an assumption that behavioral health providers have the goal to increase patient engagement in order to improve outcomes. The population of adult patients diagnosed with MDD are targeted with the intervention due to the large volume of patients with this diagnosis treated in the setting and the vast number of DHT applications available from the M-Health Index and Navigation Database (Mindapp.org website) geared toward treating depression.

Patients who are active in treatment at the outpatient behavioral health program have access to the intervention due to the fact they are already receiving telehealth through a smartphone/mobile or computer device. This also assumes that the patient has some level of digital literacy, making them capable of utilizing the intervention. Lastly, the proposed intervention strives to answer the PICO question regarding whether digital health technologies increase patient engagement in treatment.

The intervention is expected to work due to previously mentioned theoretical concepts, frameworks, the literature review outlined above, and attached appendices. Digital health technologies allow this specific population with unique treatment needs, to access patient-centered care, treatment, and resources in their homes based upon their schedules, free of stigma, and with reduced costs (Mohr et al., 2012). Technology provides patients with the autonomy and empowerment necessary to promote engagement in their healthcare decisions and treatment in order to improve outcomes.

Specific Aims

The purpose of this project is to increase patient engagement in behavioral health treatment in order to improve patient outcomes and reduce provider burden. The aim is to augment existing telehealth treatment with digital health technologies. The overarching aim of this quality improvement project is to develop, implement, and evaluate the implementation of telehealth treatment augmented with digital health technologies among adult patients 18 years and older diagnosed with Major Depressive Disorder receiving care from an outpatient behavioral health program.

The objectives of the project include:

- Convene the stakeholders, leadership and clinicians to develop the program and process.
- 20% of patients in the BH program who meet eligibility criteria based upon the DHT Guideline Algorithm will participate.
- Of patients selected to use a smartphone/ online DHT, 50% will be engaged and active in treatment, measured by participation/utilization of smartphone applications and appointment attendance.
- Post-implementation engagement rates will be higher than pre-implementation

engagement rates.

- Of patients selected to use DHTs, PHQ-9 and GAD-7 scores will reduce by 5% from intake to discharge.
- 85% of behavioral health providers will attend a digital health technology training.
- 85% of patients will find the use of digital health technologies to be helpful and adding value to their treatment.
- 85 % of behavioral health providers will perceive augmentation of digital health technologies to be feasible, adding value, and improving patient engagement in treatment.

Methods

Context

The setting for this project was an outpatient hospital behavioral health integrated program, which is a part of a of a larger hospital health system in Massachusetts. This hospital serves over 250,000 residents and visitors across Plymouth and Barnstable counties. In 2022, there were 1,523 patients referred to the behavioral health program, 6,640 appointments were scheduled, and 5,626 patients were seen for care. As noted above, the program provides treatment to patients who are referred from their primary care or specialty providers within network for behavioral health treatment, which includes short-term psychotherapy and psychopharmacologic management.

This microsystem has many positive characteristics that contributed to the successful implementation of the intervention (Appendix C). In this setting, there was a transformational leadership style which fostered growth, learning, and collective goals. There were also available resources and time for education and training, which was necessary for implementing new tools

such as digital technologies. In March 2023, the program partnered with the Digital Psychiatry Division at the main hospital within the health system, which expanded support for innovative quality improvement. Additionally, the program was extremely patient-focused, constantly seeking ways to improve care delivery, patient outcomes, and satisfaction. Tracking performance results and productivity measures are completed regularly and reviewed quarterly. This monitoring allows the program to make changes necessary to provide optimal care for the providers, patients, and community served.

It is necessary to also consider factors that potentially restrict patient engagement. A cause-and-effect diagram (Appendix D) shows barriers to patient engagement for adults diagnosed with MDD, which prompted the need for this quality improvement project. It is important to consider a patient's intrinsic motivating factors, fears of stigma, symptom severity, and response to treatment. Online or mobile-delivered treatment interventions that are engaging and anonymous can reduce social barriers and the potential risk of stigmatization (Schuster, 2019).

Accessibility, lack of transportation and inability to take time off from work are also barriers to patient engagement in treatment. Digital health technologies allow patients to access care in their homes based upon their schedules. With busy schedules, it can be challenging for collaboration and communication between providers, family members, and caregivers. Telehealth can allow others to join in on appointments from different geographic locations and healthcare centers. "Technology is at the forefront of patient and family engagement" (Reid-Ponte, 2018,p. 61), although it does pose potential barriers. Connectivity issues, digital literacy, and access to technology can affect care delivery. In this setting, one benefit is that telehealth

was already being implemented, indicating this population already had access and skills to use technology and may be receptive to additional technology to augment treatment.

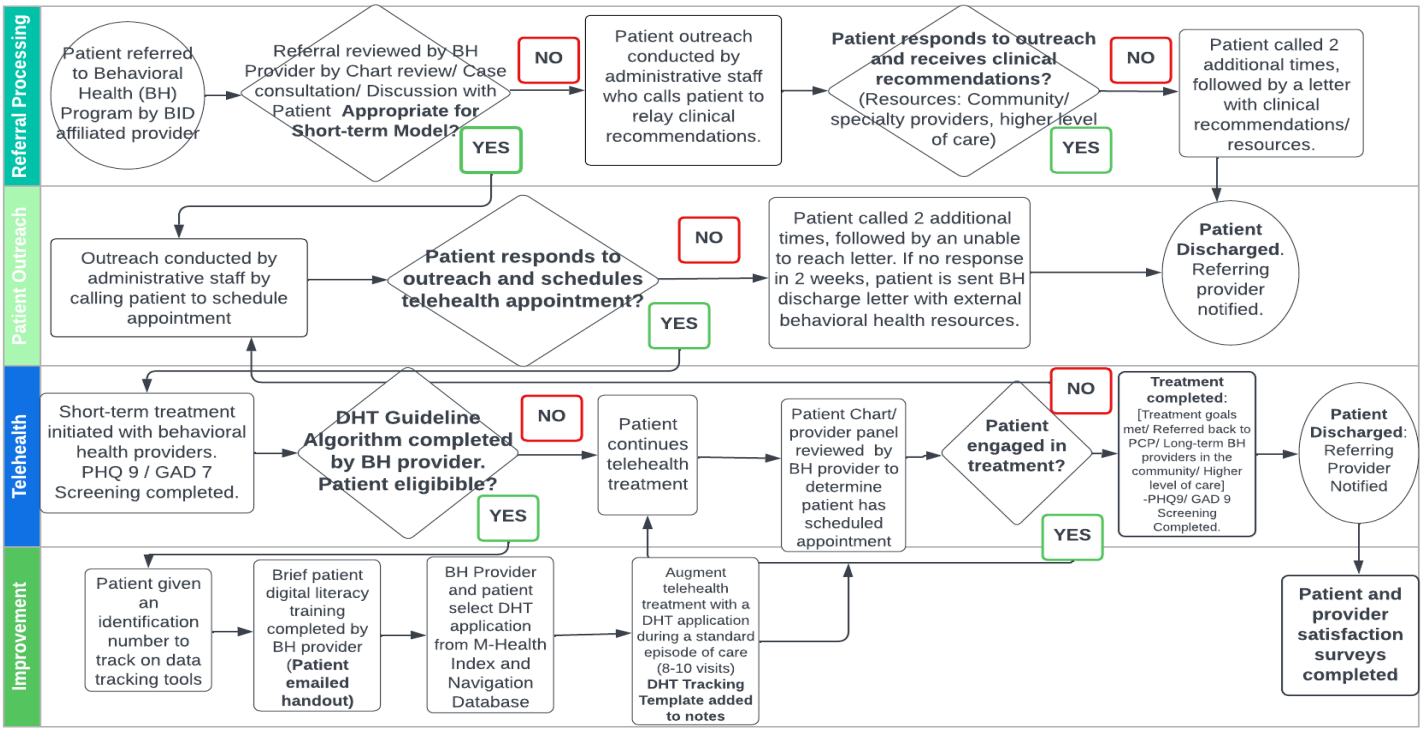
The review of a force field analysis (Appendix E) highlights driving and restraining forces that could affect the ability to augment telehealth treatment with digital health technologies (DHTS) within the proposed setting. Driving forces include: digital health technologies complementing existing telehealth treatment, leadership support, staff willingness, accessibility, patient approval, and the need for additional treatment tools since transitioning to telehealth. Restraining forces include: interoperability/ inability to merge information from digital health technologies to electronic health systems, staff training, fear of change, patient and providers digital literacy, and learning about specific digital health technologies or applications from the M-Health Index and Navigation Database (Mindapp.org website).

Intervention

This quality improvement project implemented digital health technologies (DHTs), specifically an online or smartphone application to augment existing telehealth treatment to increase patient engagement in treatment. The intervention/ improvement flow diagram (Figure

2) outlines the process of the project including four sections: referral processing, patient outreach, telehealth and improvement.

Figure 2. Intervention Flow Diagram

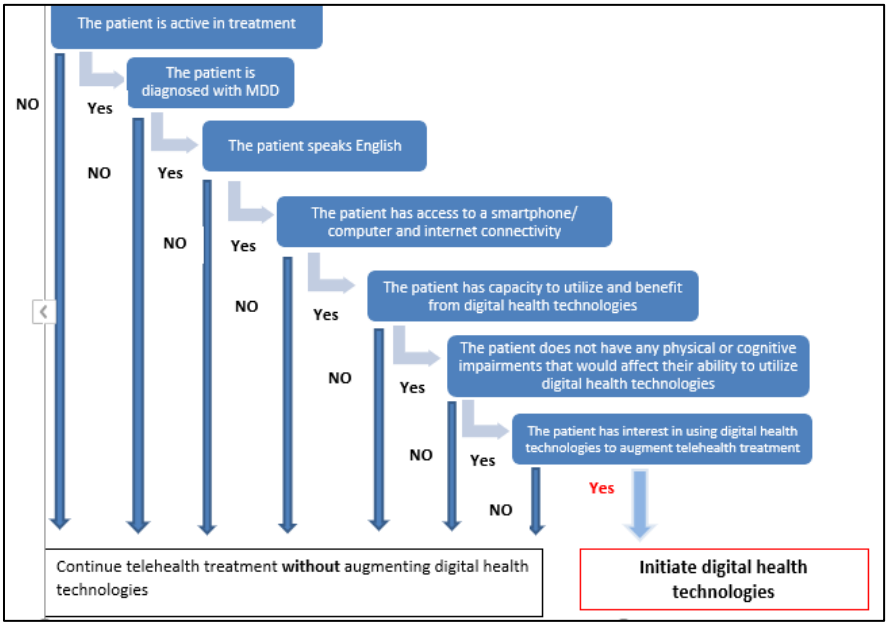


As detailed above, a literature review was conducted to obtain information about the most effective strategies to increase engagement in treatment. During the pre-planning phase of the project the purpose of increasing engagement in behavioral health treatment was identified and the site decided to focus on digital health technologies. The behavioral health team and hospital leadership were named as stakeholders and roles were defined. A timeline of incorporating screening for eligibility, training, implementation with existing telehealth, and workflow was completed. Capacity at the site was assessed and the stakeholders agreed it would be feasible.

In the planning phase of the project, the problem of low engagement and the impact this has on patients and providers was recognized. Goals and interventions to increase engagement were identified from the literature review, which included utilizing DHTs. At the local site, the purpose of utilizing an online or smartphone application DHT is to compliment treatment by

providing additional resources, therapeutic tools, psychoeducation, and self-monitoring for patients. In standard care, patients would often be provided with handouts or resources, which is not possible via telehealth.

Figure 3. DHT Guideline Algorithm

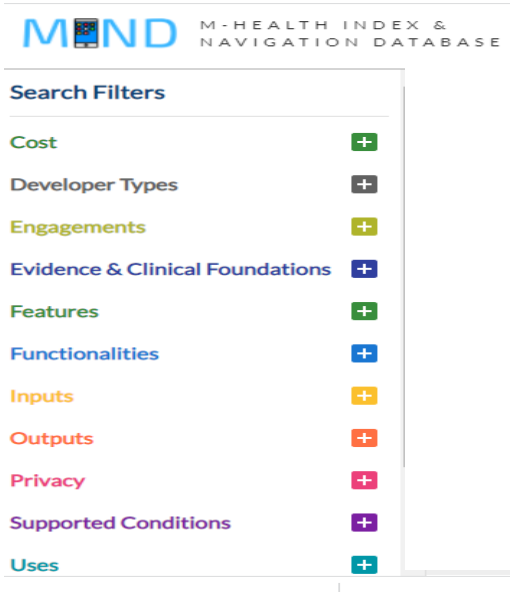


In the Fall of 2023, implementation of DHTs were utilized by patients who met eligibility and were interested in participating based upon the DHT Guideline Algorithm (Figure 3), which was created for this project. It was administered by behavioral health providers to all patients in the behavioral health program diagnosed with Major Depressive Disorder. Eligible patients were trained by their provider on digital literacy and how to use the application they selected. Providers and patients collaboratively selected an application based upon the patient's specific needs and goals, from either provider recommendations or from the M-Health Index and Navigation Database (Mindapps.org).

Mindapps.org database is a free, FDA regulated, mental health database that includes over 500 searchable applications. The database is informed by 105 objective questions from the American Psychiatric Association's App Evaluation Model and is focused on five main categories including: accessibility, privacy and security, clinical foundation, engagement style, and data sharing/interoperability. Applications were suggested based upon the patient's technology (IOS, Android, web), cost (free, subscription, or cost associated with download),

diagnosis, therapeutic goals and recommended treatment plan. Search filters to enable customization are also available (Figure 4).

Figure 4. Search Filters



Utilization of the selected application augmented a telehealth standard episode of care, which is approximately 8-10 visits. The intervention was implemented by behavioral health team providers including: a psychiatrist, psychiatric nurse practitioner, and three licensed independent clinical social workers. A DHT Application Treatment Tracker was created for this project and was used in patient's charts/ electronic medical records to document the application selected, clinical focus, and use during treatment.

The outcome of the intervention affected patients by improving their engagement in treatment. Engagement was measured by appointment no show rates and attendance. Activity and use of the application was tracked from patient report. The benefit of using a digital health technology *application* intervention was that it provided "on demand" access to evidence-based resources for the patient, family member, caregiver, and provider (Torous et al., 2021).

After the intervention was completed, results from program metrics (showing patient engagement), pre/post GAD-7 and PHQ-9 screening scores, and satisfaction surveys were analyzed to determine if the intervention was successful.

Evaluation of the Intervention

The Plan-Do-Study-Act (PDSA) framework guided the plan, implementation and evaluation of the intervention (Langley, 2009). During the "plan" stage of the project, the goal of increasing patient engagement in behavioral health treatment in order to improve patient

outcomes and reduce provider burden was determined. Stakeholders were convened and identified for their investment and contribution to the project. They agreed on the appropriateness of the site, in addition to the potential benefits for patients and providers which guided the development of the project. During the "do" stage of the project, a digital literacy training was conducted for behavioral health providers to provide education about the project and the Mindapps.org database. Following the provider training, the intervention of augmenting telehealth with DHTs was deployed. To "study" the effectiveness of the intervention, compare predictions, and to analyze the effects, satisfaction surveys and data analysis were completed. Biweekly chart reviews were conducted for patients to evaluate DHT participation (based upon DHT treatment tracker in notes), treatment engagement, and PHQ9/ GAD 7 scores. Data was recorded on a data tracking tool (Appendix H). The results from the data and qualitative analysis provided insights for the "act" stage of the project. Insights and observations from the findings guided project decision making regarding what was successful and/or what needs to be adjusted.

A logic model (Appendix F) shows the framework for measuring the interventions objectives and success. Beginning with available resources within the site, activities can be facilitated to complete the intervention in order to achieve the intended goal. For the intervention in this project to be successful, necessary resources include patient access to technology and digital literacy. Additionally, the model shows the relationship between planned activities, outputs and outcomes or intended results, while considering assumptions and contextual factors. Short-term, intermediate and long-term outcomes (ranging from 4-12 weeks) include: patient digital literacy training, utilization of the intervention, provider and patient satisfaction surveys, and PHQ-9 and GAD-7 screening results.

Measurement and Analysis

The Standards for Quality Improvement Reporting Excellence (Squire) 2.0 Guidelines (Stevens et al, 2015) were used to assist in the descriptive reporting of the project and specific aims. The following measures were tracked during the implementation phase of this quality improvement project (Figure 5). There were eight specific aims for this project.

Figure 5. Simplified Measures Table

Aims	How to Measure
1. Convene the stakeholders, leadership and clinicians to develop the program and process	Stakeholders buy-in obtained per feedback and meeting meetings. Process developed and deployed to behavioral health program for eligible patients.
2. Of patients selected to use DHTs, 50% will be engaged and active in treatment	Patient engaged in treatment (has appt scheduled and attends appointments) Patient actively utilizes applications (tracked on applications) and per patient report
3. Post-implementation engagement rates will be higher than pre-implementation engagement rates.	Attendance of BH appointments Patient has appointment scheduled Patients respond to outreach
4. 20% of patients in the BH program who meet eligibility criteria will participate.	Eligibility criteria will be determined by all patients with MDD will be screened using the DHT Guideline Algorithm in order to be selected to utilize DHTS.
5. Of patients selected to use DHTs, PHQ 9 and GAD 7 Scores will reduce by 5%	BH Provider administers PHQ9 (9-item Likert Depression Screening tool)/ GAD 7 (7-Item Likert Anxiety Screening Tool
6. 85% of behavioral health providers will attend a digital health technology training dedicated to navigating the behavioral health smartphone application database Mindapps.org, how to screen patients for capacity/ ability to use DHTS using the DHT Guideline Algorithm, how to complete patient digital literacy training.	Staff participation in training
7. 85% of patients found the use of digital health technologies to be feasible and adding value to their treatment	Measuring if DHTS were user-friendly, cost-effective, informative, helped to meet treatment goals and reduce symptoms
8. 85 % of behavioral health providers perceive augmentation of digital health technologies to be feasible, adding value and improving patient engagement in treatment.	Measuring if DHTS were user-friendly, informative, helped patients meet their treatment goals and reduce symptoms

Specific aim 1: *Convene the stakeholders, leadership and clinicians to develop the program and process.* To initiate a successful quality improvement project, it is necessary to obtain support from stakeholders. The outputs for this aim include program, process, and work-flow development to augment existing telehealth treatment with DHTS (selected from Mindapps.org database) during a standard episode of care (8-10 visits). This was completed during behavioral health team meetings which includes stakeholders, leadership and clinicians. In addition to meeting minutes, feedback was documented for qualitative analysis. This qualitative feedback instrument tracked meeting dates, attendees, and meeting minutes (Appendix I).

Specific aim 2: *20% of patients in the BH program who meet eligibility criteria based upon the DHT Guideline Algorithm will participate.* In order to select patients for the intervention, patients were screened for eligibility using the DHT Guideline Algorithm which was created for the project. Patients who met eligibility were given an identification number, emailed a Patient DHT Handout with information about digital literacy, and tracked on a project data tracking tool. Frequency and proportions measured the percentage of patients receiving the intervention.

Specific aim 3: *Of patients selected to use DHTs, 50% will be engaged and active in treatment.* The output for this aim was measured by patients' appointment attendance, response to outreach, and utilization of the DHT. Patient attendance was monitored by reviewing patient charts and provider panels. This information was recorded on project data tracking tools, Information about activity and utilization of the DHTs was obtained from patient report of how often they are using the DHTs. Frequency, proportions, and change in percentage of engagement and activity analyzed the outcomes of this aim.

Provider panels are lists of patients who are active in treatment with each behavioral health provider and are pulled from the patient registry. A patient registry is a term used by collaborative care models (CoCM), which is a list that tracks patients when they are referred. Once a patient is referred to the program, they are added to the patient registry. The registry includes patient name, date of birth, insurance, referring provider/ practice, date of referral, referral outcome, intake/ discharge date, providers seen, intake/ discharge PHQ-9/GAD-7 scores, and treatment outcomes.

Specific aim 4: *Post-implementation engagement rates will be higher than pre-implementation engagement rates.* The output for this aim was measured by the frequency and proportions of patient no shows/ attendance of appointments and the change in percentage from pre-implementation to post implementation. The data was obtained from patients' charts, provider panels, and the patient registry which was added to the project data tracking tool.

Specific aim 5: *Of patients selected to use DHTs, PHQ-9 and GAD-7 scores will reduce by 5% from intake to discharge*. The Patient-Health Questionnaire-9 (PHQ-9) is a 9-item Likert screening tool that assesses depression severity, with scoring ranging from 0-27 (1=mild, 27=severe). The General Anxiety Disorder-7 is a 7-Item Likert screening tool that assesses anxiety severity, scoring ranging from 0-21 (0=mild, 21=severe). These screening tools were completed by the behavioral health providers at intake and discharge from the behavioral health program. This data was obtained from patient charts and patient registry and was added to the project data tracking tool. In order to measure the output, a mean score was obtained comparing the average scores from intake and discharge screenings. The change in percentage of improvement was also calculated.

Specific aim 6: *85% of behavioral health providers will attend a digital health technology training.* In order for behavioral health providers to implement the intervention, it was necessary that they were trained on DHTS, including how to use the M-Health Index and Navigation Database (Mindapp.org website) and how to provide a brief digital literacy training to patients. The training was completed during a team meeting to review digital health technology concepts, technology utilization, and navigation of the Mindapps.org database. This outcome was measured by an attendance log. Additional feedback regarding provider proficiency was obtained from a debriefing, during which providers discussed knowledge learned, competency, concerns, and were able to ask questions.

Specific aim 7: *85% of patients found the use of digital health technologies to be helpful and adding value to their treatment.* A 5-point Likert satisfaction survey measured the output of this aim.

The patient satisfaction survey included six questions:

1. It was easy to use the Mindapps.org database to select a DHT application?
2. It was easy to use the DHT application I selected?
3. DHT applications complemented and added value to my treatment?
4. Using DHT applications helped me accomplish my treatment goals?
5. I had concerns about my privacy when using DHTs?
6. DHTs were enjoyable and interesting to use?

On this survey, strongly agree (5) and agree (4) were considered as yes. Additional opinions and feedback were obtained from a free text area, which underwent a qualitative analysis.

Specific aim 8: *85 % of behavioral health providers perceive augmentation of digital health technologies to be feasible, adding value and improving patient engagement in treatment*. A 5-point Likert satisfaction survey measured the output of this aim.

The survey included 5 questions:

1. It was easy to navigate the Mindapps.org database to select a DHT application for my patients?
2. DHT applications complemented and added value to existing telehealth treatment?
3. Utilizing DHT applications improved patient outcomes?
4. It was easy to integrate the implementation of DHTs into existing workflow?
5. Augmenting DHTs with telehealth increased patient engaged in treatment?

On this survey, strongly agree (5) and agree (4) were considered as yes. Additional opinions and feedback were obtained from a free text area, which underwent qualitative analysis.

Ethical Considerations

Ethical considerations regarding telehealth that have been considered and addressed when patients begin treatment with the outpatient behavioral health program include: data protection and storage, cybersecurity, patient privacy, patient location, and informed consent. See Figure 6 for the template included in patient charts for each visit. When patients initiate treatment with the program they are made aware that treatment is now provided both telehealth and in-person. Telehealth is recommended at least for intake, although exceptions can be made for in-person appointments if they do not have access to technology or due to preference. Patients who are active in treatment have access to technology initially, although inequitable access to care and

technology may change throughout treatment. For the project, verbal consent was obtained from participants who were interested in using DHTs. Participation was voluntary and there was no penalty, change in treatment or care for patients who declined to participate. Participants were given an ID number for data tracking (Appendix H). Protected health information was not shared and both The Health Insurance Portability and Accountability Act (HIPPA) and hospital compliance policies were enforced. There was no ethics review, form, or approval required for the specific site.

Figure 6. **Telehealth Consent Template**

Consent	I introduced and identified myself. I received verbal/written consent to proceed with this encounter.
Telehealth Platform	This encounter was via Doximity video/ audio
Identify	I verified patient's name and date of birth. I verified the patient's current insurance.
Patient's Location	Home/ Work in MA
Provider's Location	Home/ Office/Clinic in MA
Confidentiality	I made the patient aware that the same confidentiality and security practices apply as an in-person visit.

The Clinical Quality Improvement Checklist (Appendix J) determines this project is quality improvement and does not meet the definition of human subjects' research because it is not designed to generate generalizable findings but rather to find immediate and continuous improvement feedback in the local setting in which the project is carried out. The University of Massachusetts Boston IRB has determined that quality improvement projects do not need to be reviewed by the IRB.

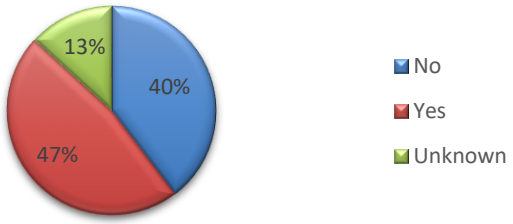
Results

The first aim of the project was to *Convene the stakeholders, leadership and clinicians to develop the program and process*. Throughout all phases of the project, hospital leadership,

stakeholders and behavioral health team members were convened and consulted, demonstrating success with this aim (Appendix I).

The second aim was *20% of patients in the BH program who meet eligibility criteria based upon the DHT Guideline Algorithm will participate.* Achievement with the second aim was completed with a participation rate of 47% (n= 25) among patients who met eligibility (n=53).

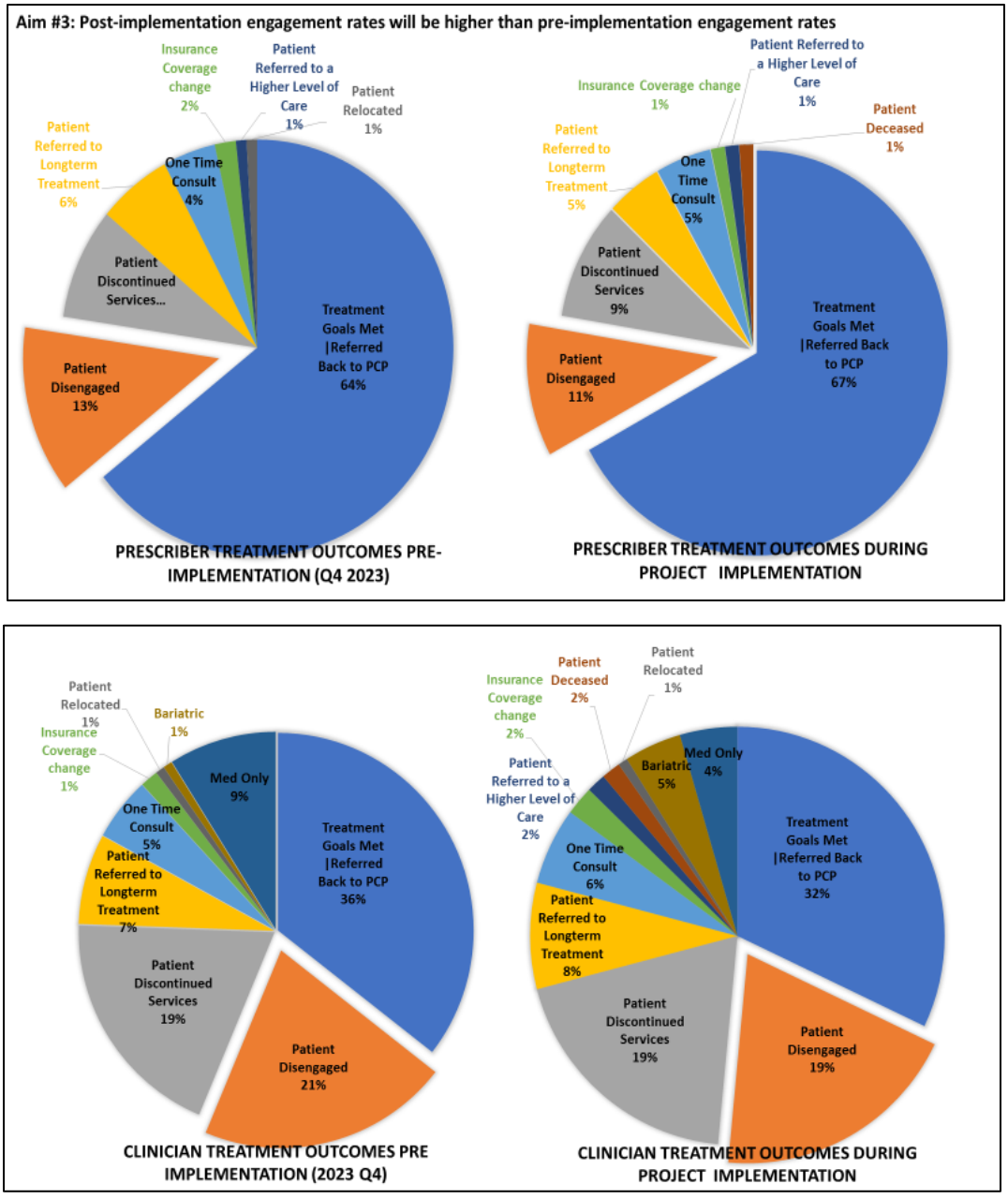
Figure 8. Participation Rate



The third aim was *of patients selected to use DHTs, 50% will be engaged and active in treatment.* This aim was met due to 100% of patients who implemented DHTs remained engaged and active in treatment. Among patients who were eligible to participate but did not implement DHTs, 98% remained engaged and active in treatment.

The fourth aim was that *Post-implementation engagement rates will be higher than pre-implementation engagement rates.* Success with the fourth aim was shown by a reduction in the disengagement rate from pre to post project implementation for both clinicians and prescribers. During pre-implementation, the percentage of patients who disengaged during treatment with prescribers was 13% and 21% with clinicians. During post implementation, the percentage of patients who disengaged during treatment with prescribers was 11% and 19% with clinicians. This is a 15% decrease in the disengagement rate in treatment with prescribers and 10% decrease in disengagement rate in treatment with clinicians (see figure 7). To reach this measure, the disengagement rate from quarter four of 2023 was compared to the disengagement rate during the implementation phase of the project.

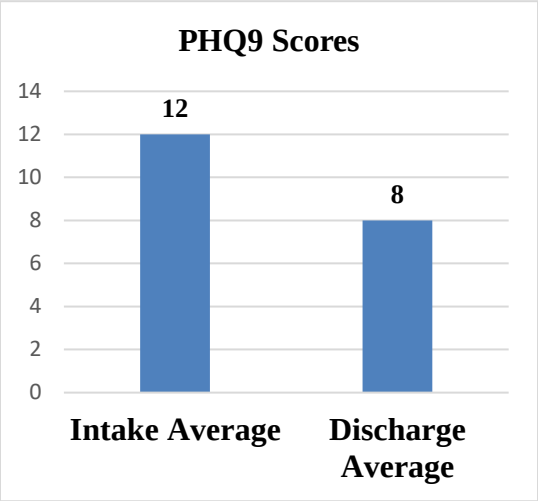
Figure 7. Disengagement Rates

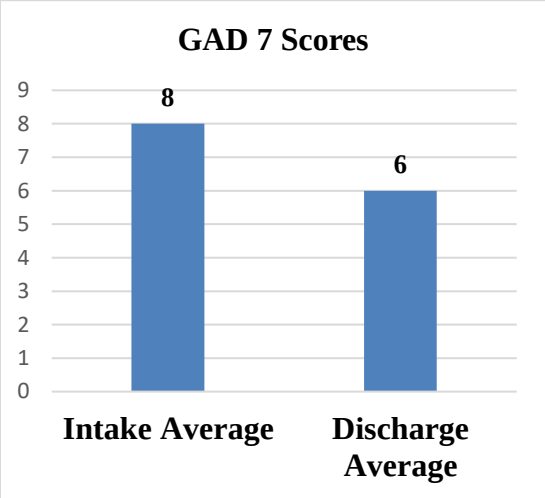


The fifth project aim was *of patients selected to use DHTs, PHQ-9 and GAD-7 scores will reduce by 5% from intake to discharge*. This aim was achieved by patients who utilized DHTs showing improvement in both PHQ-9 and GAD-7 scores. The average PHQ-9 scores reduced by

33% from intake to discharge. The average GAD-7 scores reduced by 45% from intake to discharge.

Figure 9. Screening Tool Scores





The sixth aim was *85% of behavioral health providers will attend a digital health technology training*. This aim was accomplished by 100% of behavioral health providers attending the digital health technology training.

The seventh aim was *85% of patients found the use of digital health technologies to be helpful and adding value to their treatment.* Patients who implemented DHTs were surveyed to assess feasibility and value of DHTs using a 5-point Likert satisfaction survey. On the survey, strongly agree (5) and agree (4) were considered as yes. Of the twenty-five patients who participated, 16 patients responded, which was a 64% response rate. Of patients surveyed, 25% used the Mindapps.org database and found it easy to use. Approximately 94% of patients found the application they selected easy to use. In the survey, 75% of patients expressed that the application added value to their treatment. The majority of patients (88%) found DHTs to be enjoyable and interesting to use. No patients had concerns about privacy when using DHTs.

One patient reported, “DHTs helped to reduce time spent on social media.” Another patient commented that “the mood tracker provided information/ resources they would not regularly be exposed to.”

The eighth aim was *85 % of behavioral health providers perceive augmentation of digital health technologies to be feasible, adding value and improving patient engagement in treatment.* Providers were also surveyed using a 5-point Likert satisfaction survey to assess DHTs adding value, improving patient outcomes and increasing patient engagement in treatment. The response rate was 100% among providers. On the survey, strongly agree (5) and agree (4) were considered as yes.

Of providers surveyed, 40% felt that it was easy to implement DHTs into current work flow. More than half of providers (60 %) felt that it was easy to navigate the mindapps.org database and that DHTS complemented, added value to telehealth treatment, and improved patient outcomes. A majority of behavioral health providers (80%) believed that DHTs increased patient engagement in treatment. Providers commented that “DHT’s have great potential and are effective.” One provider commented, “reminders and additional time are needed to incorporate into workflow/ practice.”

In the free text section, one provider commented that “they were not consistent in using the intervention, so it was difficult to assess.” Another provider wrote, “they saw potential benefit in DHTs and wish they incorporated them more into practice.”

Discussion

Summary

The purpose of this project was to increase patient engagement in behavioral health treatment in order to improve patient outcomes and reduce provider burden. The overarching aim

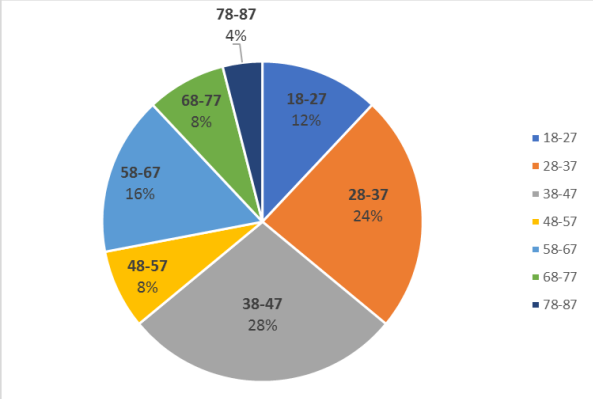
of this quality improvement project was to develop, implement, and evaluate the implementation of telehealth treatment augmented with digital health technologies among adult patients 18 years and older diagnosed with Major Depressive Disorder receiving care from an outpatient behavioral health program.

The project was successfully implemented for eligible participants from December 2023 through April 2024. This project was applicable for the site due to the existing operation of telehealth services, digital literacy, and partnership with the Digital Clinic at BIDMC. Providers had a need for additional psychoeducational tools and resources to provide for patients seen via telehealth. Patients within the program had access to technology and previous digital literacy knowledge.

Within the first few weeks of the project implementation, providers identified that it would be helpful to compile a list of the most used or peer-recommended applications based upon therapeutic technique and indication for use. The three most common applications selected were Daylio Mood Tracker and Journal, CBT-I (insomnia) Coach, and UCLA Mindful.

The high patient participation rate of 47% echoes findings from Chang et al. (2023) which suggested that DHTs enhance engagement and participation due to increasing patients' interest in their care. Increased participation can also be related to reduced social barriers and little risk for stigmatization due to the anonymity of online or mobile delivered treatments (Schuster, 2019). The main reasons for eligible patients not participating reported from outreach was forgetting, an unexpected medical illness or simply not having the time.

Figure 10. **Age of Participants**



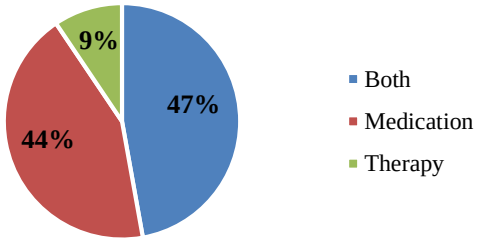
Among participants, 81% were female. There was a broad spectrum of ages among participants, contrary to preconceptions about age and use of technology (see Figure 10).

Patients who utilized DHTs showed improvement in both PHQ9 and GAD 7 scores. It is important to note that these reductions are consistent with all patients who complete treatment within the outpatient behavioral health program. This is similar with the findings from Ben-Zeev et al, 2018, that in-person treatment is comparable to telehealth treatment.

As previously mentioned, there was a reduction in disengagement rates for patients in treatment with prescribers and clinicians. These results are consistent with findings from McCue et al. (2022) which showed that the use of DHTs improved both engagement and treatment outcomes.

All providers attended the provider digital literacy training which showed their willingness to learn, in addition to the collaborative and interdisciplinary team approach within the program.Although, there was a higher participation rate and utilization of DHTs among patients of prescribing behavioral health providers (psychiatrist, psychiatric nurse practitioner) versus behavioral health clinicians (therapist/ licensed independent clinical social worker). A majority (90%) of participants were in treatment with a prescriber (44% medication only, 47% medication and therapy). Therapy was the only treatment for 9% of patients. Prescriber participation can be related to desire to find

Figure 11. Treatment Recieved



alternative interventions to reduce symptoms, in addition to medication and comfort level with incorporating resources during visits. For the clinicians, forces against change that led to reduced participation included fear of change, digital literacy, need for additional training and existing burden/ workload.

Feedback obtained from the patient satisfaction survey was beneficial to evaluate the usefulness of the intervention. One participant reported in the free text section, that DHTs provided a "quick boost". The therapeutic benefit of immediate access to resources provided by DHTs was also reported by Tourous et al. (2021).

One of the strengths of the project was support from hospital leadership and The Digital Clinic at the project site. The guidance and accessibility to resources provided a significant contribution to the project formation, clear aim/ objective development, and execution of the intervention. Additionally, utilizing the PDSA model allowed the intervention to be deployed and evaluated within a short time frame.

Interpretation

Results from this project showed the benefit DHTs can have on patient engagement and clinical outcomes within the project site. In a time with extended waitlists and sparse behavioral health resources, this intervention can be extremely useful in both behavioral health and primary care settings. The instant access to psychoeducation, self-monitoring tools, and resources can take the burden off of providers, while increasing patient activation in their care. Patients' active participation in the project aligned with the Diffusion of Innovation (DOI) Theory in which patients demonstrated adoption of digital health technologies likely due to diffusion of digital literacy and acceptance of technology within society (Rogers, 2003).

Limitations

One limitation was the short length of time for the project implementation phase due to time restraints of the Spring semester. Another limitation was that it was difficult for providers to follow up with patients to track the use of the digital health technologies because of extended length of time between appointments due to the high volume of patients. Booking follow up appointments out four to six-weeks made it difficult for providers to remember to monitor DHT use with patients, even with the DHT treatment tracker embedded in notes.

It is also important to consider selection bias when determining which patients were selected to be screened for eligibility. Variables to consider include: rapport with patient, patient's severity of symptoms, provider burden, and provider's busy schedule/ lack of time. One of the project's main objectives was to reduce provider burden, although there was limited participation from behavioral health clinicians. In the future, both patients and behavioral health providers should be screened for eligibility and interest in using DHTs to increase provider participation. A more in-depth, comprehensive training with repeated sessions should be considered to increase digital literacy for providers. An unintended limitation was a change in leadership during the implementation phase of the project. Both the Director of Social Work and the Chief of Psychiatry transitioned out of their roles.

Conclusions

This quality improvement project implemented telehealth treatment augmented with digital health technologies among adult patients diagnosed with Major Depressive Disorder from

an outpatient behavioral health program. The project results showed that all of patients who utilized DHTs remained active and engaged in treatment. Post-implementation disengagement rates were lower than pre-implementation rates. Participants also had reduced PHQ9 and GAD 7 scores showing improvement in clinical symptoms. Additionally, patients found DHTs to be feasible, interesting and enjoyable to use. The results show that the intervention was successful for patients at the project site for increasing engagement in treatment for patients with major depressive disorder. Future work should explore provider training to increase confidence and competence with incorporating DHTs into practice.

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Appendix A. Evidence/Matrix Table

Project PICO Question: Among patients 18 years and older diagnosed with Major Depressive Disorder receiving care at an outpatient behavioral health clinic, does the implementation of telehealth and/or digital health technologies, increase engagement in treatment in comparison to standard care?
Inclusion/Exclusion criteria: All Adults, English, Full Text
Keywords/search terms: Major Depressive Disorder, Patient Engagement
Databases Searched: CINAHL, PubMed, OVID Nursing Database, PsychARTICLES

Quantitative Studies

Author(s) / Year / Country	Purpose / Study Question/ Variables: Independent (IV) Dependent (DV)	Conceptual Framework & Research Design	Level of Evidence & Quality of Study	Sample Selection / Setting	Instruments / Data Collection Methods	Description of Sample / Sample Size	Significant findings
Ben-Zeev et al., 2018 United States	To study the effectiveness of treatment delivered from telehealth/mobile health (m-health) using intervention called FOCUS compared to traditional treatment and impact on patient	No conceptual framework identified. Randomized controlled trial.	Level 1, A	Recruited from electronic health record screening by 20 clinical teams. Setting: three health centers. .	Engagement measured by attendance, completion and usage of application. FOCUS Intervention engagement measured attendance by software. WRAP session attendance logged	N= 163 after calculating power of 80% and estimated 10% drop-out rate. Intervention group: FOCUS: N=82 WRAP= 81 Mean age= 49 Male 96, 59%	FOCUS group participants were more likely than WRAP participants to fully engage in treatment for at least eight weeks (56% versus 40%) (χ^2=4.50, df=1, p=.03) 90% (N=74) of participants assigned to the FOCUS group commenced use of the mHealth app, and 58% (N=47) of those assigned to WRAP group attended at least one group session (χ^2=22.11, df=1, p<.001) Satisfaction ratings were comparably high for both interventions.

	engagement and symptom management. IV: Patients who received treatment via m-health, program called FOCUS versus patients who received clinic-based intervention (Wellness Recovery Action Plan [WRAP] DV: Patients' mental health symptoms and engagement in treatment				by WRAP facilitators. Satisfaction: 7-point rating scale- self-report completed 5 times during the three-month, post-intervention assessment. General Psycho-pathology: Symptom Checklist–9 (single global rating of symptoms) Depression: 21 Item-Beck Depression Inventory Psychosis: Psychotic Symptom Rating Scales (PSYRATS) Recovery: 24- Item Recovery Assessment Scale (RAS) 5-Item Likert Scale Quality of life assessed from a 6-item questionnaire using a 7-point delighted-terrible scale	Female 67 African American 106 65% White 4 Other 12 Education High School or Less 99 More than High School 62 Diagnoses: schizophrenia or schizoaffective disorder, 49% (N=80) bipolar disorder, 28% (N=46) major depressive disorder, 23% (N=37) The only difference between treatment groups was that more participants randomly assigned to FOCUS had previously used a smartphone (73% vs. 57%).	Participants in both groups reported symptom reduction and did not differ in clinical outcomes, including general psychopathology and depression.

					Clinical outcome measures were administered researchers were trained and supervised by licensed clinical psychologists Cronbach Alpha not identified.		
Chang et al., 2023 United States	To study the effect of app engagement on clinical outcomes in a hybrid clinic for patients with depression and anxiety. IV: Patients selected for hybrid clinic which included Eight weeks of CBT-focused treatment augmented by the use of the mind LAMP app between sessions DV: patient engagement and clinical outcomes	Quasi-Experimental	Level II, A	Participants referred from primary care practices in Metro West Boston with elevated scores for depression/ anxiety. Setting: primary care practices	Standardized tests complete weekly (8 total) by researchers and participates: included 9- Item Patient Health Questionnaire (PHQ9), 7-Item Generalized Anxiety Disorder (GAD7), Working Alliance Inventory-Short Form (WAI-SR). A mind LAMP app satisfaction survey was offered in week 4 and 8. The app satisfaction survey consisted of two questions scored out of five points.	N=85 Missing= 1 Female 62 72 % Male 23 27% White 63 Asian 8 Other 11	There was no correlation between app engagement and percentage change in PHQ-9 or GAD-7 throughout treatment. PHQ-9 and GAD-7 scores reduced from the intake visit to visit ($p<0.05$)
McCue et al., 2022 United States	To compare digitally embedded care mobile	Randomized controlled pilot study	Level 1, A	Recruited patients who were diagnosed	Outcomes were assessed at 18 and 52 weeks for each arm by in-person	N=37 Researchers determined a sample	Improvements in 7-item Patient-Provider Engagement Scale were observed in both arms at 18 weeks and were sustained through 52 weeks with the intervention group.

	application versus usual treatment to improve MDD provider-patient engagement. IV: Patients who received care mobile application DV: Patients' engagement in treatment and communication with providers			with MDD from primary care practices from Advocate Health Care. Setting: Primary care practices	research visits and phone interviews Standardized tests completed by researchers and participates: included: (engagement) 7-item Patient-Provider Engagement Scale, (depression) 9- Item Patient Health Questionnaire (PHQ9), (activation) 13- Item Patient Activation Measure (P AM-13), (cognition) 5-item Perceived Deficits Questionnaire–Depression, (quality of life) 5-item World Health Organization Well-Being Index (WHO-5). Exploratory outcomes: medication changes assessed by retrospective chart review and patient and provider satisfaction with the care and use of the app	size of 20 patients per group was expected to be sufficient to provide initial information about the potential effects and benefits of the app and the feasibility of its real-world use to inform future larger-scale studies. Intervention group: n=18, 49% Usual Care: n=19, 51% Gender: Female n=31, 84% Age: mean age 36, Demographic categories were well represented and balanced between each treatment arm Race: Hispanic: 14 Black 7 White: 15 Other: 1 Employment Status: Full time: 16 Part-time: 8 Self-Employed: 3	At 52 weeks there were improvements in WHO-5 scores, which were significantly greater in intervention group than in the usual care group (*P*=.02) At 52 weeks, differences in PAM-13 scores from baseline demonstrated significantly greater improvements in the intervention app arm than in the usual care arm (*P*=.04). PHQ-9 scores decreased in both groups.

					A quality control committee reviewed the data for adequate completion and integrity Cronbach Alpha not identified	Not Employed: 5 Student: 5 Other: 4	
Mohr et al., 2013 United States	To compare telephone-administered cognitive behavioral therapy (T-CBT) versus face-to-face CBT in treating depression and completion of treatment. IV: Telephone administered cognitive behavioral therapy versus face to face cognitive behavioral therapy DV: patients' engagement in treatment and depression	No conceptual framework identified. Randomized controlled trial.	Level 1, A	Recruited from Northwestern Medical Faculty Foundation and Northwestern Memorial Physician's Group between 11/ 2007 12/2010. Setting: 4 Primary care clinics	Engagement measured from attrition/ attendance logs from18 sessions (completion vs noncompletion) Screening completed by researchers at baseline, weeks 4, 9, 14, 18. follow up 3 and 6 months. Standardized screening tools: 17 Item-Hamilton Depression Rating Scale, 9- Item Patient Health Questionnaire Cronbach Alpha not identified.	N= 325 FTF CBT T CBT N= 162 n=163 Female 127 125 Male 35 38 Race Hispanic 21 23 African 36 36 American White 98 89 Other 16 23 Married 51 56 Education	Significantly fewer participants discontinued T-CBT (n=34; 20.9%) compared with face-to-face CBT (n=53; 32.7%; *P*=.02). The study found that the T-CBT intervention improves treatment adherence and patient engagement in their care compared to face-to-face delivery. Patients showed significant improvement in depression across both treatments (*P*<.001). There were no significant treatment differences at posttreatment between T-CBT and face-to-face CBT on the Ham-D (*P*=.22) or the PHQ-9 (*P*=.89). There is question of long-term effects after treatment cessation. T-CBT was inferior to face-to-face CBT at 6-month follow-up.

	outcomes between therapy delivery				No other instruments used	High school 14 20 Some College 41 40 Bachelors 64 55 No significant difference between two groups.	
Rollman et al., 2018 United States	To study the effectiveness of treating depression and anxiety by comparing usual care (UC), to an internet support group (ISG) with an online computerized cognitive behavioral therapy (CCBT) to CCBT alone, for patients from a collaborative care program and how this impacts patient engagement. IV: Patients who received ISG/ CCBT treatment DV: Anxiety and depression symptoms/ treatment	No conceptual framework identified. Randomized clinical trial	Level I A	PCPs received a "Best Practice Alert" when entering a diagnosis for anxiety or depression for patients between the ages of 18-75 which would then prompt a reminder about the study which PCPs could sign and enroll patients in. Setting: 26 Primary care offices.	Researchers' server logs used to measure engagement with the CCBT and ISG programs. 3-month, 6-month, and 12-month follow-up interviews using audiotapes, manuals and a computer-assisted telephone interview system. Data collected from patients EMR Electronic registry documented email and telephone contacts by participants. Standardized tests completed by researchers and participates: included 9- Item	N= 704 after calculating a power of 90 % and 300 participants needed per arm. Intervention groups: CCBT alone: N= 301 CCBT + ISG: N= 302 Usual Case: N= 101 Female 562 Male 142 Race White 574 (81.8) African American 113 (16.5) Other (15) 2.1) Age 18-34: 256 (36.4) 35-59: 343 (48.7) 60-75: 15 (14.9) College Degree: 333 (47.3)	Engagement: CCBT: At 6 months 83.6 % of participants had completed 1 session, 36.7 completed all 8. CCBT + ISG: At 6 months 75 % logged in at least once and 61.8% made at least one comment or post. CCBT + ISG vs CCBT: Improvements on primary outcome measure: Short Form 12 MCS: ES, 0.02; 95% CI, −0.17 to 0.13 and Promis Depression and Anxiety scales CCBT vs. Usual Care SF-12 MCS (mean points, 0.80; 95% CI, 0.37-1.22), PROMIS Depression (mean points, 0.48; 95% CI, −0.76 to −0.19), and PROMIS Anxiety (mean points, 0.48; 95% CI, −0.79 to −0.17) The use of digital treatments can increase patient engagement due to increased patient autonomy, control over accessibility of treatment and reduced stigma.

	outcomes and engagement in care				Patient Health Questionnaire (PHQ9), 7-Item Generalized Anxiety Disorder (GAD7), 12 -Item Short-Form Health Survey, 26 Item-Primary Care Evaluation of Mental Disorders (PRIME-MD), Fixed Length Patient-Reported Outcomes Measurement Information System (PROMIS). Cronbach Alpha not identified. All analyses were performed with SAS version 9.4 (SAS Institute).	Married or living with partner 283 (47.3) Living Alone 125 (17.8) Employed 492 (69.9) No significant difference between two groups.	
Ruskin et al., 2004 United States	To compare treatment outcomes of patients with depressive disorders who received tele-psychiatric treatment compared to in-person treatment IV: Patients who received tele-	No conceptual framework identified. Randomized controlled trial	Level I, B	Recruited veterans who were referred to mental health clinics within the Department of the Veterans Affairs Maryland Health Care System.	Engagement/ adherence measured by dropout rates, number of session appointments kept, and pill counts. Standardized Tools completed by patients and researchers: 24-Item Hamilton Depression Rating Scale, 21- Item	N= 119 after calculating a power of 80% for the detection of a standardized deviation of 0.5. Invention group: 59 In-Person: 60 Mean age: 49.7 Men: 105 Women: 14	Treatment adherence: The two groups were equally adherent to appointments. Both groups kept appointments for an average of 6.5 visits during the study period (t=0.2, df=117, n.s.) Sixteen participants (27%) in the remote group and 18 (30%) in the in-person group dropped out of the study There was no difference in the percentage of adherent patients between the two treatment groups (χ^2=0.2, df=1, n.s.) Depressive symptoms improved for both groups p<0.001

	psychiatric treatment DV: Treatment outcomes, engagement and satisfaction			Setting: 3 outpatient mental health clinics	Beck Depression Inventory, Spielberger Trait Anxiety Inventory Scale, 40- item Spielberger State Anxiety Scale, Global Assessment of Functioning Scale (GAF), 7- point Clinical Global Impression (CGI), Medical Outcomes Study 12-Item Short-Form Health Survey Patient Satisfaction: 17-item scale Cronbach Alpha not identified.	African American: 36% Caucasian: 61 % Hispanic or Asia: 3% Married 44% Divorced, Widowed 37% Never Married 19% More than 12 Years Edu 50% High School Grad 33% Less than 12 years of edu 17 %d There were more males in the study, although no significant differences found between groups	There was no difference in patient satisfaction between the remote and in person groups
Schuster et al., 2019 Austria	To evaluate patient treatment engagement and outcomes in addition to therapists' perceptions of an integrated internet and mobile blended group therapy (BGT) model to treat depression.	No conceptual framework identified. Mixed-Methods, Clinical Interviews, Patient Self-Reports, Cross-validation survey.	Level II, A	Recruited from flyers and advertisements on depression-related websites. Setting: University outpatient clinic	Engagement measured by patient completion of treatment (log data) and t interviews. Regional ethics committee of the University of Salzburg approved the study procedure	N= 27 after calculating a power of 90% with a medium within-subject effect size of d=0.65. Intervention group: N=27 Female: 14 (51.9) Male: 13 Education > 9 years: 7	Patient completion: group attendance=82.4%, usage of digital elements was high: completion rate of Web-based modules 76%, and 67% for the mobile-based diary app. Interview themes: Greater learning effect. Patients more open Treatment flexibility Disadvantages: Challenges during a crisis Security

	IV: Patients who received integrated internet and mobile blended group therapy DV: Patient engagement and treatment outcomes				Documentation of researchers' credentials and training Standardized Tools completed by patients and researchers: 12-Item German Mini-Diagnostic Interview for Psychological Disorders (DIPS), 17 -Item Center of Epidemiologic Studies Depression (CES-D) scale , 5- Point Self-report scale Acceptance and Action Questionnaire-II, 22- Item, 4-point Likert scale Anxious Thoughts Inventory, 16-Item Penn State Worry Questionnaire, 8-Item Client Satisfaction Questionnaire Web elements measured by the 10 Item, 5-point System Usability Scale (SUS)	> 12 years: 12 Tertiary education: 8 Employment: Fulltime: 11 Part time: 6 Unemployed: 5 In school: 5 No significant difference between two groups.	Overall Therapists identified advantages to the intervention as increased patient engagement, treatment intensification, and improved therapeutic relations. CES-D showed a statistically significant decrease in self-reported depressiveness, *P*<.001. GHQ-12/Self-reported psychological distress reduction *P*<.001 The Study found that the integrated internet and mobile supported blended group therapy intervention provided effective, therapeutic and flexible treatment to patients. Increasing accessibility to information to patients can increase patient engagement and improvement depression outcomes.

					Therapist interviews were audiotaped Coding/ Thematize categories used Structured interview guide used. Interviews were transcribed. Member checking completed The Cronbach alpha used.		
Topooco et al., 2017 European Union	To examine mental health stakeholders views on digital treatments for depression.	No conceptual framework identified. Mixed-Methods survey and free text	Level IV, B	764 European stakeholders were contacted with a 23% response rate. Setting: Online survey conducted in eight European countries: France, Germany, Netherlands, Poland, Spain,	The survey data was analyzed by using descriptive statistics, Kruskal-Wallis tests, $\chi 2$ and analysis of variance (ANOVA) Post-hoc tests were used to test differences in responses. Survey included 40 questions- 6-point scales (0-5), yes/ no options, in addition to free text). Themes:	N= 175 Organizations who completed E-COMPARED survey Countries: Poland 29 United Kingdom 4 France 4 Germany 58, S Switzerland 13 Netherlands 22 Sweden 23 Spain 22 Category of providers and professionals: government bodies: 27, research institutions: 26 patients/service-users: 14	Caregivers provided most comments (n = 15) and most frequently highlighted the negative aspects of therapeutic alliance, clinical effect and patient commitment, and of implementation aspects (cost and budgeting, training of staff) The most important reason for the implementation of ICBT into existing care services was the reduced cost of treatment (33%). More rapid patient access to treatment was ranked the second most important incentive among all stakeholder group. Barriers for implementation was the perception that their current care system was not ready for service delivery of ICBT (21%), limited internet access/literacy (service-funders), lack of clinical effectiveness (patient/ service-users), and

				Sweden, Switzerland and The United Kingdom	1.knowledge of treatments 2. attitudes towards treatments 3. acceptability (recommendation) of treatments and 4. near future expectations of treatments. The Cronbach alpha not identified.	service funding: 11 represented technology provider/developers: 9 Due to no higher limit of participants there was a high proportion of German responders	negative attitudes from patients and professionals (government bodies) as the main barriers to implementation.
Wilson et al., 2018 United States	Evaluate patient engagement and effects of an Internet-Based, self-directed program (Think Clearly About Depression) for treating depression among adults with chronic diseases.	Theoretically based principles of Ryan and Sawin's individual and family self-management theory (IFSMT) Randomized controlled trial	Level I A	Recruited from outpatient clinical sites in the western United States and online advertisements. Setting:	Engagement was measured using Self-Efficacy Scales (10- item Likert scales) All participants completed the following scales at baseline, Week 4, and Week 8: (a) the Patient Health Questionnaire (PHQ-8) (9^{th} question omitted), (b) the Health Distress Scale, (c) the 4-item Self-Rated Health Scale 6-point Likert-type scale, and (d) the Chronic Disease These questionnaires are validated tools with	Based on a two-tailed test, $\alpha = .05$, $1 - \beta = .80$, and effect size f = .20, a sample size of 42 was estimated to compare means between two groups anticipated attrition of 20% Number Needed to Treat (NNT) analysis was performed N=53 Intervention: 22 Control 25 Male 7 Female 40 High School 3 Some College 14 College 30	Results indicated that engagement increased values on self-efficacy subscale: (B = 1.47, SE = .69, p = .03) Treatment group improved on PHQ-8 scores, $t(21) = 3.14$, $p = .005$, $d = .85$, and self-efficacy management of depressive symptoms, $t(18) = -3.79$, $p = .001$, $d = .93$

					internal reliability greater than .89 Cronbach's alpha was used.	Never Married 4 Married 25 Divorced 17 White 42 Hispanic 2 Black 4 Other 1	
Zanjani et al., 2008 United States	To examine the effectiveness of a telephone-based referral care management (TBR-CM) intervention for improving engagement in psychiatric treatment. IV: The use of a telephone-based referral care management (TBR-CM) intervention DV: Patients engagement in psychiatric treatment	No Specific Conceptual Frameworks Identified Randomized controlled trial	Level I B	Recruited veterans receiving care from Philadelphia Veterans Affairs Medical Center (PVAMC). Setting: The Mental Illness Research at the PVAMC.	Attendance was monitored from PVAMC centralized computer medical record system. Standardized screening tools completed by researchers and participants: 9-Item Patient Health Questionnaire, short, structured, diagnostic Mini-International Neuropsychiatric Interview, Medical Outcomes Study 12-item short form, 6-Item Blessed Memory Test Patient self-report of measure of alcohol use using a seven-	N=113 after calculating a power of 80% to detect a medium (.25) to large (.40) effect size at α=.05 between the intervention and the control group. Intervention group N=57 Usual care N= 56 Male 108 96% Female 5 Married 37 33% Lives alone 18 16% White 35 31% Hispanic 3 3% Participants were majority male which could affect generalizability of findings	The study found that the TBR-CM intervention program was effective at improving psychiatric treatment engagement. Participants in the intervention group were significantly more likely to attend their scheduled psychiatric appointments compared with the usual care group (70% versus 32%, respectively) (χ^2 =16, df=1, p<.001) Participants who received TBR-CM were significantly more likely to attend their initial psychiatric appointment, and they were also more likely to have attended a greater number of psychiatric appointments over the six months after baseline.

					day timeline follow-back, past and current use of illicit substances Five-item Paykel scale for 12-month suicide ideation Cronbach Alpha not identified.		
Zimmerman et al., 2023 United States	To compare the effectiveness of partial hospitalization telehealth treatment of major depressive disorder (MDD) versus in-person treatment. IV: Patients who received telehealth treatment DV: Patient outcomes and engagement in care.	No conceptual framework identified. Quasi-Experimental	Level II, A	Recruited patients who were attending a partial hospitalization program referred from outpatient providers, inpatient psychiatric units or emergency services. Setting: Outpatient partial Hospitalization Program	Attendance logged though Zoom. Intakes, visits, group sessions and therapy conducted using HIPPA compliant Zoom virtual platform. Standardized tools: Clinically Useful Patient Satisfaction Scale (CUPSS) 0-4 Likert scale, 14- Item Remission from Depression Questionnaire (RD: Q-M) *t*-tests sed to compare the telehealth and in-person groups on continuously distributed variables and chi-square	N= 836 Intervention/ Telehealth group: N=294 In-person group: N=542 More patients had graduated from a 4-year college in the telehealth group. Male 217 Female 592 Non-Binary 25 White 570 Hispanic 113 Black 63 Asian 24 Other 62 Less than high school 45 High School Diploma 460 4-year college 296	Higher proportion of patients completed treatment in the telehealth program $p < .01$ Reduction in death wishes Telehealth: p <.01 In Person p < .001 Change scores from admission to discharge were significantly greater in the telehealth group for the depression $p < .01$ and anxiety $p < .05$

					statistics to compare categorical variables Cronbach Alpha not identified.	Marital status Married 215 Never Married 340	

Qualitative Studies

Author(s)/ Year	Purpose & Study Question	Conceptual Framework & Research Design	Sample Size & Selection	Setting	Data Collection Methods	Significant Findings
Guinart et al., 2021 United States	To examine the experience and attitudes of mental health care providers towards telehealth	No conceptual framework identified Qualitative	Psychiatrists, psychologists, nurses and nurse practitioners, social workers, therapists, mental health counselors, residents, and fellows were invited to complete the survey anonymously Age: 39% > 45 years old N= 819 mental health care providers completed an electronic survey	Setting: 18 hospitals across the United States	12-item satisfaction survey with 5-point Likert scale questions about potential challenges and experiences. Descriptive statistics used to report qualitative results All data were analyzed with JMP (version 13, SAS Institute Cronbach Alpha not identified	Advantages: a. flexible scheduling or rescheduling: N=633, 77% b. timely appointment starts N=568, 69% c. lack or reduction of no-shows N=427, 52% Overall experience: Excellent or good: N=523. 73% Challenges: Patient inability to use conferencing device 52% N=422 There were not challenges among professional categories, although challenges differed by provider age (χ^2=112, df=84, p=0.023 Free text themes:

						Useful, time saving Technical difficulties
Krog et ak., 2018 Denmark	To explore barriers and facilitators to using a web-based version of the Major Depression Inventory (eMDI) when evaluating patients for depression in primary care practices.	Theoretical framework: The Behavior Change Wheel Qualitative/ Semi-structured individual interviews	N= 9 general practitioners	Setting: 8 Primary care practices in Central Denmark	All interviews were recorded and transcribed verbatim Field notes were written down immediately after each interview Peer Review, member checking and debriefing conducted An interview guide was developed according to the method of focused interviewing Data transcription, coding, thematic categories used Documentation of researchers' credentials and training Limitations discussed Standardized tools used: Major Depression Inventory (MDI) Self report questionnaire	Facilitating Factors: Motivation: a. Flexible Use for Patients b. Improved Use of Consultation Time c. Improved Patient Monitoring d. Improved Prioritization between Patients e. Improved Services for Patients f. Better Consultations g. Easy documentation process Limitations: a. Resource Demanding introduction to change b. Time-consuming login process c. Familiarity with paper-based MDI

Non-Research Evidence

Authors(s)/ Year	Type	Setting	Significant Findings	Limitations	Evidence Level & Quality
Bijkerk, (2022)	Literature Review	Healthcare	Review of methods and Instruments to measure engagement	none	V/A
Coulter, (2017)	Expert Opinion	Healthcare	Strategies to facilitate patient engagement	none	V/A
Drenkard et al. (2016)	Expert Opinion	Healthcare	Person Engagement Index The Interactive Care Model	none	V/A
Gruman, 2010	Expert Opinion	Healthcare	Engagement Behavior Framework	Year article published	IV/ A
Hall, (2001)	Expert Opinion	Mental Healthcare Settings	Multi-Item Engagement Measure "The Engagement Measure"	Year article published	IV/A
O'Brien, (2009)	Literature Review	Mental Healthcare are Settings	Definition of disengagement; Proportion of disengagement	Year article published	IV/ A
Reid-Ponte, (2018)	Expert Opinion	Healthcare	Core principles of patient engagement	none	V/ A
Swartwout, (2016)	Guideline	Healthcare	Competencies supporting patient engagement	none	V/ A

Appendix B. Synthesis/ Summary Table

Intervention/ Type of Digital Health Technology Used	Studies	Significant Outcomes/ Themes	Sample Size & Description	Level of Evidence, Conceptual Framework, Research Design
Telehealth	a. Ben-Zeev et al. 2018	a. Mobile health group participants (FOCUS group) were more likely than in-person participants (WRAP group) to fully engage in treatment for at least eight weeks (56% versus 40%) (χ^2=4.50, df=1, p=.03).	a. 163 participants; mean age 49; 65% African American; 38% greater than a high school education	a. Level I, A
	b. Guinart et al. 2021	b. 52% of mental health care provider responders identified lack or reduction of no-shows as a potential advantage of telehealth treatment.	b. 819 participants; all mental health care providers; 39% > 45 years old	b. none identified, Qualitative
	c. Mohr et al. 2013	c. Significantly fewer participants discontinued telephone-cognitive behavioral therapy (n=34; 20.9%) compared with face-to-face cognitive behavioral therapy (n=53; 32.7%; P=.02).	c 325 participants; mean age 48; 77% female;13.5 % Hispanic or Latino; 32% married	c. Level I, A
	d. Ruskin et al. 2004	d. Both in-person and telehealth groups kept appointments for an average of 6.5 visits (t=0.2, df=117, n.s.). Depressive symptoms improved for both groups p<0.001.	d. 119 participants; mean age of 49.7; Caucasian 61%, 92% men	d. Level I, B
	e. Schuster et al. 2019	e. Attendance for internet and mobile blended group therapy (BGT) was 82.4% and usage of digital elements was high: completion rate of Web-based modules 76%, and 67% for the mobile-based diary app.	e. 27 participants; 52% female; 44% > 12 years of education	e. Level II, A
	f. Topooco et al., 2017	f. The E- COMPARED survey results reported the negative aspects of digital treatments for depression include impact on therapeutic alliance, clinical effect and patient commitment.	f. 175 stakeholders from the European Union including 6 categories of providers and professionals.	f. Level IV, B/ Mixed Methods
	g. Wilson et al. 2018	g. Results showed increased engagement with use of an Internet-Based, self-directed program based upon increased values on Self-Efficacy Scale: (B = 1.47, SE = .69, p = .03).	g. 53 participants; 75% female; 75% have a college degree; 63% married	g. Level I, A

Telehealth Partial Hospitalization Program (PHP)	h. Zimmerman et al. 2023	h. A higher proportion of patients completed treatment in the telehealth partial hospitalization program $p < .01$ in comparison to in-person treatment. Change in scores from admission to discharge were significantly greater in the telehealth group for the depression $p < .01$ and anxiety $p < .05$.	h. 836 participants; 71% female; 71 % white, 55% had high school diploma or GED	h. Level II, A
Digital Applications	i. Chang et al. 2023	i. There was no correlation between app engagement and percentage change in PHQ-9 or GAD-7 throughout treatment. Applications should be considered as a tool used by providers, rather than a standalone device.	i. 85 participants; 72% female; 73 % white, 91 % not Hispanic or Latino, 39 % had an annual household income > $100,000 +	i. Level II, A
	j. McCue et al. 2022	j. Improvements in 7-item Patient-Provider Engagement Scale was observed in both arms at 18 weeks and were sustained through 52 weeks with the intervention group.	j. 37 participants; mean age 36, 84% female;	j. Level I, A
Electronic Screening Tools	k. Krog et al. 2018	k. Providers identified advantages from using a web-based version of the Major Depression Inventory (eMDI) when evaluating patients for depression which can increase patient engagement: -Flexible use for patients -Improved services for patients	k. 9 Primary Care Providers in Denmark	k. Theoretical Framework: The Behavior Change Wheel/ Qualitative
Internet-Delivered cognitive behavioral therapy & Internet Support Group	l. Rollman et al. 2018	l. At 6 months, 83.6 % of participants completed computerized cognitive behavioral health treatment. At 6 months, 75 % logged in at least once and 61.8% made at least one comment or post to internet support group	l. 704 participants; mean age 42.7 years; 79.8 % female, 81.8 % White; 47.3% with a college degree	l. Level I, A
Telephone Referral Care Management	m. Zanjani et al. 2008	m. Participants who received who received telephone-based referral care management were significantly more likely to attend their scheduled psychiatric appointments compared to the usual care group (70% versus 32%, respectively) ($\chi 2 = 16$, df=1, p<.001).	m. 113 participants; 96% male; 33 % married; 31 % white	m. Level I, B

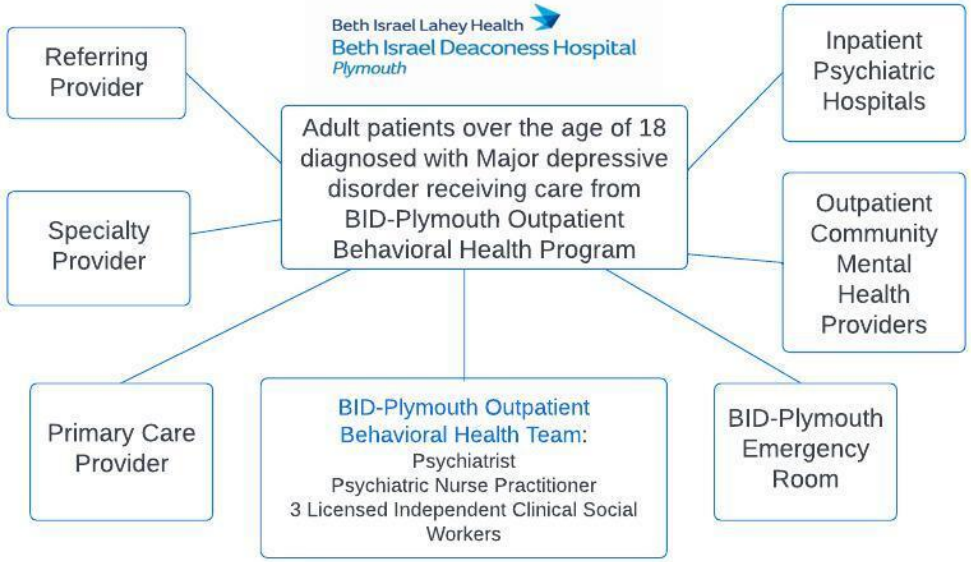
Appendix C. External Mapping Tool

External Mapping Tool

1. Clinical Microsytem: Beth Israel Deaconess Hospital Plymouth- Outpatient Behavioral Health Program
2. Subpopulation: Adults over the age of 18 diagnosed with Major Depressive Disorder receiving outpatient behavioral health care

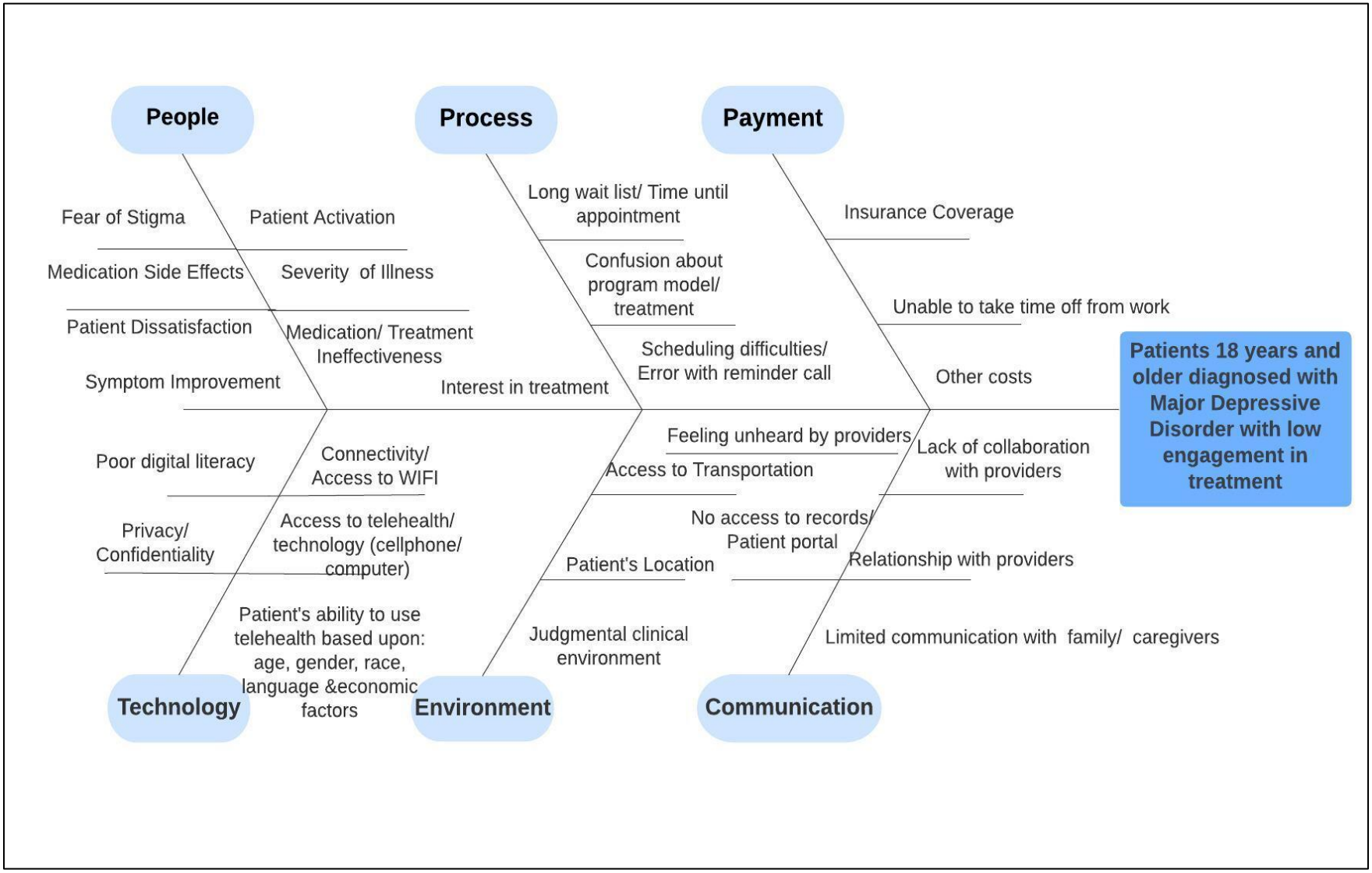
3. Patient-Specific Health Care Needs

a. Clinical Assessment/ Diagnostic Evaluation
b. Medication Management
c. Psychotherapy
d. Case Management/ Case Consultation
e. Social Work
f. Referral Review/ Brief Intervention/ Crisis Management
g. Family/ Caregiver support
h. Care Coordination/ Patient Outreach
i. Specialty Referrals/ Recovery Navigator
j. Bridge to Long-term Providers

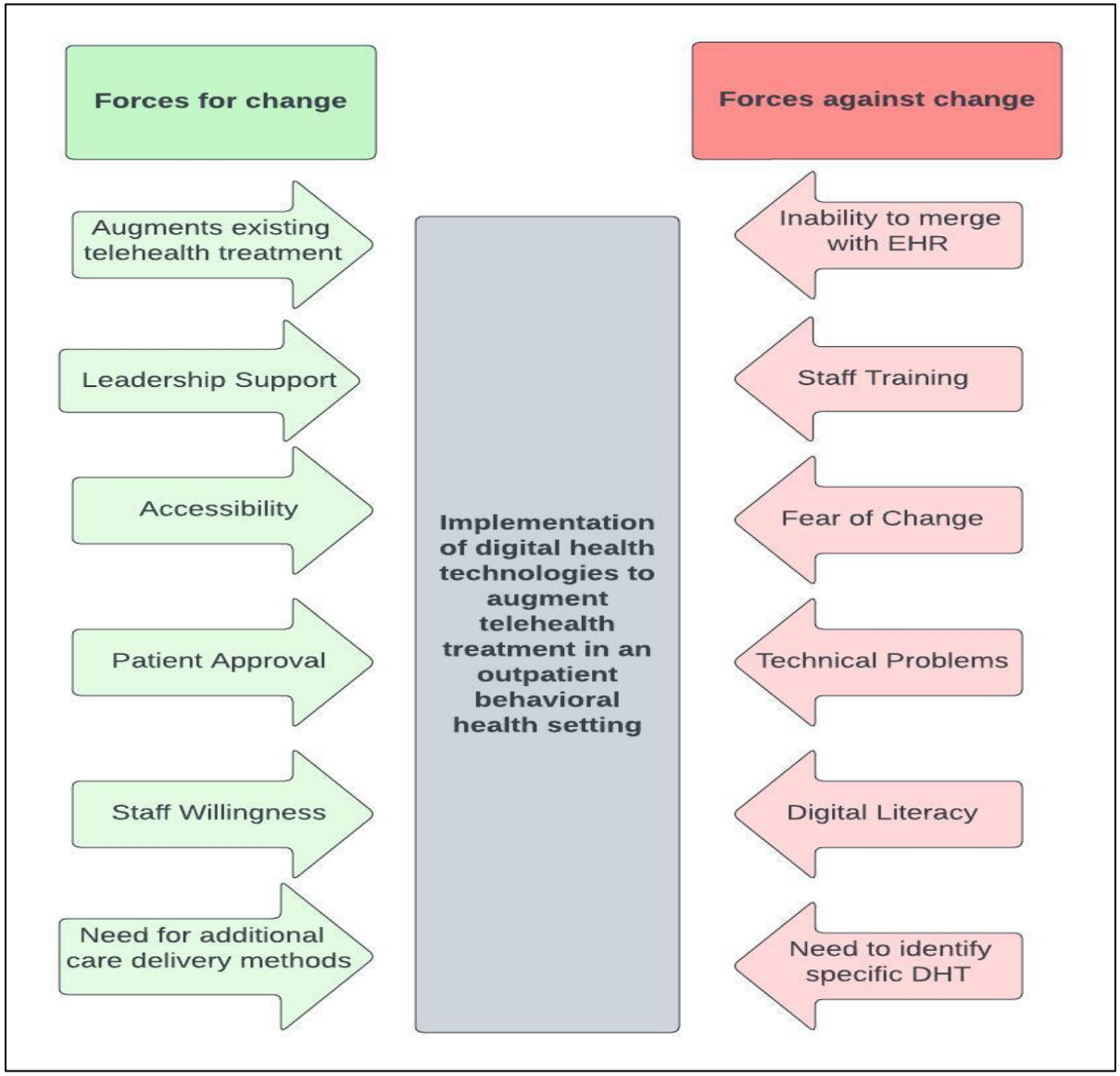


Improvement Ideas: BID-Plymouth Outpatient Behavioral Health Providers implement digital health technologies (DHTs) to augment telehealth treatment to increase patient engagement.

Appendix D: Cause and Effect Diagram



Appendix E: Force Field Analysis

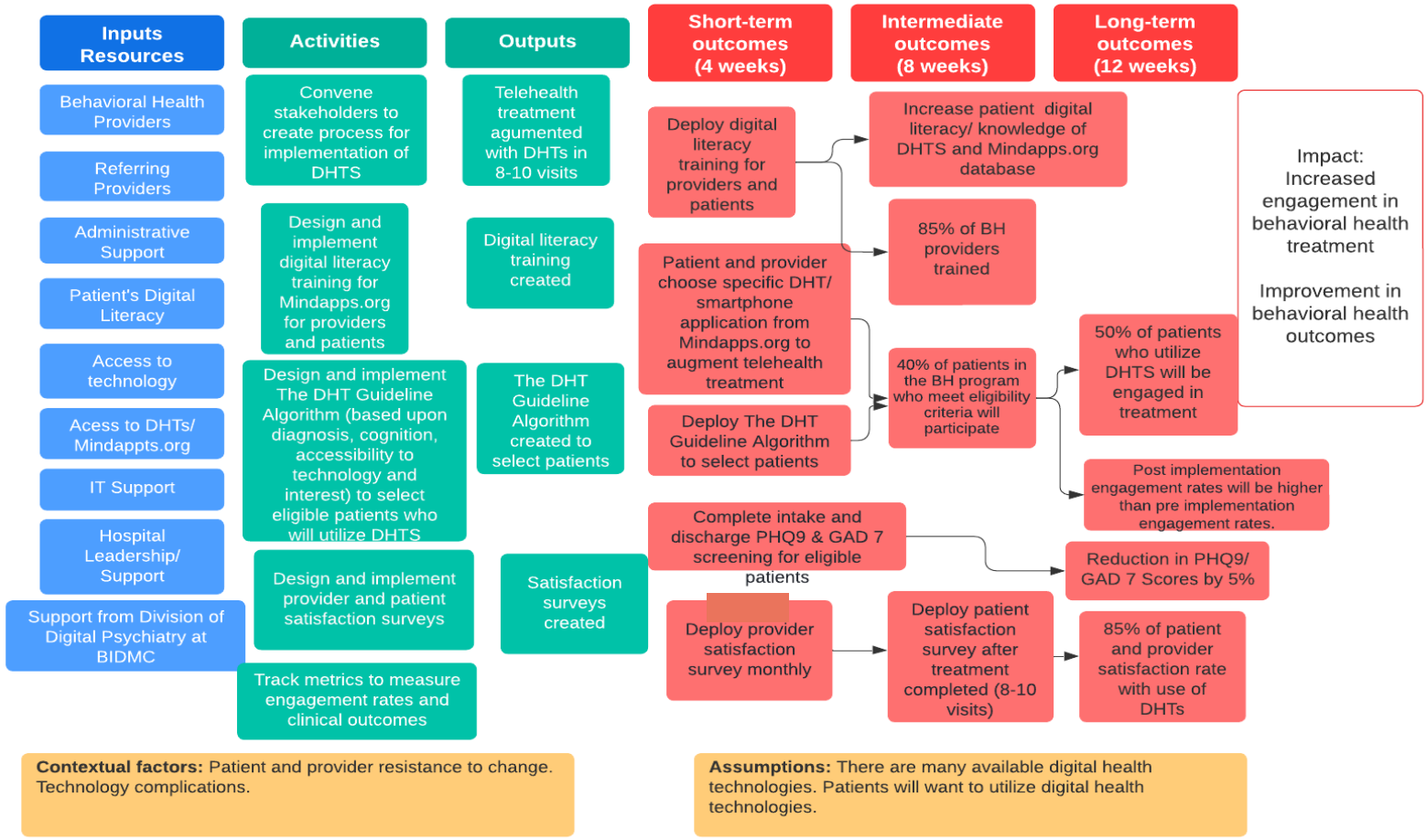


Appendix F: Logic Model

Logic Model: Engagement in treatment among patients diagnosed with Major Depressive Disorder at BID-Plymouth Outpatient Behavioral Health Program

Problem: Within the outpatient behavioral health program at BID-Plymouth; low engagement in treatment among adult patients over the age of 18 diagnosed with Major Depressive Disorder negatively affects patient outcomes while contributing to provider burden.

Goal: To increase patient engagement in treatment by augmenting existing telehealth treatment with digital health technologies.



Appendix G: Measures Table

		Measures			Analysis
Aim or Objectives	**Outcomes/ outputs**	**How operationalize/ measure**	**Where will you get the information**	**Will you have a comparison**	**Analysis**
Convene the stakeholders, leadership and clinicians to develop the program and process	Stakeholders will develop quality improvement project / process to augment DHTs with Telehealth treatment	Telehealth is augmented with DHTS during a treatment episode of 8-10 visits by selecting a specific DHT from Mindapps.org database.	Minutes from meetings	No	Qualitative reporting
Of patients selected to use DHTs, 50% will be engaged and active in treatment	Patients complete treatment episode and utilize DHTs	Patient engaged in treatment (has appt scheduled and attends appointments) Patient actively utilizes applications (tracked on applications) and per patient report	Patient Registry Metrics Chart Review Smartphone application tracking measures	No	Frequency, proportion, change % improvement
Post-implementation engagement rates will be higher than pre-implementation engagement rates.	Engagement rates increased by 10%.	Attendance of BH appointments Patient has appointment scheduled Patients respond to outreach	Patient Registry Chart review	Pre-Implementation engagement rates	Frequency, proportion, change % improvement
20% of patients in the BH program who meet eligibility criteria will participate.	40% of patients in the BH program met eligibility criteria to utilize DHTS with telehealth treatment and participated.	Eligibility criteria will be determined by all patients with MDD will be screened using the DHT Guideline Algorithm in order to be selected to utilize DHTS.	Patient Registry, Chart Review, DHT Guideline Algorithm	No	Frequency, proportions
Of patients selected to use DHTs, PHQ 9 and GAD 7 Scores will reduce by 5%	5% reduction in PHQ9 and GAD 7 scores	BH Provider administers PHQ9 (9-item Likert Depression Screening tool)/ GAD 7 (7-Item Likert Anxiety Screening Tool	PHQ9/ GAD 7 Scores, Chart Review	No	Mean Score, change % improvement

85% of behavioral health providers will attend a digital health technology training dedicated to navigating the behavioral health smartphone application database Mindapps.org and how to screen patients for capacity/ ability to use DHTS using the DHT Guideline Algorithm	85% of staff is trained on new process	Staff participation in training	Attendance log Provider debriefing on training/ knowledge learned	No	Quantitative, frequency and proportions
85% of patients found the use of digital health technologies to be feasible and adding value to their treatment	85 % of patients satisfied with augmenting telehealth treatment with DHTS.	Measuring if DHTS were user-friendly, cost-effective, informative, helped to meet treatment goals and reduce symptoms	Patient Satisfaction Survey	No	Survey

Appendix H. Data Tracking Tool

ID Number	Intake PHQ9	Intake GAD 7	Discharge PHQ9	Discharge GAD 7	Handout Sent	Implemented	Application Selected	Satisfaction Survey	Engaged	Treatment Outcome	Age	Sex	Treatment
1	5	13	5	4	Yes	No		N/A	Yes	Discharged	30	F	Medication
2	9	12	4	1	Yes	Yes		Yes	Yes	Active	64	F	Therapy
3	9	7			Yes	Yes	CBT-I Coach	Yes	Yes	Discharged	80	F	Both
4	10	13			Yes	Yes	Breathe Easy Smoking Cessation	Yes	Yes	Active	38	F	Medication
5	19	12			Yes	No		N/A	Yes	Active	69	M	Both
6	16	13			Yes	Yes	ACT Coach	No	Yes	Active	39	F	Therapy
7	7	5			Yes	Yes	Journal	Yes	Yes	Active	43	F	Medication
8	10	3	6	6	Yes	Yes	Calm	Yes	Yes	Active	54	F	Both
9	9	6			Yes	Unknown	UCLA mindful	N/A	Yes	Active	34	F	Medication
10	7	11			Yes	No		N/A	Yes	Active	56	F	Both
11	12	9			Yes	No		N/A	Yes	Active	63	M	Therapy
12	11	17			Yes	Unknown		N/A	Yes	Discharged	34	F	Medication
13	10	16			Yes	Unknown		N/A	Yes	Discharged	27	F	Medication
14	19	12	10	4	Yes	No		N/A	Yes	Active	42	F	Both
15	25	21			No	No		N/A	Yes	Active	36	F	Therapy
16	13	9	16	4	No	Yes	Daylio	Yes	Yes	Active	32	F	Medication
17	8	6			Yes	Unknown		N/A	Yes	Discharged	59	F	Therapy
18	17	15	15	11	Yes	No		N/A	Yes	Active	70	F	Both
19	6	6	4	9	Yes	No		N/A	Yes	Active	32	F	Both
20	18	17	8	4	Yes	No		No	Yes	Active	49	F	Medication
21	12	19	8	9	Yes	Yes	Impulsve	Yes	Yes	Active	38	F	Both
22	16	11	9	12	Yes	Yes	Reflectly	Yes	Yes	Active	29	F	Both
23	1	5			No	Yes	The Tapping Solution	yes	yes	Active	75	M	Medication
24	15	10	8	9	No	Yes	Mood Tracker	No	Yes	Active	31	M	Both

25	12	7	6	2	No	Unknown		N/A	Yes	Discharged	52	F	Both
26	16	11			No	No		N/A	yes	Active	27	F	Both
27	10	12			No	Yes	CBT-I Coach	No	Yes	Active	32	F	Both
28	18	5	11		Yes	No		N/A	yes	Active	52	F	Both
29	15	13	5	6	Yes	Yes	Halo	Yes	yes	Active	63	F	Medication
30	10	9			Yes	No		N/A	Yes	Active	22	M	Medication
31	12	9			Yes	Yes	ADHD	Yes	yes	Active	18	M	Medication
32	19	16			Yes	Unknown		N/A	Yes	Active	41	F	Medication
33	13	15			Yes	No		N/A	Yes	Active	64	F	Both
34	4	3	2	2	Yes	Yes	You me breathe	Yes	yes	Active	36	F	Medication
35	3	3			Yes	Yes	UCLA mindful	No	Yes	Active	39	M	Medication
36	17	19			Yes	Yes	UCLA mindful	No	Yes	Active	41	F	Both
37	16	13			Yes	Unknown	CBT-I Coach	No	Yes	Active	45	F	Medication
38	1	2			Yes	No		N/A	Yes	Active	63	F	Both
39	12	6	7	5	Yes	Yes	ADHD Life Hack	Yes	Yes	Active	23	F	Medication
40	11	5	8	3	No	Yes	Daylio	Yes	yes	Active	20	F	Medication
41	16	14			Yes	No		N/A	Yes	Active	31	F	Both
42	16	2			Yes	Unknown		Yes	Yes	Active	40	F	Both
43	8	18			Yes	Yes	Insight Timer	Yes	Yes	Active	56	F	Medication
44	24	15			Yes	Yes	UCLA mindful	Yes	Yes	Active	29	F	Medication
45	6	11			Yes	Yes		No	Yes	Active	65	F	Medication
46	19	16			Yes	No		N/A	No	Disengaged	22	M	Both
47	11	16			Yes	No		N/A	Yes	Active	59	M	Both
48	11	7			Yes	No		N/A	Yes	Active	81	M	Medication
49	11	15			Yes	Yes	Molehill Mountain	Yes	Yes	Active	39	F	Both
50	7	8			No	Yes	CBT-I Coach	Yes	Yes	Active	69	M	Medication
51	17	14			Yes	No		N/A	Yes	Active	26	F	Both

52	17	14	14		Yes	No		N/A	Yes	Active	66	F	Both
53	13	17	6	6	Yes	Yes	mindful eating/ exercise application	Yes	Yes	Active	67	F	Both

Appendix I. Aim 1 Log

Date:	Attendee(s):	Minutes:
3/2/2023	• Director of The Digital Clinic • BH Team	BIDMC Digital Clinic presentation followed by team meeting
5/1/2023	• Director of The Digital Clinic • Chief of Psychiatry at project site/ hospital • BH Team	Stakeholder Buy in
5/17/2023	• Director of The Digital Clinic • Chief of Psychiatry at project site/ hospital • BH Team	Emailed paper, Project discussion
5/30/2023	• Director of BH at another hospital within network	Discussed project- Digital Program at this site
6/1/2023	• BH team	Discussed project concept, target population, problem to address
6/28/2023	• Chief of Psychiatry at project site/ hospital	Discussed project for hospital leadership buy in
10/5/2023	• BH Team	Discussed project outline
11/28/2023	• BH Program Manager	Discussed project
12/7/2023	• BH Team	Provider Training
12/22/2023	• BH Team	Created application List for providers
1/4/2024	• BH Team	Feedback obtained, answered questions
2/1/2024	• BH Team	Discussed Project timeline, Implementation ending
2/28/2024	• BH Team	Project update, Gantt Chart shared
3/7/2024	• BH Team	Discussed Project, obtained feedback, challenges
4/4/2024	• BH Team	Team meeting, deployed satisfaction surveys

CLINICAL QUALITY IMPROVEMENT CHECKLIST

Date: 3/29/23 **Project Leader:** Lauren Collier

Project Title: Digital Health Technologies used to Promote Engagement Among Adults with Major Depressive Disorder

Institution where the project will be conducted: BID-Plymouth Outpatient Behavioral Health

Instructions: Answer YES or NO to each of the following statements about QI projects.	YES	NO
The specific aim is to improve the process or deliver of care with established/ accepted practice standards, or to implement change according to mandates of the health facilities' Quality Improvement programs. There is no intention of using the data for research purposes.	X	
The project is **NOT** designed to answer a research question or test a hypothesis and is **NOT** intended to develop or contribute to generalizable knowledge.	X	
The project does **NOT** follow a research design (e.g. hypothesis testing or group comparison [randomization, control groups, prospective comparison groups, cross-sectional, case control]). The project does **NOT** follow a protocol that over-rides clinical decision-making.	X	
The project involves implementation of established and tested practice standards (evidence-based practice) and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does **NOT** develop paradigms or untested methods or new untested standards.	X	
The project involves implementation or care practices and interventions that are consensus-based or evidence-based. The project does **NOT** seek to test an intervention that is beyond current science and experience.	X	
The project has been discussed with the QA/QI department where the project will be conducted and involves staff who are working at, or patients/clients/individuals who are seen at the facility where the project will be carried out.	X	
The project has **NO** funding from federal agencies or research-focused organizations, and is not receiving funding for implementation research**.**	X	
The clinical practice unit (hospital, clinic, division, or care group) agrees that this is a QI project that will be implemented to improve the process or delivery of care.	X	
The project leader/DNP student has discussed and reviewed the checklist with the project Course Faculty. The project leader/DNP student will **NOT** refer to the project as research in any written or oral presentations or publications.	X	

ANSWER KEY: If the answer to **ALL** of these questions is **YES**, the activity can be considered a Clinical Quality Improvement activity that does not meet the definition of human research. **UMB IRB review is not**

Appendix J. Clinical Quality Improvement Checklist

required. **Keep a dated copy of the checklist in your files.** If the answer to ANY of these questions is NO, the project must be submitted to the IRB for review.